Teaching Learning Process

1. Curricula and Syllabus for each of the Program

DIRECTION

No. 21/2020 Date :- 24/10/2020

Subject :- Examination leading to the Degree of B.E./ B.Text.E. /B.Tech. (Chem.Engg.) (Four Year Degree Course.. Semester Pattern) (C.B.C.S.) in the Faculty of Science & Technology, Direction 2020.

Whereas, Direction No. 29 of 2010 in respect of the Examination leading to the Degree of B.E./ B.Text.E. /B.Tech. (Chem.Engg.) (Four Year Degree Course .. Semester Pattern) (C.B.C.S.) in the Faculty of Engineering & Technology, Direction, 2010 of B.E. /B.Text. E.(Common to all branches) as per Credit Grade System in the Faculty of Engineering & Technology was in existence up to the session 2018-19 and abrogated stage wise vide Direction No. 26 /2019,

AND

Whereas, Direction Nos. 31/2011, 31/2012, 3/2013, 16/2014, 12/2016, 19/2016, 20/2016, 11/2017 and 37/2018 in respect of the Schemes of teaching & examination of Semesters III to VIII in the various branches of B.E. /B.Text.E. /B.Tech. (Chem. Tech.) as per Credit Grade System in the Faculty of Engineering & Technology are in existence,

AND

Whereas, Direction No. 26 of 2019 in respect of the Examination leading to the Degree of B.E./ B.Text.E. /B.Tech.(Chem.Engg.), B.Tech.(Chem. Tech.) (Polymer) (Plastic) Tech. (Four Year Degree Course..Semester Pattern) (C.B.C.S.) in the Faculty of Science & Technology, Direction, 2020 is in existence,

AND

Whereas, the Hon'ble Vice-Chancellor had constituted a Committee of all the Chairpersons of the Board of Studies of Engineering & Technology under the Chairmanship of the Dean, Faculty of Science & Technology for preparing of the Schemes of teaching & examination of Under Graduated Courses of Semester III to VIII of B.E. /B.Text.E. / B.Tech. (Chem.Engg.) / B.Tech. (Chem.Tech.) as per the guidelines of A.I.C.T.E. Model Curriculum to be implemented from the session 2020-21 & onwards in phase wise manner,

AND

Whereas, the Committee in its series of meetings dtd. 6.6.2020, 22.6.2020 & 23.6.2020 has prepared, finalized and recommended the Schemes of teaching & examination of the branches Civil Engg., Mechanical Engg., Electronics & Telecommunication Engg., Computer Science & Engg. / Computer Engg., Electrical Engg., Electrical Engg. (Electronics & Power), Electrical & Electronics Engg., Information Technology, Textile Engg., Chemical Engg., (C.B.C.S.) of Semester III to VIII as per guidelines of AICTE Model Curriculum to the office to be implemented from the session 2020-21 & onwards in phase wise manner,

AND

Whereas, the Hon'ble Vice-Chancellor had accepted and accorded approval to the schemes of teaching & examination of Semester III to VIII of B.E. /B.Text.E. /B.Tech. (Chem.Engg.) on behalf of Faculty of Science & Technology and Academic Council on 24.7.2020 to be implemented from the session 2020-21 & onwards in phase wise manner,

AND

Whereas, the above Schemes of teaching & examinations of Semesters Semester III to VIII of B.E. /B.Text.E./B.Tech.(Chem.Engg.) in the Faculty of Science & Technology are required to be regulated by the Ordinance /Regulation,

AND

Whereas, making the Ordinance /Regulation is a time consuming process,

Now, therefore, I, Dr. M.G.Chandekar, Vice-Chancellor, Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of Section 12 of the Maharashtra Public Universities Act, 2016, do hereby direct as under :-

(1) This Direction shall be called "Examination leading to the Degree of B.E./ B.Text.E. /B.Tech. (Chem.Engg.) (Four Year Degree Course..Semester Pattern) (C.B.C.S.) in the Faculty of Science & Technology, Direction, 2020".

(2) This Direction shall come into force from the date of its issuance.

(3) Subject to the conditions prescribed by the Government from time to time, for admission to First Year B.E./B.Text.E. / B.Tech. (Chem. Engg.) / B.Tech. (Chem. Tech.) Polymer (Plastic) Tech. courses the candidate shall be considered eligible :

Passing 12th Standard examination of the Maharashtra State Board of Secondary and Higher Secondary Education, with subjects :

1. English (Higher or Lower)
2. Modern Indian Language (Higher or Lower)
3. Mathematics and Statistics.

4. Chemistry.
5. Physics.
6. Any other optional subject from out of the list prescribed by the said Secondary and Higher Secondary Education Board.

OR

i) English (Higher or lower)
ii) Mathematics and Statistics.
iii) Chemistry
iv) Physics
v) Vocational subject (Defined by the said Board as a Technical Subject)

OR

An Examination recognised by the Sant Gadge Baba Amravati University as an equivalent to the above.

(4) Subject to the conditions prescribed by the Govt. from time to time for direct admission to the second Year B.E. / B.Text.E. / B.Tech. (Chem. Engg.) / B.Tech. (Chem. Tech.) Polymer (Plastic) Tech. the candidates shall be considered eligible :-

Passing Diploma in relevant branch in First Division, awarded by the Board of Technical Examination of Maharashtra State, Mumbai.

OR

Any Diploma equivalent to the corresponding Diploma of the Board of Technical Examination of Maharashtra State, Mumbai.

(5) (a) The Degree of Bachelor of Engineering shall be awarded to examinee who in accordance with the provisions of this Direction qualifies for the award in any of the following branches.

i. Civil Engineering
ii. Mechanical Engineering
iii. Electrical Engineering (Electronics & Power)
iv. Electrical Engineering
vi. Electrical and Electronics Engineering.
vii. Electronics and Telecommunication Engineering
viii. Computer Science & Engineering
ix. Information Technology
x. Computer Engineering
xi. Chemical Engineering
xii. Textile Engineering

(b) The Degree of Bachelor of Textile Engineering shall be awarded to examinee, who qualifies in accordance with the provisions of this Direction.
(c) The Degree of Bachelor of Technology (Chemical Engineering) shall be awarded to examinee who qualifies in accordance with the provisions of this Direction.
(d) The Degree of Bachelor of Technology (Chemical Technology) Polymer (Plastic) Tech. shall be awarded to examinee who qualifies in accordance with the provisions of this Direction.

(6) (i) There shall be eight semester examinations leading to the Degree of B.E./B.Text.E./B.Tech. (Chem. Engg.) /B.Tech. (Chem. Tech.) Polymer (Plastic) Tech. (First, Second, Third, Fourth, Fifth, Sixth, Seventh & Eight Semester)
(ii) The first & Second Semester Examinations shall be common for all the branches.
(iii) The procedure for bifurcation of the students in Group - A & Group - B shall be as given in **Appendix -B**.

(7) The period of Academic Session shall be such as may be notified by the University.

(8) The main examination of first, third, fifth and seventh semester shall be held by the University in winter & supplementary examination in summer every year. And main examination of second, fourth, sixth & eighth semester shall be held in summer & the supplementary examination in winter every year.

(9) The Internal Assessment marks for theory should be based on Class Test and Attendance as follows:-

(a) Class Test Marks will be based upon two Class Tests.	-	15
(b) Attendance	-	Mark/s
75% to 80%	-	1
81% to 85%	-	2
86% to 90%	-	3
91% to 95%	-	4
96% to 100%	-	5

Wherever, if internal assessment marks are ‘ten (10)’ then it should be converted out of “20”.

(10) Subject to his/her compliance with the provisions of this Direction & other Ordinances pertaining to Examination in force from time to time, the applicant for admission, at the end of the course of study of a particular semester/session, to an Examination specified in column (1) of the table I below, shall be eligible to appear if,

i) he/she satisfies with the conditions in the table and the provisions there under.
ii) he/she complies with the provisions of the ordinance pertaining to the Examination in general from time to time.
iii) he/she has prosecuted a regular course of study in a college affiliated to the University.

iv) he/she has in the opinion of the Principal shown satisfactory progress in his/her studies.

TABLE I

Name of Exam B.E./B.Text.E./ B.Tech. (Chem. Engg.)/B.Tech. (Chem.Tech.) Polymer (Plastic)Tech.	The student should have passed Exam. of	The Student should have satisfactorily completed the following semester	The student should have passed the following examination
1.	2.	3.	
First Semester Group A/Group B	XII standard Examination or equivalent	....	....
Second Semester Group A/Group B	....	I Semester Group A/Group B	.....
Third Semester	....	II Semester Group A/Group B	2/3rd heads of I & II Sem. combined together
Fourth Semester	.....	III Semester	.....
Fifth Semester	I & II Sem.	IV Semester	2/3rd heads of III & IV Sem. combined together
Sixth Semester	....	V Semester	.....
Seventh Semester	III & IV Sem. combined together	VI Semester	2/3rd heads of V & VI Sem.
Eighth Semester	.....	VII Semester	.....

(11) An examinee who has passed 2/3 rd heads of passing shall be allowed to keep term in the next higher class.
Explanation:
(i) While calculating 2/3 rd heads of passing, fraction if any shall be ignored
(ii) For considering the heads of passing, every theory and every practical shall be considered as separate head of passing.

(12) The schemes of teaching & examinations shall be as provided under "**Appendix-A**" appended with this Direction.

(13) The fees for each B.E./B.Text.E./B.Tech. (Chem. Engg.)/B.Tech. (Chem. Tech.) Polymer (Plastic) Tech. Examinations (Theory & Practical) shall be as prescribed by University from time to time.

(14) The computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) of an examinee shall be done as given below :-

The marks will be given in all examinations which will include college assessment marks and the total marks for each Theory / Practical shall be converted into Grades as per **Table II**.

SGPA shall be calculated based on Grade Points corresponding to Grade as given in Table II and the Credits allotted to respective Theory / Practical shown in the scheme for respective semester.

SGPA shall be computed for every semester and CGPA shall be computed only in VIII semester. The CGPA of VIII semester shall be calculated based on SGPA of VII and SGPA of VIII semester as per following computation :-

$$SGPA = \frac{C_1 \times G_1 + C_2 \times G_2 + \ldots\ldots + C_n G_n}{C_1 + C_2 + \ldots\ldots + C_n}$$

Where, C_1 = Credit of individual Theory / Practical
G_1 = Corresponding Grade Point obtained in the respective Theory / Practical

$$CGPA = \frac{(SGPA)_{VII} \times (Cr)_{VII} + (SGPA)_{VIII} \times (Cr)_{VIII}}{(Cr)_{VII} + (Cr)_{VIII}}$$

Where, $(SGPA)_{VII}$ = SGPA of VII Semester
$(Cr)_{VII}$ = Total Credits for VII Semester
$(SGPA)_{VIII}$ = SGPA of VIII Semester
$(Cr)_{VIII}$ = Total Credits for VIII Semester

CGPA equal to 6.00 and above shall be considered as equivalent to First Class which shall be mentioned on Grade Card of VIII Semester as a foot note.

TABLE II
THEORY

Grade	Percentage of Marks	Grade Points
AA	80 ≤ Marks ≤ 100	10
AB	70 ≤ Marks < 80	9
BB	60 ≤ Marks < 70	8
BC	55 ≤ Marks < 60	7
CC	50 ≤ Marks < 55	6
CD	45 ≤ Marks < 50	5
DD	40 ≤ Marks < 45	4
FF	00 ≤ Marks < 40	0
ZZ	Absent in Examination	—

PRACTICAL

Grade	Percentage of Marks	Grade Points
AA	85 ≤ Marks ≤ 100	10
AB	80 ≤ Marks < 85	9
BB	75 ≤ Marks < 80	8
BC	70 ≤ Marks < 75	7
CC	65 ≤ Marks < 70	6
CD	60 ≤ Marks < 65	5
DD	50 ≤ Marks < 60	4
FF	00 ≤ Marks < 50	0
ZZ	Absent in Examination	—

(15) (i) The scope of the subjects shall be as indicated in the syllabi.
(ii) The medium of instruction and examination shall be English.

(16) The Schemes of teaching & examination of Semester I & II (Group A & B) of B.E. /B.Text. E./B.Tech. (Chem.Engg.)/ B.Tech. (Chem. Tech.) (Polymer) (Plastic) Tech. had been already implemented from the session 2019-2020 which was notified vide Direction No. 26/2019.

(17) As per A.I.C.T.E. Model Curriculum, an Induction Program of three (3) weeks duration is mandatory to the students at the start of the first semester.

(18) The Schemes of teaching & examination of Semester III to VIII of B.E./ B.Text.E./ B.Tech. (Chem.Engg.) (C.B.C.S.) of the branches Civil Engg., Mechanical Engg., Electronics & Telecommunication Engg., Computer Science & Engg., Computer Engg., Electrical Engg., Electrical Engg. (Electronics & Power), Electrical & Electronics Engg., Information Technology, Textile Engg., Chemical Engg., (C.B.C.S.) as per A.I.C.T.E. Model Curriculum shall be implemented in phase wise manner as under :

(i) For Semester III & IV from the session - 2020-2021
(ii) For Semester V & VI from the session - 2021-2022
(iii) For Semester VII & VIII from the session - 2022-2023

(19) The Schemes of teaching & examination of Semester I & II of B.E. / B.Text.E./ B.Tech. (Chemical Engg.) (common to all branches) and Semester III to VIII of the branches Civil Engg., Mechanical Engg., Electronics & Telecommunication Engg., Computer Science & Engg., Computer Engg., Electrical Engg., Electrical Engg. (Electronics & Power), Electrical & Electronics Engg., Information Technology, Textile Engg., Chemical Engg., (C.B.C.S.) as per A.I.C.T.E. Model Curriculum shall be as per Appendices A,B,C,D,E,F,G,H,I,J,K and L appended with this Direction.

(20) (i) The Semester wise chart regarding the workload and Credits as per A.I.C.T.E. Model Curriculum guidelines for Engineering & Technology Courses for the Schemes of teaching & examination of Sem. III to VIII is as under :

CHART

Sem.	Theory	Pract.	Theory credits	Pract. Credits	Semester Credits	Hours/ week	Remarks
I	4	4	15	5	20	25	Started from session 2019-20
II	4	4	15	5	20	25	
III	5	4	16	4	20	26	ES 2T, 0 credit
IV	5	4	18	4	22	26	ES 2T, 2 credits
V	5	4	16	4	20	24	PE-1,OE-1
VI	5	4	16	4	20	24	PE-1,OE-1
VII	5	3	16	3+4	23	30	PE-2 or 3, Project seminar - 8 hrs, 4 credits
VIII	4	2	12	2+6	20	28	PE-1 or 2, Project seminar 12hrs, 6 credits
Total	**37**	**29**	**124**	**41**	**165**		

(ii) The workload for the subject Environment Studies for Semester III & IV (3ES06 & 4ES06) which is common for all branches in all the Faculties as per Ordinance No. 42/2005 is as : 2 theory in III semester with no credits, 2 theory in IV semester with 2 credits and examination at the end of IV semester at college level having distribution as : 80 (Max. marks for Theory) + 20 (Internal) = 100 (Total marks) – 40 (Minimum marks for passing)

(iii) Open Electives (OE): Open Elective to be opted from the courses offered by other disciplines of Engineering & Technology of the university / Massive Open learning Courses (MOOC) such as SWAYAM pertaining to the profession.

(iv) Students completing foreign language course or completing minimum 4 weeks internship (Full time in Vacations) or participating in sports at National / International level shall be exempted from O.E. in the same / adjacent semester.

(v) An Orientation Program of 15 hours duration /MOOC to be offered to the students during (a)VthSemester : Indian Constitution (b) VIth Semester: Indian Traditional Knowledge.

(21) The Provisions of Ordinance No. 18 of 2001 in respect of an Ordinance to provide grace marks for passing in a Head of passing and improvement of division (Higher Class) and getting distinction in the subject and condonation of deficiency of marks in a subject in all the Faculties prescribed by the Direction No. 15 of 2017 shall be applicable to each examination under this Direction.

(22) An examinee who does not pass; or who fails to present himself/herself for the examination shall be eligible for re-admission to the same examination/semester, on payment of fresh fees and such other fees as may be prescribed from time to time.

(23) A candidate who could not complete a semester satisfactorily or who has failed will be eligible for readmission to the same semester.
However, re-admission to semester should be allowed only when a regular session is running for the particular semester.

(24) One who has passed the Final B.E./B.Text.E./B.Tech. (Chem. Engg.)/B.Tech. (Chem. Tech.) Polymer (Plastic) Tech. examination of the University in one branch and who desires to take B.E./B.Text.E./B.Tech.(Chem. Engg.)/ B.Tech. (Chem. Tech.) Polymer (Plastic) Tech. Degree in another branch shall be admitted to the third Semester of that branch and shall be governed by this Direction for all other purposes.

(25) After examinations the Board of Examination & Evaluation shall publish the result of the examinees as early as possible and the branch wise merit list shall be notified as per Ordinance No.6.

(26) Notwithstanding anything to the contrary in this Direction, no one shall be admitted to any examination under this Direction, if he/she has already passed the said examinations or an equivalent examinations of any statutory University.

(27) (i) The examinees who have passed in all the subjects prescribed for all the examinations of the particular branch shall be eligible for award of the Degree of Bachelor of Engineering / Bachelor of Technology (Chemical Technology) Polymer (Plastic) in the branch concerned, Bachelor of Textile Engineering and Bachelor of Technology (Chemical Engineering).

(ii) The Degree certificate in the prescribed form shall be signed by the Vice-Chancellor.

(28) The Guidelines of the A.I.C.T.E. New Delhi and D.T.E., Govt. of Maharashtra, Mumbai shall be applicable from time to time after having noted / approved by the Competent Authority.

(29) The existing Direction No. 26/2019 shall stand abrogated stage wise and only applicable to the students who have already sought their admissions as per its provisions and shall abrogated after exhausting the chances given to the failure students of Semester I /II (Group A & B) of B.E. /B.Text. E./B.Tech. (Chem.Engg.) of the University.

(**30**) The provisions in existing Direction Nos. 31/2011, 31/2012, 3/2013, 16/2014, 12/2016, 11/2017 and 37/2018 shall stand only be applicable to the students of Semester III to VIII of the branches Civil Engg., Mechanical Engg., Production Engg., Electronics & Telecommunication Engg., Electronics Engg., Instrumentation Engg., Computer Science & Engg., Computer Engg., Electrical Engg., Electrical Engg. (Electronics & Power), Electrical Engg. (Electrical & Power), Electrical & Electronics Engg., Information Technology, Textile Technology, Chemical Engg., Chemical Technology (Polymer) (Plastic) and Biomedical Engg. who have already sought their admissions as per its provisions and shall stand abrogated after exhausting the chances given to the failure students of Old Course by the University.

Sd/-
Date :- 24/10/2020 (Dr.M. G.Chandekar)
Vice Chancellor

Four Year Degree Course in Bachelor of Engineering Branch : B.E./B.Tech./B.Text. E.(Common to all the Branches) **Appendix-A**
Semester Pattern (Choice Based Credit system)

Sr. No.	Subject Code	Subject	TEACHING SCHEME: HOURS / WEEK Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	EXAMINATION SCHEME: THEORY DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	PRACTICAL MAX. MARKS EXTERNAL	INTERNAL	TOTAL	MIN. PASSING MARKS
Semester :FIRST/ SECOND GROUP A																
THEORY																
01	1 A 1	Engineering Mathematics I	3	1	_	4	4	3	80	20	100	40	_	_	_	_
02	1 A 2	Engineering Physics	4	_	_	4	4	3	80	20	100	40	_	_	_	_
03	1 A 3	Engineering Mechanics	3	1	_	4	4	3	80	20	100	40	_	_	_	_
04	1 A 4	Computer Programming	3	_	_	3	3	3	80	20	100	40	_	_	_	_
PRACTICALS																
05	1 A 5	Workshop Practice	_	_	4	4	2	_	_	_	_	_	25	25	50	25
06	1 A 6	Engineering Physics Laboratory	_	_	2	2	1	_	_	_	_	_	25	25	50	25
07	1 A 7	Engineering Mechanics Laboratory	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	1 A 8	Computer Programming Laboratory	_	_	2	2	1	_	_	_	_	_	25	25	50	25
		TOTAL	13	2	10	25	20				400				200	
	Note- An Induction Program of Three Weeks duration to be offered to the students at the start of First Year.													TOTAL	600	
Semester :FIRST/ SECOND GROUP B																
THEORY																
01	1 B 1	Engineering Mathematics II	3	1	_	4	4	3	80	20	100	40	_	_	_	_
02	1 B 2	Engineering Chemistry	4	_	_	4	4	3	80	20	100	40	_	_	_	_
03	1 B 3	Basic Electrical Engineering	3	1	_	4	4	3	80	20	100	40	_	_	_	_
04	1 B 4	Engineering Graphics	3	_	_	3	3	3	80	20	100	40	_	_	_	_
PRACTICALS																
05	1 B 5	English Communication Skills Laboratory	_	_	4	4	2	_	_	_	_	_	25	25	50	25
06	1 B 6	Engineering Chemistry Laboratory	_	_	2	2	1	_	_	_	_	_	25	25	50	25
07	1 B 7	Basic Electrical Engineering Laboratory	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	1 B 8	Engineering Graphics Laboratory	_	_	2	2	1	_	_	_	_	_	25	25	50	25
		TOTAL	13	2	10	25	20				400				200	
														TOTAL	600	

Note- An Induction Program of Three Weeks duration to be offered to the students at the start of First Year.

Appendix – B

The procedure for bifurcation of the students in Group – A and Group-B of First Year Scheme for B.E. /B.Text.E. / B.Tech. (Chem. Engg.) / B.Tech. (Chem. Tech.) Polymer (Plastic) Tech.

1) The sanctioned intake and / or the number of candidates admitted to first year Engineering shallbe divided into two groups as A and B in multiples of 60 preferably at the institute level.

2) Group-A candidates shall register for Group-A subjects in first semester and Group-B candidates shallregister for Group-B subjects in first semester.

3) The candidates shall be examined for their subjects from the respective groups in first semester.

4) In the Second semester, candidates from Group-B shall register for subject of Group-A. Similarly, candidates fromGroup-A shall register for subjects of Group-B.

5) The candidates shall be examined for their subjects from the other groups in second semester.

6) Thus, at the end of the first year, all the subjects shall be studied by the candidates from both thegroups.

7) The mark list shall show only the group obtained in respective Semester, like First Semester Group- B,First Semester Group-A.

8) The exercise on the part of the college shall be to ensure that the candidates fill up the examinationforms correctly according to the subjects group they have registered in both the semesters.

****

Four Year Degree Course in Bachelor of Engineering Branch: **MECHANICAL ENGINEERING**
Semester Pattern (Choice Based Credit Grade System)

SEMESTER : THIRD

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	3ME01	Mathematics-III	3	1	--	4	4	3	80	20	100	40	--	--	--	--
02	3ME02	Manufacturing Processes	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	3ME03	Mechanics of Materials	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	3ME04	Engineering Thermodynamics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	3ME05	Fluid Mechanics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Studies	2	--	--	2	--	--	--	--	--	--	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	3ME07	Manufacturing Processes- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	3ME08	Mechanics of Materials- lab .	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	3ME09	Fluid Mechanics- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	3ME10	Machine Drawing- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**17**	**1**	**8**	**26**	**20**	--	--	--	**500**	--	--	--	**200**	--
														Grand Total		**700**

Note: **The Examination of the Subject Environmental Studies shall be conducted in IV Semester.

SEMESTER : FOURTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks Int.	Max. Marks Ext.	Total	Min. Passing Marks
THEORY																
01	4ME01	Material Science	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	4ME02	Energy Conversion - I	3	1	--	4	4	3	80	20	100	40	--	--	--	--
03	4ME03	Manufacturing Technology	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	4ME04	Basic Electrical Drives & Control	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	4ME05	Hydraulic & Pneumatic Systems	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Studies	2	--	--	2	2	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	4ME07	Material Science-lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	4ME08	Manufacturing Technology-lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	4ME09	Basic Electrical Drives & Control -lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	4ME10	Hydraulic & Pneumatic Systems-lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**17**	**1**	**8**	**26**	**22**	--	--	--	**600**	--	--	--	**200**	--
														Total	**800**	

Note: **The Examination of Mandatory Subject Environmental Science shall be conducted in IV Semester.

SEMESTER : FIFTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks Int.	Max. Marks Ext.	Total	Min. Passing Marks
THEORY																
01	5ME01	Heat Transfer	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	5ME02	Metrology & Quality Control	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	5ME03	Kinematics of Machines	3	1	--	4	4	3	80	20	100	40	--	--	--	--
04	5ME04	Measurement Systems	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	5ME05	Open Elective – I (OE-I)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	5ME06	Heat Transfer- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	5ME07	Metrology & Quality Control- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	5ME08	Kinematics of Machines- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	5ME09	Measurement Systems –lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**15**	**1**	**8**	**24**	**20**	--	--	--	**500**	--	--	--	**200**	--
														Grand Total	**700**	

Open Elective – I (For other Disciplines) : (i) Production Management (ii) Manufacturing Techniques

An Orientation Program of 15 Hours duration / MOOCs on Advanced Courses line Machine learning, 3-D Printing, Virtual Reality, Supply Chain Management, Numerical Computation for Mechanical Engineers, Bio-mechanics, Fundamentals of nano-Engineering, Micro-Electro Mechanical Systems, Nano-to-Macro Transport Processes, Fundamentals of Photo Voltaics,Machine Tools etc. be offered during V semester.

Open Elective-I to be opted from the University's faculty of Engineering & Technology offered inter-disciplinary courses or MOOCs courses pertaining to the Engineering Profession.

SEMESTER : SIXTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	6ME01	Design of Machine Elements	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	6ME02	Dynamics of Machines	3	1	--	4	4	3	80	20	100	40	--	--	--	--
03	6ME03	Control System Engineering	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	6ME04	Prof. Elective - I	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	6ME05	Open Elective - II	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	6ME06	Design of Machine Elements- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	6ME07	Dynamics of Machines- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	6ME08	Prof. Elective - I - lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	6ME09	Research Skills - lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**15**	**1**	**8**	**24**	**20**	--	--	--	**500**	--	--	--	**200**	--
														Grand Total	**700**	

An Orientation Program of 15 Hours duration / MOOCs on Entrepreneurship Development to be offered during VI Semester.

6ME04: Prof. Elect. (I) : (i) Tool Engineering (ii) Non- Conventional Energy Sources (iii) Computer Aided Design & Simulation

6ME05: Open Elect. (II) [For other Disciplines] : (i) Non- Conventional Energy Sources (ii) Automobile Engineering

Open Elective-II to be opted from the University's faculty of Engineering & Technology offered inter-disciplinary courses or MOOCs courses pertaining to the Engineering Profession.

SEMESTER : SEVENTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS /WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks Int.	Max. Marks Ext.	Total	Min. Passing Marks
THEORY																
01	7ME01	Mechatronics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	7ME02	Productivity Techniques	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	7ME03	Industrial Management & Costing	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	7ME04	Energy Conversion - II	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	7ME05	Professional Elective- II	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	7ME06	Mechatronics- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	7ME07	Energy Conversion – II- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	7ME08	Professional Elective- II – lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	7ME09	Technical Seminar & Project	--	--	8	8	4	--	--	--	--	--	50	--	50	25
		Total	**15**	**0**	**14**	**29**	**22**	**--**	**--**	**--**	**500**	**--**	**--**	**--**	**200**	**--**
														Grand Total	**700**	

7ME05: Prof. Elect.-II : (i) Computer Integrated Manufacturing (ii) Robotics (iii) Artificial Intelligence

SEMESTER : EIGHT

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS /WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks Int.	Max. Marks Ext.	Total	Min. Passing Marks
THEORY																
01	8ME01	Operation Research Techniques	3	--		3	3	3	80	20	100	40	--	--	--	--
02	8ME02	I.C. Engines	3	--		3	3	3	80	20	100	40	--	--	--	--
03	8ME03	Professional Elective-III	3	--		3	3	3	80	20	100	40	--	--	--	--
04	8ME04	Professional Elective- IV	3	--		3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
05	8ME05	I.C. Engines- lab.	--	--	2	2	1	--	--	-- --	--	--	25	25	50	25
06	8ME06	Prof. Elective-IV –lab.	--	--	2	2	1	--	--	-- --	--	--	25	25	50	25
07	8ME07	Project	--	--	12	12	6						75	75	150	75
		Total	**12**	**--**	**16**	**28**	**20**	**--**	**--**	**--**	**400**	**--**	**--**	**--**	**250**	**--**
														Grand Total		**650**

8ME03 Prof. Elect. –III : (i) Automobile Engineering (ii) Production Planning & Control (iii) Product Design

8ME04 : Prof. Elect. IV: (i) Design of Transmission Systems (ii) Refrigeration & Air Conditioning (iii) Finite Element Analysis

Four Year Degree Course in Bachelor of Engineering Branch: **ELECTRONICS & TELECOMMUNICATION ENGINEERING**
Semester Pattern (Choice Based Credit Grade System)

SEMESTER : THIRD

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME									
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL				
			Lecture	Tutorial	P/D			Duration OfPaper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	3ETC01	Engineering Mathematics-III	4	--	--	4	4	3	80	20	100	40	--	--	--	--
02	3ETC02	Electronic Devices & Circuits	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	3ETC03	Digital System Design	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	3ETC04	Electromagnetic Waves	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	3ETC05	Object Oriented Programming (ES)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Science (Mandatory Course)	2	--	--	2	0	--	--	--	--	--	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	3ETC06	Electronic Devices andCircuits Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	3ETC07	Digital System Design	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	3ETC08	Object Oriented Programming Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	3ETC09	Electronic Workshop	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**18**	**0**	**8**	**26**	**20**	--	--	--	**500**	--	--	--	**200**	--
														Total	**700**	

Note: **The Examination of Mandatory Subject Environmental Science shall be conducted in IV Semester.

SEMESTER : FOURTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks Int.	Max. Marks Ext.	Total	Min. Passing Marks
THEORY																
01	4ETC01	Analog and Digital Communication	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	4ETC02	Analog Circuits	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	4ETC03	Network Theory	4	--	--	4	4	3	80	20	100	40	--	--	--	--
04	4ETC04	Signals and Systems	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	4ETC05	Values and Ethics (HS)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Science (Mandatory Course)	2	--	--	2	2	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	4ETC06	Analog and Digital Communication Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	4ETC07	Analog Circuits Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	4ETC08	Network Theory Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	4ETC09	Signals & Systems Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**18**	**0**	**8**	**26**	**22**	--	--	--	**600**	--	--	--	**200**	--
														Total	**800**	

Note: **The Examination of Mandatory Subject Environmental Science shall be conducted in IV Semester.

SEMESTER : FIFTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks Int.	Max. Marks Ext.	Total	Min. Passing Marks
THEORY																
01	5ETC01	Microcontroller	4	--	--	4	4	3	80	20	100	40	--	--	--	--
02	5ETC02	Control System	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	5ETC03	Digital Signal Processing	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	5ETC04	Professional Elective –I (PE-I)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	5ETC05	Open Elective – I (OE-I)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	5ETC06	Microcontroller Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	5ETC07	Digital Signal Processing Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	5ETC08	Power Electronics Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	5ETC09	Electronic lab based on Instrumentation	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**16**	**0**	**8**	**24**	**20**	--	--	--	**500**	--	--	--	**200**	--
														Total	**700**	

5ETC04: PE (I) : (i) Power Electronics (ii) Fiber Optic Communication (iii) Speech and Audio Processing

5ETC05: OE (I) : (i) Sensors and Transducers (ii) Data Structure (iii) Introduction to Java

A student will be eligible to get Under Graduate degree with Honors or additional Minor Engineering, if he/she completes an additional 20 credits relevant to the UG program.
The detail of which is as follows:

Course Name	Semester	Credit
MOOCs Course-I	**V**	**04**
MOOCs Course-II	**VI**	**04**
MOOCs Course-III	**VII**	**04**
MOOCs Course-IV	**VIII**	**04**
Internship	**V to VIII Sem**	**02**
Industrial Visit	**V to VIII Sem**	**02**
	Total	**20**

Note: The student needs to submit
1. **MOOCs Course passing certificate of each semester**
2. **Completion & Evaluation Certificate of Internship**
3. **Industrial Visit certificate.**

Note: Only One MOOCs course per semester shall be considered.

SEMESTER : SIXTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	6ETC01	Communication Network	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	6ETC02	Computer Architecture	4	--	--	4	4	3	80	20	100	40	--	--	--	--
03	6ETC03	Professional Elective -II (PE-II)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	6ETC04	Open Elective - II (OE-II)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	6ETC05	Economics for Engineers (HS)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	6ETC06	Communication Network Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	6ETC07	Electronic Circuit Design Lab (Hardware + Software)	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	6ETC08	Python Programming Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	6ETC09	Mini Project	--	--	2	2	1	--	--	--	--	--	50	--	50	25
		Total	**16**	**0**	**8**	**24**	**20**	--	--	--	**500**	--	--	--	**200**	--
														Total	**700**	

6ETC03: PE (II) : (i) CMOS Design (ii) Satellite Communication (iii) Adaptive Signal Processing

6ETC04: OE (II) : (i) Introduction to Python Programming (ii) Data Base Management System
(iii) Renewable Energy Sources (Solar & Electric Vehicles)

SEMESTER : SEVENTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	7ETC01	Microwave Theory and Techniques	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	7ETC02	Digital Image and Video Processing	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	7ETC03	Project Management and Entrepreneurship	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	7ETC04	Professional Elective - III (PE-III)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	7ETC05	Professional Elective- IV (PE-IV)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	7ETC06	Microwave Theory and Techniques Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	7ETC07	Digital Image and Video Processing Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	7ETC08	Project Management and Entrepreneurship Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	7ETC09	** Project Stage I (Seminar)	--	--	8	8	4	--	--	--	--	--	100	--	100	50
		Total	**15**	**0**	**14**	**29**	**22**	--	--	--	**500**	--	--	--	**250**	--
														Total	**750**	

7ETC04: PE(III) : (i) High Speed Electronics (ii) Mobile Communication and Networks (iii) Mixed Signal Design

7ETC05: PE(IV) : (i) Introduction to MEMS (ii)Error Correcting Codes(iii) Antenna and Propagation

Note: ** Seminar based on Final year Major Project

SEMESTER : EIGHT

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	8ETC01	Embedded Systems	3	--		3	3	3	80	20	100	40	--	--	--	--
02	8ETC02	Cryptography & Network security	3	--		3	3	3	80	20	100	40	--	--	--	--
03	8ETC03	Prof. Elective-V (PE-V)	3	--		3	3	3	80	20	100	40	--	--	--	--
04	8ETC04	Prof. Elective-VI (PE-VI)	3	--		3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
05	8ETC05	Embedded Systems- Lab	--	--	2	2	1	--	--	-- --	--	--	25	25	50	25
06	8ETC06	Cryptography & Network security Lab	--	--	2	2	1	--	--	-- --	--	--	25	25	50	25
07	8ETC07	Project stage -II	--	--	12	12	6	--	--	--	--	--	100	100	200	100
		Total	**12**	**--**	**16**	**28**	**20**	**--**	**--**	**--**	**400**	**--**	**--**	**--**	**300**	--
														Total	**700**	

8ETC03 : PE-V: (i) Nano Electronics (ii) Wireless Sensor Networks (iii) Wavelets (iv) Bio-medical Electronics

8ETC04 : PE-VI: (i) 5G-6G Mobile Communication (ii)Information Theory & Coding (iii) Scientific Computing

Four Year Degree Course in Bachelor of Engineering Branch: **COMPUTER SCIENCE & ENGINEERING**

Semester Pattern (Choice Based Credit Grade System)

SEMESTER : THIRD

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	3KS01	Mathematics-III	3	1	--	4	4	3	80	20	100	40	--	--	--	--
02	3KS02	Discrete Structure & Graph Theory	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	3KS03	Object Oriented Programming	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	3KS04	Data Structures	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	3KS05	Analog & Digital Electronics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	Environmental Studies *	2	--	--	2	0	--	--	--	--	--	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	3KS06	Object Oriented Programming Jawa-Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	3KS07	Data Structures Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	3KS08	Analog & Digital Electronics Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	3KS09	C Skill-Lab I (#)	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**17**	**1**	**8**	**26**	**20**	--	--	--	**500**	--	--	--	**200**	--
														Total	**700**	

Note: **The Examination of the Subject Environmental Science shall be conducted in IV Semester as per Ordinance No. 42 of 2005.

C Skill Lab I - based on technology like -**Python/Django** etc. to be decided by Individual Dept. of respective College.

SEMESTER : FOURTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks Int.	Max. Marks Ext.	Total	Min. Passing Marks
THEORY																
01	4KS01	Artificial Intelligence	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	4KS02	Data Communication & Networking	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	4KS03	Operating System	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	4KS04	Microprocessor & Assembly Lang. Prog.	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	4KS05	Theory of Computation	3	1	--	4	4	3	80	20	100	40	--	--	--	--
06	4ES06	Environmental Studies *	2	--	--	2	2	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	4KS06	Data Communication & Networking Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	4KS07	Operating System Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	4KS08	Microprocessor & Assembly Lang. Prog. Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	4KS09	C Skill-Lab II (#)	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**17**	**1**	**8**	**26**	**22**	--	--	--	**600**	--	--	--	**200**	--
														Total	**800**	

Note: **The Examination of Mandatory Subject Environmental Science shall be conducted in IV Semester.

C Skill Lab II - based on technology like -**PHP, Web Technology, Raspberry Pi/Ardino**, etc. to be decided by Individual Dept. of respective College.

SEMESTER : FIFTH																	
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME									
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL				
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																	
01	5KS01	Database Management Systems	4	--	--	4	4	3	80	20	100	40	--	--	--	--
02	5KS02	Compiler Design	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	5KS03	Computer Architecture & Organization	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	5KS04	Professional Elective –I (PE-I) *	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	5KS05	Open Elective – I (OE-I) **	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																	
06	5KS06	Database Management Systems - Lab (@)	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	5KS07	Compiler Design Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	5KS08	Emerging Tech. Lab-I	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	5KS09	C Skill Lab III (*)	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**16**	**0**	**8**	**24**	**20**	--	--	--	**500**	--	--	--	**200**	--
														Total	**700**		

Prof. Elect I (*) : i) Cognitive Technologies
(ii) Data Science and Statistics
(iii) Internet of Things
(iv)Introduction to Cyber Security

Open Elect : I (**) (i) Fund. of Fin. & Acctg.
(ii) Prin. of Marketing for Engg.
(iii)Entrepreneurship

* **C Skill Lab III** - based on technology like - **Angular & React, Express, Node.js** etc.
to be decided by Individual Dept. of respective College

(@ Practicals using Mongo DB,MySQL

Emerging Technology Lab# I : AI : IBM Watson, Microsoft Cognitive Toolkit , Tensor Flow, Apache System ML, Caffe, Open NN, Torch, Neuroph
DS : R, Python, Cassandra, Apache Hadoop
IoT : Arduino, DeviceHive, Kaa, Home Assistant
CS : Kali Linux, Open VPN, NMAP, Metasploit Framework

An Orientation Program of 15 hours duration /MOOC on* <u>Indian Constitution</u> *to be offered to the students during the Vth Semester

Open Elective I to be opted from the courses offered by other engineering technology boards of the university /Massive Open learning Courses (MOOC) such as SWAYAM pertaining to the profession

SEMESTER : SIXTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks Int.	Max. Marks Ext.	Total	Min. Passing Marks
THEORY																
01	6KS01	Security Policy & Governance	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	6KS02	Design & Analysis of Algorithms	4	--	--	4	4	3	80	20	100	40	--	--	--	--
03	6KS03	Software Engg.	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	6KS04	Prof. Elective -II (PE-II)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	6KS05	Open Elective - II (OE-II)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	6KS06	Design & Analysis of Algorithms- Lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	6KS07	Software Engg. – lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	6KS08	Emerging Tech. Lab-II	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	6KS09	C Skill Lab IV (*)	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**16**	**0**	**8**	**24**	**20**	--	--	--	**500**	--	--	--	**200**	--
														Total	**700**	

Prof. Elect II (*) : i) Natural Language Processing
(ii) Big Data Analytics
(iii) Sensors & Actuators
iv) Cryptography

Open Elect : II (**) (i) Computational Biology
(ii) Cyber Law & Ethics
(iii) Intellectual Property Right

FOSS Tools & Technology for Practicals :
Natural Language Toolkit (NLTK),SpaCy, PyTorch-NLP, Natural, Retext, Text Blob
KNIME, Spark, Neo4J, MongoDB, Hive, Storm
Devicehub, Zetta, Node-RED, Flutter, M2MLabs Mainspring
VeraCrypt, ModSecurity, AdBlocker, CheckShortURL, SPAMfighter, SpamBully

* C Skill Lab IV - based on technology like - **DevOp to be decided by Individual Dept. of respective College**

An Orientation Program of 15 hours duration /MOOC on* Indian Constitution *to be offered to the students during the Vth Semester .

Open Elective II to be opted from the courses offered by other engineering technology boards of the university /Massive Open learning Courses (MOOC) such as SWAYAM pertaining to the profession

SEMESTER : SEVENTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	7KS01	Social Science & Engineering Economics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	7KS02	Computer Graphics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	7KS03	Cloud Computing	4	--	--	4	4	3	80	20	100	40	--	--	--	--
04	7KS04	Prof. Elective - III (PE-III) (*)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	7KS05	Prof. Elect.- IV (PE-IV) (**)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	7KS06	Computer Graphics- Lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	7KS07	Emerging Tech. Lab-III	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	7KS08	Emerging Tech. Lab-IV	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	7KS09	** Project & Seminar	--	--	8	8	4	--	--	--	--	--	--	50	50	25
		Total	**16**	**0**	**14**	**30**	**23**	**--**	**--**	**--**	**500**	**--**	**--**	**--**	**200**	**--**
														Total	**700**	

Prof. Elect III (*) : (i) Robotics
(ii) Data Warehousing & Mining
(iii) Embedded Systems
iv) Digital Forensic

Prof. Elect : IV (**) (i) Block Chain Fundamentals
(ii) Image Processing
(iii) Optimization Techniques

Emerging Technology Lab# V : Ethereum,Bigchain DB, Corda
OpenCV, Simple CV, Keras, Caffe
Open Eaagles, Repast, Open Simulator

SEMESTER : EIGHT																
Sr. No.	**Subject Code**	**Subject**	**TEACHING SCHEME**					**EXAMINATION SCHEME**								
			HOURS / WEEK			**Total HOURS/WEEK**	**CREDITS**	**THEORY**					**PRACTICAL**			
			Lecture	**Tutorial**	**P/D**			**Duration Of Paper (Hr.)**	**Max. Marks Theory Paper**	**Internal Marks**	**Total**	**Min. Passing Marks**	**Max. Marks**		**Total**	**Min. Passing Marks**
													Int.	**Ext.**		
THEORY																
01	8KS01	Object Oriented Analysis & Design	3	--		3	3	3	80	20	100	40	--	--	--	--
02	8KS02	Professional Ethics & Management	3	--		3	3	3	80	20	100	40	--	--	--	--
03	8KS03	Prof. Elective-V (PE-V)	3	--		3	3	3	80	20	100	40	--	--	--	--
04	8KS04	Prof. Elective-VI (PE-VI)	3	--		3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
05	8KS05	Emerging Tech. Lab-V	--	--	2	2	1	--	--	-- --	--	--	25	25	50	25
06	8KS02	Emerging Tech. Lab-VI	--	--	2	2	1	--	--	-- --	--	--	25	25	50	25
07	8KS03	Project & Seminar	--	--	12	12	6	--	--	--	--	--	75	75	150	75
		Total	**12**	**--**	**16**	**28**	**20**	**--**	**--**	**--**	**400**	**--**	**--**	**--**	**250**	--
															Total	**650**

Prof. Elect V (*) : (i) Virtual & Augmented Reality
(ii) Machine Learning and AI
(iii) Wireless Sensor Networks
iv) System & Software Security

Prof. Elect : VI (**) (i) Distributed Ledger Technology
(ii) Multimedia Computing
(iii) Modeling & Simulation

Emerging Tech. Lab# V : i) Google's ARCore, AR.js, ARToolKit, , DroidAR Brio, Adobe Aero
ii) R Studio, Orange, D3.js, Ggplot2, Jupyter Notebooks
iii) Wireshark, Burp Suit, Nessus

Emerging Tech. Lab# VI : i) Hyperledger, HydraChain, MultiChain, Elements
ii) Google Colab, GPUImage, Cuda, Aforge/Accord.NET
iii) OR-Tools, Locust.io, httperf, Apache JMeter, Siege

Four Year Degree Course in Bachelor of Engineering Branch: **ELECTRICAL ENGINEERING (ELECTRONICS & POWER)**
Semester Pattern (Choice Based Credit Grade System)

SEMESTER : THIRD																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	3EP01	Engineering Mathematics-III	3	1	--	4	4	3	80	20	100	40	--	--	--	--
02	3EP02	Electrical Circuit Analysis	2	1	--	3	3	3	80	20	100	40	--	--	--	--
03	3EP03	Electrical Machines - I	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	3EP04	Energy Resources & Generation	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	3EP05	Electronic Devices & Circuits	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Studies	2	--	--	2	0	--	--	--	--	--	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	3EP06	Electrical Circuit Analysis – lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	3EP07	Electrical Machines – I – lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	3EP08	Electronic Devices & Circuits – lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	3EP09	Electrical Technology - lab	--	--	2	2	1	--	--	--	--	--	50	--	50	25
		Total	**16**	**2**	**8**	**26**	**20**	--	--	--	**500**	--	--	--	**200**	--
												TOTAL			**700**	

Note: **The Examination of the Subject Environmental Science shall be conducted in IV Semester. [As per Ordinance of 42/ 2005]

SEMESTER : FOURTH																	
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME									
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL				
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																	
01	4EP01	Electromagnetic Fields	2	1	--	3	3	3	80	20	100	40	--	--	--	--
02	4EP02	Electrical Measurements & Instrumentation	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	4EP03	Control Systems	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	4EP04	Numerical Methods & Optimization Techniques	2	1	--	3	3	3	80	20	100	40	--	--	--	--
05	4EP05	Analog & Digital Circuits	3	1	--	4	4	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Studies	2	--	--	2	2	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																	
07	4EP06	Electrical Measurements & Instrumentation – lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	4EP07	Control Systems - lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	4EP08	Analog & Digital Circuits - lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	4EP09	Electronics Technology – lab	--	--	2	2	1	--	--	--	--	--	50	--	50	25
		Total	**15**	**3**	**8**	**26**	**22**	--	--	--	**600**	--	--	--	**200**	--
												TOTAL			800	

Note: **The Examination of the Subject Environmental Science shall be conducted in IV Semester. [As per Ordinance of 42/ 2005]

SEMESTER : FIFTH																	
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME									
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL				
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																	
01	5EP01	Power System – I	4	--	--	3	3	3	80	20	100	40	--	--	--	--
02	5EP02	Microprocessor & Microcontroller	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	5EP03	Electrical Machines - II	3	--	--	4	4	3	80	20	100	40	--	--	--	--
04	5EP04	Professional Elective –I (PE-I)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	5EP05	Open Elective – I (OE-I)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																	
06	5EP06	Power System – I Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	5EP07	Microprocessor & Microcontroller- Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	5EP08	Electrical Machines – II - lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	5EP09	Information & Communication Tech.-lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**16**	**0**	**8**	**24**	**20**	--	--	--	**500**	--	--	--	**200**	--
														TOTAL	**700**		

Prof. Elective-I: I) Signal & Systems II) Network Analysis & Synthesis III) Electronic Communication Theory

Open Elective – I : (For other disciplines) (i) Electrical Drives (i). Power Supply Systems (iii) Power Plant Engineering

An Orientation Program of 15 Hours duration/ MOOCs on **Indian Constitution** to be offered during **V semester.**

Open Elective-I to be opted from the university's faculty of Engineering & Technology offered inter disciplinary courses or MOOCs courses pertaining to the Engineering Profession.

SEMESTER : SIXTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK					THEORY					PRACTICAL			
			Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	6EP01	Power Electronics	4	--	--	4	4	3	80	20	100	40	--	--	--	--
02	6EP02	Electrical Energy Distribution & Utilization	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	6EP03	Computer Aided Electrical Machine Design	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	6EP04	Prof. Elective -II (PE-II)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	6EP05	Open Elective - II (OE-II)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	6EP06	Power Electronics – lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	6EP07	Electrical Energy Distribution & Utilization – lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	6EP08	Computer Aided Electrical Machine Design –lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	6EP09	Computer Technology – lab	--	--	2	2	1	--	--	--	--	--	50	--	50	25
		Total	**16**	**0**	**8**	**24**	**20**	--	--	--	**500**	--	--	--	**200**	--
														TOTAL	**700**	

Professional Elective – II: (I) Advanced Control Systems (II) Process Control System (III) Industrial Electrical System

Open Elective – II: (For other disciplines) (i) Energy Audit & Management (ii) Electrical Estimation & Costing (iii) Electrical Materials

An Orientation Program of 15 Hours duration/ MOOCs on **Indian Traditional Knowledge** to be offered during **VI semester.**

An Orientation Program of 15 Hours duration / MOOCs on **Entrepreneurship Development** to be offered during **VI semester.**

SEMESTER : SEVENTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME									
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL				
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																	
01	7EP01	Power System II	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	7EP02	Digital Signal Processing	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	7EP03	Entrepreneurship & Project Management	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	7EP04	Prof. Elective - III (PE-III)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	7EP05	Prof. Elective- IV (PE-IV)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																	
06	7EP06	Power System II Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	7EP07	Digital Signal Processing - Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	7EP08	Entrepreneurship & Project Management Lab	--	--	2	2	1	--	--	--	--	--	50	--	50	25
09	7EP09	Project & Seminar	--	--	8	8	4	--	--	--	--	--	50	--	50	25
		Total	**15**	**0**	**14**	**29**	**22**	**--**	**--**	**--**	**500**	**--**	**--**	**--**	**200**	--
														TOTAL	**700**		

7EP04: PE(III) : (i) Wind & Solar Energy Systems **(ii)** Electrical Estimation & Costing **(iii)** Power System Operation & Control

7EP05: PE(IV) : (i) Artificial Intelligence (ii) Electrical Drives & Control (iii) Distributed Automation

SEMESTER : EIGHT

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
								Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
			Lecture	Tutorial	P/D								Int.	Ext.		
THEORY																
01	8EP01	Power System Protection	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	8EP02	Computer Methods in Power System Analysis	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	8EP03	Prof. Elective-V (PE-V)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	8EP04	Prof. Elective-VI (PE-VI)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
05	8EP05	Power System Protection - Lab	--	--	2	2	1	--	--	-- --	--	--	25	25	50	25
06	8EP06	Computer Methods in Power System Analysis- Lab	--	--	2	2	1	--	--	-- --	--	--	25	25	50	25
07	8EP07	Project & Seminar	--	--	12	12	6	--	--	--	--	--	75	75	150	75
		Total	**12**	**--**	**16**	**28**	**20**	**--**	**--**	**--**	**400**	**--**	**--**	**--**	**250**	--
														TOTAL	**650**	

8EP03 : PE-V: (i) High Voltage Engineering (ii) HVDC & Facts (iii) Smart Grid System

8EP04 : PE-VI: (i) Power Quality (ii) Electrical Energy Conservation & Auditing (iii) Electric & Hybrid Vehicle

Four Year Degree Course in Bachelor of Engineering Branch: **INFORMATION TECHNOLOGY**
Semester Pattern (Choice Based Credit Grade System)

SEMESTER : THIRD																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	3IT01	Mathematics-III	3	1	--	4	4	3	80	20	100	40	--	--	--	--
02	3IT02	Discrete Structure & Graph Theory	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	3IT03	Object Oriented Programming	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	3IT04	Assembly Language Programming	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	3IT05	Analog & Digital Electronics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Studies	2	--	--	2	0	--	--	--	--	--	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	3IT06	Object Oriented Programming Jawa lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	3IT07	Assembly Language Programming- Lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	3IT08	Analog & Digital Electronics- Lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	3IT09	Comp. Skil Lab.-I	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**17**	**1**	**8**	**26**	**20**	--	--	--	**500**	--	--	--	**200**	--
														Total	**700**	

Note: **(i) The Examination of Mandatory Subject Environmental Science shall be conducted in IV Semester.
(ii) # C Skill Lab I – based on technology like – Python, R etc. to be decided by individual Dept. of respective College.

SEMESTER : FOURTH																	
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME									
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL				
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																	
01	4IT01	Computer Organization & Architecture	3	1	--	4	4	3	80	20	100	40	--	--	--	--
02	4IT02	Data Communication & Networking	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	4IT03	Operating System	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	4IT04	Data Structures	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	4IT05	Social Science & Engg. Economics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Science	2	--	--	2	2	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																	
07	4IT06	Data Communication & Networking Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	4IT07	Operating System Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	4IT08	Data Structures Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	4IT09	Comp. Skill Lab.-II	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**17**	**1**	**8**	**26**	**22**	--	--	--	**600**	--	--	--	**200**	--
														Total	**800**	

Note: **(i)The Examination of Mandatory Subject Environmental Science shall be conducted in IV Semester.
(ii) # C Skill Lab I – based on technology like – Python, R etc. to be decided by individual Dept. of respective College.

SEMESTER : FIFTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks Int.	Max. Marks Ext.	Total	Min. Passing Marks
THEORY																
01	5IT01	Database Management Systems	4	--	--	4	4	3	80	20	100	40	--	--	--	--
02	5IT02	Theory of Computation	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	5IT03	Software Engineering	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	5IT04	Professional Elective –I (PE-I)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	5IT05	Open Elective – I (OE-I)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	5IT06	Database Management Systems Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	5IT07	Software Engineering Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	5IT08	Professional Elective –I Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	5IT09	Comp. Skill Lab.-III (#)	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**16**	**0**	**8**	**24**	**20**	**--**	**--**	**--**	**500**	**--**	**--**	**--**	**200**	**--**
														Total	**700**	

5IT04: PE (I) : (i) Information Security Systems (ii) Data Science & Statistics (iii) Internet of Things

5IT05: OE (I) : (i) Soft Skills & Interpersonal Communication (ii) Computational Biology (iii) Cyber Law & Ethics. Open Elective- I to be offered from the Courses offered by other Engg. & Technology Boards of the University / Massive Open Learning Courses (MOOCs) such as SWAYAM pertaining to the profession.

(#) Computer Skill Lab III-based on technology like-DevOp, Angular & React, etc. to be decided by Individual Dept. of respective College.

An Orientation Program of 15 hours duration / MOOCs on **Indian Constitution** to be offered to the students during the **V th Semester.**

SEMESTER : SIXTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks Int.	Max. Marks Ext.	Total	Min. Passing Marks
THEORY																
01	6IT01	Compiler Design	4	--	--	4	4	3	80	20	100	40	--	--	--	--
02	6IT02	Design & Analysis of Algorithms	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	6IT03	Artificial Intelligence	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	6IT04	Prof. Elective - II (PE-II)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	6IT05	Open Elective - II (OE-II)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	6IT06	Compiler Design Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	6IT07	Design & Analysis of Algorithms - Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	6IT08	Prof. Elective - II - Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	6IT09	Comp. Skill Lab.-IV (#)	--	--	2	2	1	--	--	--	--	--	50	--	50	25
		Total	**16**	**0**	**8**	**24**	**20**	--	--	--	**500**	--	--	--	**200**	--
														Total	**700**	

6IT04: PE (II) : (i) Cryptography & Network Security (ii) Big Data Analytics (iii) sensors & Activators

6IT05: OE (II) : (i) Economic Policy in India (ii) Human Resource Development & organization (iii) Intellectual Property Right. Open Elective- I to be offered from the Courses offered by other Engg. & Technology Boards of the University / Massive Open Learning Courses (MOOCs) such as SWAYAM pertaining to the profession.

(#) C Skill Lab IV- Mini project based on Software Engineering to be decided by Individual Dept. of the respective College.
An Orientation Programm of 15 hours duration .MOOC on Indian Traditional Knowledge to be offered to the students during the VII Semester.

SEMESTER : SEVENTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	7IT01	Mobile Computing	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	7IT02	Embedded Systems	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	7IT03	Cloud Computing	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	7IT04	Prof. Elective - III (PE-III)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	7IT05	Prof. Elective- IV (PE-IV)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	7IT06	Embedded Systems - Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	7IT07	Prof. Elective - III Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	7IT08	Prof. Elective- IV Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	7IT09	Project & Seminar	--	--	8	8	4	--	--	--	--	--	--	50	50	25
		Total	**15**	**0**	**14**	**29**	**22**	**--**	**--**	**--**	**500**	**--**	**--**	**--**	**200**	**--**
														Total	**700**	

7IT04: PE(III) : (i) Machine learning (ii) Data Warehousing &Mining (iii) Wireless Sensor Networks

7IT05: PE(IV) : (i) Block Chain Fundamentals (ii)Business Intelligence (iii) Digital Forensic

SEMESTER : EIGHT

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	8IT01	Object Oriented Analysis & Design	3	--		3	3	3	80	20	100	40	--	--	--	--
02	8IT02	Professional Ethics & Management	3	--		3	3	3	80	20	100	40	--	--	--	--
03	8IT03	Entrepreneurship & Project Management	3	--		3	3	3	80	20	100	40	--	--	--	--
04	8IT04	Prof. Elective-V (PE-V)	3	--		3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
05	8IT05	Object Oriented Analysis & Design Lab	--	--	2	2	1	--	--	-- --	--	--	25	25	50	25
06	8IT06	Prof. Elective-V (PE-V)- Lab	--	--	2	2	1	--	--	-- --	--	--	25	25	50	25
07	8IT07	Project & Seminar	--	--	12	12	6	--	--	--	--	--	75	75	150	75
		Total	**12**	**--**	**16**	**28**	**20**	**--**	**--**	**--**	**400**	**--**	**--**	**--**	**250**	--
														Total	**650**	

8IT04 : PE-V: (i) Robotics (ii) Virtual & Augmented Reality (iii) Human Computer Interaction (iv) Cross Platform Application Development

SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE

Official Publication of Sant Gadge Baba Amravati University

PART- TWO

(Extra-Ordinary)
Saturday, the 31st August,
2019

NOTIFICATION

No. 111 /2019 Date : 31/08/2019

Subject :- Implementation of new syllabi of Semester I & II of B.E./B.Text. E. /B.Tech. (Chem. Engg.)/ B.Tech.(Chem.Tech.) Polymer(Plastic) Tech. for the session 2019-2020 as per A.I.C.T.E. Model Curriculum.

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabi as per A.I.C.T.E. Model Curriculum of Semester I & II (Group A & B)of B.E./B.Text.E./ B.Tech.(Chem. Engg.)/ B.Tech. (Chem.Tech.) Polymer(Plastic)Tech. from the academic session 2019-2020 and onwards in phase wise manner as per **Appendix – A** :

Moreover, It is notified for general information of all concerned that the authorities of the University have accepted Induction Program as per A.I.C.T.E. Guidelines for Semester I as per **Appendix – B.**

Sd/-
(Dr.T.R.Deshmukh)
Registrar
Sant Gadge Baba Amravati University

Appendix – A

Syllabus of B.E./B.Text.E./ B.Tech.(Chem. Engg.)/
B.Tech. (Chem.Tech.)Polymer(Plastic) Tech.
Sem. I & II
Group - A

1A1 ENGINEERING MATHEMATICS-I

Aim :

The aim of this course is to familiarize the prospective engineers with techniques in differential calculus and equations. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Objectives:

1. To identify algebraic problems from practical areas and obtain the solutions in certain cases
2. To understand maxima and minima concept.
3. To solve differential equations of certain types, including systems of differential equations that they might encounter in the same or higher semesters.

Course Outcomes:

On completion of the course the students will learn:

- Able to understand Rolle's Theorem and its applications to Engeering Problems.
- Able to understand maxima minima concept.
- Able to apply Demoiver's theorem in various concepts of complex number.
- Able to solve differential equations of certain types that they might encounter in the same or higher semester.

SECTION - A

Unit I : Differential Calculus :

Successive Differentiation, Leibnitz's Theorem, Rolle's Theorem, Mean value theorem, Expansions of function using Taylor's and Maclaurin's theorems; Indeterminate Forms Using L'Hospital Rule. (8)

Unit II: Multivariable Differential Calculus :

Partial differentiation, total differential coefficients, exact differential, Euler's theorem on homogeneous function, Maxima & Minima of a function of several connected independent variables (Lagrange's multipliers). (8)

Unit III : Complex Numbers :

Demoiver's theorem and its applications, Hyperbolic and inverse hyperbolic functions, separation of real and imaginary parts, Logarithm of complex numbers. (8)

SECTION –B

Unit IV: - First order and First Degree Ordinary Differential Equations :

Ordinary differential equations of first order and first degree in various Forms, (Variable separable, linear differential equation, homogeneous differential, exact differential equation) and reducible to above forms, methods of substitution. (8)

Unit V : First order and Higher Degree Ordinary Differential Equations :

Solution of differential equation of first order and higher degree by various methods.

Applications of Ordinary Differential Equations :

Applications of differential equations of first order and first degree to the problems on orthogonal trajectories and Electrical engineering. (8)

Unit VI :Sequences and Series

Convergence of Sequence and Series, Test for Convergence, Comparison Test, Ratio Test, Root Test, Raabe's Test, Range of Convergence. (8)

Text / Reference Books :

i) Wartikar P.N . , Wartikar J.N. – A text of applied Mathematics, Volume I, II, Pune V.G. Prakashan , Pune.
ii) Grewal B. S. – Higher Engineering Mathematics, (latest Edition), Khanna Publishers .
iii) Kreyszig E.K. – Advanced engineering Mathematics, John Wiley.
iv) Ramana B. V. - Higher Engineering Mathematics, (TMH).
v) Singh R.R. And Bhatt M. - Higher Engineering Mathematics, (TMH).
vi) N.P.Bali and Manish Goyal – A text book of Engineering Mathematics, Laxmi Publications.
vii) Veerarajan T. Engineering mathematics for first year,(TMH).

I A 2 ENGINEERING PHYSICS

Aim:

To enable the students to correlate the theoretical principles of fundamentals of modern aspects in Physics with application oriented studies of engineering.

Objectives:

At the end of the course the students would be exposed to fundamental, knowledge in:

- Electromagnetic phenomena and wave propagation.
- Interferometric techniques in metrology, communication.
- Application of quantum physics to optical & electrical phenomena.
- Application of lasers and Fiber Optics in Engineering and Technology.
- Conducting, superconducting and dielectric materials.
- Semi conducting and new engineering materials.
- Physics of Modern engineering materials.
- Application of ultrasonic's, acoustics.

SECTION-A

Unit I: Solid State Physics: Classification of solids on the basis of energy band diagram, Covalent bonds, bound & free electrons, holes, electron and hole mobilities, Intrinsic and Extrinsic semiconductors, energy band diagram for semi-conductors. Fermi and Impurity levels, semi-conductor conductivity with derivation, Law of mass action (only statement), P-N junction diode, Zener diode, Light Emitting Diode. Hall effect. (9)

Unit II: Modern Physics: Planck's hypothesis, properties of Photons, Compton effect, De-Broglie's concept of matter waves, wave particle duality, Heisenberg's Uncertainty Principle (only statement), applications of uncertainty principle (electrons cannot exists in the nucleus and binding energy of electron in atom), wave function and its significance, time independent Schrodinger equation. (7)

Unit III : Electric and Magnetic Fields : Motion of electron in uniform transverse electric field and transverse magnetic fields, velocity selector (energy filter), positive rays, Bainbridge mass spectrograph, Cathode ray oscilloscope : block diagram and working of each block. (7)

SECTION-B

Unit IV: Interference and Diffraction: Fundamental condition of interference, thin film interference due to reflected light, Newton's ring; equation for radius of bright and dark rings, determination of wavelength, R. I. of medium using Newton's ring. Fresnel and Fraunhoffer class of diffraction, single slit diffraction, plane transmission grating; construction and determination of wavelength of light using grating, dispersive power of grating. (7)

Unit V: Fibre Optics and LASER: Principle and construction of optical fibre, acceptance angle and acceptance cone numerical aperture, types of optical fibres and refractive index profile, attenuation in optical fibres, different mechanisms of attenuation, application of optical fibres.; LASER: spontaneous and stimulated emission of radiation, Pumping, Optical Pumping, Ruby LASER (Construction and Working), Characteristics & Applications of Laser in Industrial, Medical and Scientific field. (7)

Unit VI: Acoustics: Sound waves, reflection of sound waves, defects due to reflected sound (echo and reverberation), absorption of sound, Sabine's formula for reverberation of time, Factors affecting architectural acoustics and its remedies.
Ultrasonics: Ultrasonic waves, Production of Ultrasonic waves (piezo-electric and magnetostriction methods), properties of Ultrasonic waves and applications. Fluid dynamics: Viscosity, Stoke's law, liquid flow (streamline and turbulent), flow of liquids through a capillary tube (Poiseuille's equation), Continuity equation, Bernoulli's theorem (only derivation). (7)

I A 6 ENGINEERING PHYSICS – Lab.

Practicals :

1) Determination of Band gap energy of semiconductor.
2) To study the forward and reverse characteristics of P-N junction diode.
3) To study the reverse characteristics of Zener diode.
4) To study the forward characteristics of Light Emitting Diode.
5) To determine the wavelength of monochromatic light by Newton's Rings method.
6) Determination of wavelength of spectral lines using diffraction grating.
7) Determination of grating element of a diffraction grating using LASER beam.
8) Study of Hall Effect
9) Amplitude and frequency measurement of ac signal using CRO
10) Study of CRO
11) Determination of unknown frequency of ac signal using Lissajious spattern
12) To determine resolving power of telescope
13) Determination of Planck's constant using photocell
14) To determine the coefficient of viscosity of water by capillary flow.
15) To determine the specific charge (e/m) of electron by Thomson method.
16) Experiment on the basis of Non Destructive Testing.

(Note: Minimum 08 experiments shall be conducted)

Text Books:

1) M.N. Avadhanulu & P. G. Kshirsagar: Engineering Physics, S. Chand Pub., 2008
2) Dr. (Mrs.) S. D. Wakde & J. S. Bakare: Engineering Physics, SSGMCOE, 2004

Reference Books:

1) R. K. Gaur & S. L. Gupta: Engineering Physics, Dhanpat Rai & Sons.
2) Hitendra K. Malik & A. K. Singh: Engineering Physics, Tata McGraw Hill
3) Beiser: Mordern Physics, Tata McGraw Hill
4) Mani & Mehta: Mordern Physics, Affiliated East- West Press
5) N. Subrahmanyam, Brijlal, M. N. Avadhanulu: A Text Book of Optics, S. Chand & Company.

1A3 ENGINEERING MECHANICS

Course Objectives :

Students will be taught -

1. Concepts related to Forces and its effects, resolution and composition of coplanar forces.
2. Application of principles of statics to the system of rigid bodies.
3. Analysis of simple structures like trusses and beams.
4. Concepts related to friction, its application.
5. Concepts related to centroid, moment of inertia, radius of gyration and product of inertia and its application.
6. Concepts related to kinematic and kinetic equations, and its applications to various types of motion.
7. Concepts related to conservation of momentum and laws of impacts.

Course Outcomes :

At the end of course students will be able to -

1. Compose and resolve the forces along with its effect.
2. Apply principles of statics to the system of rigid bodies and analyse simple structures.
3. Calculate frictional forces for simple contact, wedges and belt friction.
4. Locate centroid and calculate moment of inertia.
5. Calculate various kinematic quantities.
6. Solve the problems using different kinetic equations related to direct and interconnected particles.
7. Apply principle of conservation of momentum and laws of impact.

SECTION - A

UNIT-I (STATICS) :

Resultant: Concept of a force, force systems, moment of a force about a point, couple, resolution and compositions of coplanar forcesystem.

Equilibrium: Free-body diagrams, equations of equilibrium, problems ofequilibrium involving co-planar force system acting on a particle,rigid body and system of rigid bodies. (09)

UNIT-II (STATICS) :

Trusses: Definitions, assumptions, types, Analysis of simple plane perfect trusses by method of joints and method of section.

Friction: Definitions of friction, types, angle of friction, angle of repose, cone of friction, Coulomb's laws of friction. Applications to simple contact friction, wedges and belt friction. (09)

UNIT-III : Centroid, First Moment of Area, Problem on Centroid of composite sections, Second Moment of Area, Radius of Gyration,product of inertia, perpendicular and parallel axis theorem, polar moment of inertia, radius of gyration, Definition of principal axes and principal moment of inertia. (07)

SECTION - B

UNIT-IV (DYNAMICS - KINEMATICS) :

Definitions of displacement, velocity and acceleration and their relations, rectilinear motion under variable & constant accelerations, curvilinear motion using rectangular coordinates, normal and tangential components(involves Problems on calculation of total acceleration, radius of curvature and projectile motion). (06)

UNIT-V (DYNAMICS – KINETICS) :

Kinetics of rectilinear, curvilinearand rotatory motion of a particle actedupon by a force system, Application of D'Alembert'sprinciple, concept of dynamic equilibrium, rectilinear motion ofseveral interconnected particles, and rotation of rigid body about a fixed axis. **(**07)

UNIT-VI (DYNAMICS – KINETICS) :

Application of work-energy equation and impulse-momentum equation, law of conservation of momentum for aparticle and a system of particles in a rectilinear translation,direct central impact, collisionof two particles, coefficient of restitution.

TEXT BOOKS :

1) Bhattacharyya Basudeb, Engineering Mechanics, Oxford University Press.
2) Bhavikatti, S. S. and Rajashekarappa, K. G., Engineering Mechanics, New Age International Publishers, New Delhi.

REFERENCE BOOKS :

1) Singer, F. L., Engineering Mechanics, Harper Collins Pub., Singapore
2) Timoshenko, S. P. and Young, D. H., Engineering Mechanics, McGraw-Hill International C.,Auckland.
3) Beer, F. P. and Johnston, E. R., Vector Mechanics for Engineers, McGraw-Hill International C., Auckland.
4) Shames, I. H., Engineering Mechanics, P.H.I. Pvt. Ltd., New Delhi.

1A7 ENGINEERING MECHANICS – Lab.

Course Objectives :

Students will be taught -

1. Performance of practicals based on concepts related to engineering mechanics.
2. Working of Lifting Machines

Course Outcomes :

Students will be able to -

1. Prove the concepts related to engineering mechanics.
2. Calculate lifting machine parameters.
3. Perform graphical analysis of force systems and simple structures.

PRACTICALS:

(Two compulsory graphical solutions to the problems of statics)

1. Law of Polygon of forces
2. Reactions at the supports of simple beam.
3. Forces in members of Jib crane.
4. Determination of coefficient of friction on inclined plane.
5. Determination of Coefficient of coil friction.
6. Determination of law of machine for screw jack/differential axle wheel /single and double purchase crab (for any two machines).
7. Determination of mass moment of inertia of fly wheel
8. Determination of gravitational acceleration by compound pendulum.

1A4 COMPUTER PROGRAMMING

Aim: The course is aimed at impart knowledge to analyze, solve, design and code real-life problems using C language

Course Outcomes: At the end of course, the students will be able -

- To explain fundamental concepts of computer and computing.
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To recognize various problem solving techniques and computer applications.
- To apply programming concepts to solve real life problems.

UNIT I: **Fundamental of the Computer and Computing Concepts** : Generation of computers, Classification of computers, Basic Anatomy of Computer System, Input Devices, Processor, Output Devices, Memory Management, Types of Computer Software, Overview of Operating system, Networking Concepts, Microsoft Office, Number systems: Decimal, Binary, Hexadecimal, Octal, Conversion of Numbers, Binary Arithmetic Operations, Programming Languages, Logic gates (8)

UNIT II: **C Fundamentals :** Introduction, Importance of C, Basic Structure of C Programs, Program execution, Basic programs based on C such as Printing Message, Adding two numbers, Interest calculations, Use of subroutines, math function. C tokens, Keywords and Identifiers, Character set, Data Types, Constant and Variables, Declaration of Variables, Declaration of Storage Class (8)

UNIT III: **Operators, Expression and Input-Output operation** : Operators, Types of Operators: Arithmetic, Relational, Logical, Assignment, Increment-decrement, Conditional, Bitwise, Special. Arithmetic expression, Evaluation of Expression, Precedence of Arithmetic Operators, Input-Output Operation: Reading and Writing Character, Formatted Input, Formatted Output. (8)

UNIT IV: C Control constructs : Decision-making using if, if-else, nested if, else if ladder and switch-case statements, ?: Operator, Goto Statement, Loops using for, while, do-while statements, break and continue statements, Jumps in Loops, Concise Test Expressions. (8)

UNIT V: Array, Strings and Structures: Introduction to array, One Dimensional Array: Declaration & Initialization, Two Dimensional: Declaration & Initialization, Multi Dimensional, Strings: Declaration and Initialization, Reading String from terminal, Writing String to Screen, Putting Strings together, Comparison of Two Strings, String-Handling Functions, Table of Strings, Other features of String, Structures – Define, Declaration, Accessing the members of a structure **(8)**

UNIT VI: User Defined Functions, Pointers and File Management : Functions, Need for User defined Functions, Multi Function Program, Elements of User Defined Functions, Return Values and their types, Function Calls, Function Declaration, and Categories of Functions. Definition and uses of pointers, Accessing the address of a variable, Introduction to File Management, Defining and Opening File, Closing File, Input/output Operations on File. (8)

TEXT BOOK : E Balagurusamy: Computing Fundamentals & C Programming‖ – Tata McGraw-Hill, 2nd Edition .

REFERENCE BOOKS:

1. Pradeep Dey and Manas Ghosh, " Computer Fundamentals & Programming in C" Oxford University Press 2006.
2. K R Venugopal and S R Prasad,"Mastering C" Tata-McGraw Hill.
3. Seymour Lipschutz, "Data Structure Using C", Tata-McGraw Hill.
4. Herbert Schildt - C Complete Reference (Tata-McGraw Hill).

1A8 COMPUTER PROGRAMMING- LABORATORY

Based on the Syllabus of 1A4 Computer Programming – Minimum Eight (8) experiments be performed preferably covering all the Units.

1A5 WORKSHOP PRACTICE

Course Objectives :

- To give students 'hands on experience' of craftsmanship.
- To make students familiar with different work trades.
- To develop quality & safety consciousness amongst the students.
- To develop awareness of fire safety amongst the students.
- To develop respect towards labor work amongst the students.
- . To develop skill sets for creating entities from primitive engineering materials
- To develop skill sets for establish in connections through wires and cables.
- This exercise also aims at inculcating respect for physical work and hard labor in addition to some value addition by getting exposed to interdisciplinary engineering domains.

Course Outcomes :

- Upon completion of this course, the students will gain knowledge of different manufacturing processes which are commonly employed in industry.
- Upon completion of this course, the students will be able to fabricate the components using various manufacturing techniques.
- The students will be conversant with the concept of dimensional accuracy and tolerances.

PERFORMANCE:

Students should perform minimum six jobs out of following :

I) SMITHY: Introduction to smithy operations like upsetting, drawing ,bending, Forming; Tools- hammer, hot and cold chisels, swages ,drifts, flatters, tongs, anvils and various smithy tools & equipments ,their use. Forging Principle, forge welding, use of forged parts.

One job on smithy: Job involving upsetting, drawing down, flattering. Change of cross sectional area like round to rectangular or making a ring from a round bar, S – Hook, forming such as a square / hexagonal headed bolt, hook etc.

II) FITTING: Introduction to different fitting tools. Use and setting of fitting tools for marking, center punching, chipping, cutting, filing, drilling, their use, different measuring tools, Files – Material and Classification.

One job on fitting: involving operations like marking, filing, hacksaw cutting, drilling and tapping, making simple assemblies like a male-female type pair

III) TAPS & DIES: introduction to Taps & Dies, Different sizes of Taps & Dies their uses, holding instruments of taps & dies.

One job on taps & dies: Job involving, External and internal threads on plate or pipe, marking, center punching, cutting, filing, drilling

IV) SHEET METAL: Introduction to sheet metal tools, their use, different sheet metal joints, soldering, surface development. Specifications of metal sheets, Surface coatings; Operations like cutting, bending, folding, punching, riveting ; Joining by brazing and soldering.

One job on sheet metal: Job involving soldering operation like marking ,cutting, bending, joining operations of small sheet metal parts. Typical examples: sheet metal tray, funnel, dustbin, etc.

V) WELDING : Classification & brief introduction to welding processes- Arc, Gas and Resistance. Definition of welding, brazing and soldering processes, and their applications. Oxy-Acetylene Gas welding process, Equipment and Techniques, Type of flames and their applications. Manual metal arc welding technique and equipment, AC and DC welding Electrodes, constituents and functions of Electrode coating. Welding positions. Type of welding joint. Common welding defects such as cracks, undercutting, slag inclusions, Porosity

One job on welding: Job consisting of edge preparation for arc welding of different parts like lap welding of two plates, butt welding of two plates and welding to join plates at right angles.

VI) CARPENTRY : Brief study of various hand tools like chisel, saw ,planer. Timber, definition, engineering applications, seasoning and preservation, plywood and ply boards. Use of marking tools & hand tools such as marking gauge, try squares, steel rules, saws, jackplane, etc. Use of power tools, safety precautions.

One job on carpentry: Job like preparing a wooden joint; involving operations like wood sizing, planning, marking, sawing, chiseling and groove making. Use and setting of hand tools like hack saw, jack plane, chisels and gauges for construction of various joints like T – Lap joint, Bridle joint ,Corner mortise joint, Dovetail / butt joint such as a tray, frame etc.

VII) MACHINE TOOLS AND PROCESSES: Introduction to different machining tools, different measuring tools.

One job on Lathe: Job involving marking, metal removing showing basic operations like plain turning, facing, step turning etc.

VIII) FOUNDARY : Molding sand , preparation of molding sand, pattern, core, runner ,riser cope & drag box.
One job on molding : Preparation of sand mould with pattern, core with runner riser

IX) PRINTED CIRCUIT BOARDS : PCB etching and drilling, tinning and soldering techniques. Assembly of Electronic components on the printed circuit board (PCB).

One job of PCB design: Job involving development of PCB for electronic circit which comprises of layout design , masking, etching , drilling, tinning & component soldering.

X) PLASTIC INJECTION MOULDING: Introduction, principle, equipment & its operation, mould introduction & setting, Safety precautions and demonstration of plastic injection molding process (Demonstration)

REFERENCES :

1. B. S. Raghuvanshi, A Course in Workshop Technology, Vol – I,Dhanapat Rai and Sons.
2. Hajara Choudhari, Elements of Workshop Technology, Vol – I, Media Promoters.
3. Gupta and Kaushik, Workshop Technology, Vol – I, New Heights.
4. Chapman, Workshop Technology, Vol – I, The English Language Book Society.
5. H.S.Bawa, Workshop Technology, Vol.-I, TMH Publications, NewDelhi.
6. S.K.Hajra Choudhary ,Elements Of Workshop Technology ,Media Promoters &Publishers Pvt.Ltd,
7. Workshop Technology, Vol I, II and III, Chandola S.P., Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
8. K.T. Kulkarni, Introduction to Industrial Safety ,K.T .Kulkarni ,Pune Reference Books
9. Hwaiyu Geng, Manufacturing Engineering Handbook ,McGraw Hill Publishing Co.Ltd.
10. Lawrence E.Doyle, Manufacturing Processes and Materials for Engineers ,Prentice Hall Inc.

NOTE : Journal should be prepared and submitted based on information of tools and equipments used, jobs prepared by using various tools, equipments, machines in the above trades of performance sections. The term work shall be assessed based on a) the record of attendance, b) Term work done, c) the written/ practical / oral tests on the term work to decide the depth of understanding. The term work is to be assessed weekly.

PRACTICAL EXAMINATION:

Practical examination will consists of actual preparation of one job from any of the above performance sections. Duration of examination will be 3 hrs. Total marks are 25, out of which 15 marks are for job preparation and 10 marks for viva voce which should be conducted when the students are on job.

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Sem. I & II
Group B

I B 1 ENGINEERING MATHEMATICS-II

Aim:

The aim of this course is to familiarize the prospective engineers with techniques in integral calculus, algebra. Also to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Objectives:

1. To find solution of simultaneous equations by matrix method.
2. To familiarize the prospective engineers with techniques in integral calculus.
3. To understand the expansion of Fourier series.
4. To understand double and triple integration and enable them to handle integrals of higher orders.
5. To deal with functions of several variables that is essential in most branches of engineering.

Course Outcomes:

On completion of the course the students will be able to:

1 The essential tool of matrices and linear Algebra in a comprehensive Manner.
2 Evaluation of Integrals by Reduction Formulae, Gamma and Beta Function
3 Use the tool of Fourier series for learning advanced engineering mathematics.
4 Use new techniques DUIS to evaluate Integrals and Tracing of Curves
5 The Mathematical tools needed in evaluating Multiple Integrals and their usage.

SECTION-A

Unit I : Matrices :
Inverse by Partitioning, Rank of a matrix, Rank-nullity theorem(without proof), System of linear equations; Eigen values and Eigen Vectors, Cayley-Hamilton Theorem **.** (8)

Unit II : Fourier series:
Periodic function, Fourier expansion of periodic function in (C, C+2L), half range Fourier series, Parseval's Theorem, Harmonic Analysis. (8)

Unit III: Integral Calculus :
Reduction formulae, Beta and Gamma function, Evolutes and involutes. (8)

Section - B

Unit IV: (a) Rule of differentiation under integral sign.
(b) Tracing of curves (Cartesian, Parametric and polar forms)
(c) Rectification (Cartesian, Parametric and polar forms). (8)

Unit V: Multivariable Integral Calculus I :

Double Integrals, Cartesian, Change of Order of Integration, Change of Variables (Cartesian to polar coordinates), Evaluation of area by Double Integration.. (8)

Unit VI: Multivariable Integral Calculus II :

Triple integrals, Cartesian, transformation to spherical polar coordinates, Volume by Triple Integration, Mean and RMS Value Theorem. (8)

Text / Reference Books :

i) Wartikar P.N . , Wartikar J.N – A text of applied Mathematics, Volume I, II Pune V.G. Prakashan, Pune.
ii) Grewal B. S. – Higher Engineering Mathematics, (latest Edition), Khanna Publishers .
iii) Kreyszig E.K. – Advanced engineering Mathematics, John Wiley.
iv) Ramana B. V. - Higher Engineering Mathematics, (TMH).
v) Singh R.R. And Bhatt M. - Higher Engineering Mathematics, (TMH).
vi) N.P.Bali and Manish Goyal – A text book of Engineering Mathematics, Laxmi Publications.
vii) Veerarajan T. - Engineering mathematics for first year, (TMH)

1B2 ENGINEERING CHEMISTRY

Aim:

To impart the sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering students.

Course Objectives:

1. To provide the fundamental background required for industrial setups.
2. To provide the exposure for conducting the experiments in view of engineering aspects.
3. To provide the knowledge about properties of materials and their applications.
4. To utilize the knowledge about polymer and engineering materials towards different applications
5. To provide the knowledge about importance of fuels and lubricants
6. To provide the knowledge about analytical techniques.

Coursd Outcomes:

1. Apply the knowledge of chemistry in softening processes involved in water technology.
2. Identify various types of corrosion and methods to protect the metallic structures form corrosive environment
3. Understanding of the energy storage system (battery) .
4. Apply the knowledge of useful engineering materials such as cement, lubricants, ceramics, refractories and nano materials based on their properties.
5. Develop the technique involved in the manufacturing process of cement
6. Apply the knowledge about the properties of chemical fuels for the generation of power.
7. Apply the knowledge of various polymeric material, their synthesis and applications.
8. Identify various phases of material at different thermodynamics variables.
9. Identification and analysis of materials by using advanced analytical techniques.

SECTION - A

Unit I: Water Treatment and Analysis: [8 Hrs.]

Hardness of water: Types of hardness, Unit of hardness, Determination of hardness of water by EDTA method. Disadvantages of hard of water, Boiler troubles: Scale and Sludge formation, Caustic embritlement, Priming & Foaming, Boiler corrosion. Softening of water by Zeolite process, Ion exchange process and Reverse Osmosis (RO). Numerical problems based on calculations of hardness and Zeolite process.

Unit II: Corrosion and Energy storage system: **[8 Hrs.]**

Corrosion: Introduction, Dry & Wet corrosion and their mechanism, Types of corrosion: Pitting corrosion, waterline corrosion, inter-granular corrosion, Galvanic and Stress corrosion. Pilling Bed worth rule.

Corrosion Control: a) Design and material selection b) Cathodic protection, c) Protective surface coatings- Hot Dipping (Galvanizing and Tinning).

Energy storage system: Basic principles of batteries & their types, Construction, working and applications of lithium- ion battery, Ni-Cd battery.

Unit III: Engineering Materials: [8 Hrs.]

Cement: Raw materials, Ingredients of cement and their functions, Wet process of manufacturing of cement, Properties of cement: Setting & Hardening, Heat of hydration & Soundness of cement.

Lubricants: Introduction, Functions of Lubricant, Classification of lubricant: Thick Film, Thin Film & Extreme Pressure lubrication. Physical Properties of lubricants (Definitions): Viscosity & Viscosity index, Flash & Fire point, Cloud & Pour point, Carbon residue.

Industrial Material: Definition, properties and Applications of ceramics & refractories, Nanomaterial.

SECTION- B

Unit IV: Energy Science: **[8 Hrs.]**

Introduction of chemical fuels its classification, Calorific value: Gross & Net calorific values, and its relation .Analysis of coal: Proximate & Ultimate analysis and their significance, Characteristic of Good fuel, Cracking of petroleum fractions, use of gasoline and diesel in IC engine. Knocking, octane number, cetane number. Numerical based on combustion (Mass to Mass, Volume to Volume and less air supplied type)

Unit V: Polymer chemistry: [8 Hrs.]

Introduction and Classification of polymers, Methods of polymerization: Addition polymerization:- Free radical, Cationic & Anionic mechanism of polymerization, Preparation, properties and uses of Polyethylene, Poly vinyl chloride, Teflon. Condensation polymerization: Preparation, properties and uses of Bakelite. Thermosetting & Thermoplastic, Rubber: Natural rubber, Drawbacks of natural rubber & Vulcanization. Synthetic rubbers: Preparation, Properties & Applications of - Styrene rubber, Nitrile rubber, Butyl rubber. Biodegradable polymers: properties and applications, Conducting polymers: Introduction, types of conducting polymer and their examples.

Unit VI: Phase rule and Spectrophotometric techniques : [8 Hrs.]

Phase rule: Gibb's Phase rule, Explanation of the terms: Phase, Components and Degree of Freedom, Application of Phase rule to One Component System (Water System), Condensed phase rule and its application to two component system (Bi-Cd).

Spectrophotometric techniques :

Qualitative and quantitative analysis, Principles and instrumentation of spectrophotometry: U.V and.IR spectroscopy. Principle & instrumentation of NMR spectroscopy. Applications of spectroscopy technique. Surface characterization technique: X-ray diffraction.

TEXT BOOKS:

(1) "A Text Book of Engineering Chemistry"-S. S. Dara. (S. Chand).
(2) "Engineering Chemistry"-Jain & Jain. (Dhanpat Rai &Sons).
(3) A Text book of Engineering Chemistry Shashi Chawla.

REFERENCE BOOKS:

1 "A Text book on Experiments & Calculations in Engineering Chemistry- S. S. Dara. (S.Chand).
2 "Text book of Engineering &Technology" Vol I & II-Rajaram & Kuriacose.
3 "A Text Book of Polymer Science &Tech"-V Gowarikar.
4 Nanotechnology Fundamentals and Applications: Manasi Karkare, I K International Pub
5 Fundamentals of molecular spectroscopy : C. N. Banwell.

1B6 ENGINEERING CHEMISTRY - LABORATORY

Course Objectives:

To provide the practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skill to built technical competence.

Course outcomes :

After completion of this course the student shall be able to :

1. Understand the objective of their experiments.
2. Record and analyze the results
3. Follow the proper and safe procedure to get the accurate results.
4. Interpret the results through proper writing in journal.

LIST OF EXPERIMENTS :

1. Determination of alkalinity of water sample in given alkali mixture. (NaOH and Na_2CO_3)
2. Determination of hardness of water by EDTA method.
3. Determination of chloride ions in water sample.(Mohr's Method)
4. Determination of chlorine in water sample. (Iodometry)
5. Determination of % CaO in given cement sample.
6. Preparation of phenol formaldehyde & Urea formaldehyde resin.
7. Determination of viscosity of lubricating oil by Redwood viscometer no. 1/no.2
8. Determination of flash point of lubricating oil by Pensky Marten's Apparatus/ Abel's apparatus
9. To carry out proximate analysis of coal.
10. Determination of acid value of lubricating oil.
11. Determination of Fe_2^+ and Fe_3^+ in given solution
12. Determination of Dissolved Oxygen in Water Sample.
13. Determination of conductivity of unknown sample by conductivity meter.
14. Determination of PH of unknown sample by PH meter.
15. Estimation of Nickel (Ni) by gravimetric method
16. Determination of Copper or Nitrate ion in water using UV-VIS spectrophotometer

(Note : Minimum 08 experiments shall be conducted)

1B3 BASIC ELECTRICAL ENGINEERING

Course Objectives:

1] To introduce students with different terminologies in electrical engineering and different theorems.
2] To understand magnetic circuits.
3] To study A.C. fundamentals.
4] Study of polyphase circuits.
5] To acquire the knowledge about electrical machines and transformer
6] To study different measuring instruments and electrical apparatus and safety(earthing).

Course Outcomes:

A student completing this course should able to do the following:

1] Explain the basic concepts of electric and magnetic circuits.
2] The students will be able to solve problems on AC fundamentals & three phase circuits
3] Explain the operating principles of various electrical machines and describe the working of various measuring instruments and importance of earthing

SECTION-A

Unit I: Basic concepts of Voltage, Current, Power, Energy and relationship between them Resistance, Resistivity, Conductivity, Temperature effect on resistance and temperature coefficient of resistance. Series and parallel circuits, Ohm's law, Kirchoff's laws, Superposition theorem, Thevenin's theorem, Star-Delta transformation (8 Hrs)

Unit II: Magnetic Circuit & Electromagnetism :Basic concept of Magnetic flux, Flux density, MMF, Reluctance, Magnetic field intensity and their relationship, Series and Parallel Magnetic circuits, Principles of Electromagnetic induction, self and mutual inductance, Leakage and fringing of flux, coefficient of coupling and Magnetization curves. (8 Hrs)

Unit III: A.C. Fundamentals, RMS, Average values, form factor, peak factor for Sinusoidal Wave form only, Single phase A.C. Series circuit with Resistance, Inductance and Capacitance, phasor Diagram. Single phase A.C. Parallel circuit with Resistance, Inductance and Capacitance, phasor Diagrams. Impedance Triangle, Active and Reactive power (8 Hrs).

SECTION-B

Unit IV: Polyphase Circuits, Balanced Three phase circuits, Production of three phase emf, Star and Delta connections. Relationship of Phase and line values of voltage and current for Star and Delta circuits, Star and Delta balanced load. (7)

Unit V: Electrical machines A) Single Phase Transformer, Construction and working (no load & on load), EMF Equation, Losses, Efficiency, Regulation and phasor diagram.

B) Electromechanical Energy Conversion, Working principle, Construction of D.C. Motors, types of dc motor, characteristics and applications of D.C. Motors (8 Hrs)

Unit VI: Electrical Apparatus and safety, Measurement of Current, Voltage, Power, Energy, Construction and working of PMMC, MI, Electro-dynamometer & Induction type Measuring Instruments. Necessity of earthing and types of earthing (Plate earthing & Pipe earthing) (7 Hrs)

TEXT BOOKS /REFERENCE BOOKS: - .

1. Basic Electrical Engineering , First Ed., Kulshreshtha D.C., TMH
2. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", TMH Pub. Co. Ltd., New Delhi , 4th Edition
3. Basic Electrical Engineering, V. N. Mittle, TMH Publishing company Ltd
4. Basic Electrical Engineering, Fifth Edition, Fidzgerald A.E., TMH -2006.
5. Basic Electrical Engineering, First ed., R. Anand Natarajan & P. Ramesh
6. Principle of Electrical Engineering , 4th Edition, Del Toro V., PHI 2005
7. Basic Electrical Engineering –First ed., T. K. Nagsarkar, OXFORD University Press, 2005
8. Electrical Technology – Volume - I, B. L. Theraja, S. Chand & Co. Publication.

1B7 BASIC ELECTRICAL ENGINEERING – LAB.

List of experiments in Basic Electrical Engineering:

(Minimum (8) eight experiments based on above syllabus]

1. To verify KCL and KVL .
2. To verify Superposition theorem.
3. To verify Thevenin's theorem
4. To verify the effect of temperature on conductor and temperature coefficient of resistance.
5. To analyze series RLC circuit
6. To analyze Star connected resistive circuit
7. To analyze Delta connected resistive circuit
8. To perform load test on a single phase transformer
9. To study D.C. Motors
10. To study measuring instruments

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1B4 ENGINEERING GRAPHICS

Course Objectives:

1) To acquire and apply engineering graphics knowledge for communicating ideas, information and instructions, as well as to understand the conventions of engineering drawing
2) To understand the representations of 3D objects, their projections and sectional views
3) To understand the representations of orthographic and isometric views of 3D objects
4) To introduce students with the drafting commands of commercial graphics software

Course Outcome:

On successful completion of the course, the students will be able to attain following Course Outcomes:

1) Students will able to read/prepare/understand the engineering drawings
2) Students will able to create the projections and sectional views of 3D objects
3) Students will able to draw the orthographic and isometric views of 3D objects
4) Students will able to use graphics software to create Engineering drawings and represent engineering systems

SECTION A

Unit 1: Introduction to Engineering Drawing and Projection :

Use of various drawing instruments, concept of dimensioning and scales, geometric construction, projection of point, line and plane, projection on auxiliary plane.

Unit 2: Projection of Solids :

Projection of solids for prism, pyramid, cone and cylinder.

Unit 3: Section of Solids :

Section of solids for prism, pyramid, cone and cylinder.

SECTION B

Unit 4: Orthographic Projection :

Conversion of pictorial view of objects to orthographic projections by using first and third angle projection methods

Unit 5: Isometric Views and Projections :

Construction of isometric views and projection of given two dimensional views

Unit 6: Introduction to CAD Software :

Drafting environment and drafting screen, coordinate systems, drafting and dimensioning commands, editing commands, drafting of basic geometrical shapes, display commands, CAD software customization.

List of Books Recommended :

Text Books:

1. Bhatt N. D. & Panchal V. M. Engineering Drawing, 49th Edn., Charotar Pub. House, Anand, Gujrat, 2007.
2. Shah P. J. – Engineering Drawing, S. Chand Publication, 2008.
3. Dhawan R. K. – Engineering Drawing, S. Chand Publication, (5th edition, 2008).
4. Tickoo Sham – AutoCAD, BPB Publications.

Reference Books:

1. Naraynan K. L., Kannaiah P. – Engineering Drawing, Scitech.
2. Jolhe D. A. – Engineering Drawing, Tata McGraw Hill Publication, 2008.

1B8 ENGINEERING GRAPHICS – LAB.

List of Practicals :

Every student will submit a set of at least SIX drawing sheets (from 1 to 7 listed below) and perform at least TWO practical (from 8 to 10 listed below) using CAD software. Examination will consist of viva-voce based on the syllabus.

1. Loci of points of various mechanisms
2. Projection of straight line
3. Projection of plane
4. Orthographic projection
5. Projection of solids
6. Isometric projection/view
7. Free hand sketches of simple machine elements, like :
   (a) Screw threads ISI profile
   (b) Types of nuts, bolts, studs, set screws, washers, locking arrangement of nuts & bolts
   (c) Foundation bolts – Rag, eye, lewis types
8. Drafting of basic 2D geometrical shapes using CAD software
9. Drafting of basic 3D geometrical shapes using CAD software
10. Drafting of 2D and 3D objects using surface modeling commands

ENGLISH COMMUNICATION SKILLS LABORATORY - 1B5

Teaching Scheme: Practical: 4Hrs. / week
Examination Scheme : Internal Test :25 marks External Practical examination : 25 marks

Course Outcomes:

- The learning outcome of students will be assessed through assignments, tests and final exams and most importantly through practical performances.
- Through these tests, it would be revealed that students are able to reproduce their understanding of concepts/principles of communication in English language.
- Students can present themselves well in front of large audience on a variety of topics. Moreover they get the knack for structured conversation to make their point of views clear to the listeners.

PRACTICALS:

Exercise 1: Types of communication, barriers to communication, effective communication
Exercise 2: Foundation of language: grammaticality and acceptability, word power, accuracy and appropriateness.
Exercise 3: Assignment on vocabulary building & Writing skill :nature of writing, stages of writing (pre, while and post), qualities of effective writing, what makes writing poor, the what, howand why of writing, drafting, summarizing, letter writing, writing reports.
Exercise 4: Speaking: pronunciation, stress, intonation and pauses, formal and informal expressions, conversation skills, presentation skills, business etiquette.
Exercise 5: Group Discussion- To study about group discussion technique.
Exercise 6: Interview skill- To study about personal interview.
Exercise 7: Planning and Mot- To study how to plan and execute an activity in a group.
Exercise 8: Seminar skill- To study how to conduct and deliver a seminar.
Exercise 9: Conference – To study how to conduct conference.
Exercise 10: Interpersonal communication- Conduct an activity for social cause.
Exercise 11: Project- Writing class newsletter.

Reference Books:

1. S. Mishra & C. Muralikrishna, “Communication Skills for Engineers”, Pearson Education.
2. T.M. Farhathullah , “Communication Skills for Technical Students”, Orient Longman.
3. Saran Freeman, “Written Communication in English”, Orient Longman.
4. Raymond Murphy, “Essential English Grammar (Elementary & Intermediate)”, CUP.
5. Shirley Tailor, “Communication for Business: A Practical Approach”, Longman Developing .
6. Krishna Mohan &MeeraBanerji, “ Communication Skills”, Macmillan.
7. R. C. Sharma & Krishna Mohan, “Business Correspondence and Report Writing”, Tata McGraw Hill.

Websites:

- http://www.englishpage.com
- http://www.english-4u.de/
- http://www.nonstopenglish.com/
- http://www.business-english.com
- http://www.breakingnewsenglish.com/
- http://www.elllo.org/

Appendix-B

A Guide to Induction Program

1 Introduction

*(Induction Program was discussed and approved for all colleges by AICTE in March 2017. It was discussed and accepted by the Council of IITs for all IITs in August 2016. It was originally proposed by a Committee of IIT Directors and accepted at the meeting of all IIT Directors in March 2016.*1 *This guide has been prepared based on the Report of the Committee of IIT Directors and the experience gained through its pilot implementation in July 2016 as accepted by the Council of IITs. Purpose of this document is to help institutions in understanding the spirit of the accepted Induction Program and implementing it.)*

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond.

The graduating student must have knowledge and skills in the area of his study. However, he must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he would understand and fulfill his responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.

There is a mad rush for engineering today, without the student determining for himself his interests and his goals. This is a major factor in the current state of demotivation towards studies that exists among UG students.

The success of gaining admission into a desired institution but failure in getting the desired branch, with peer pressure generating its own problems, leads to a peer environment that is demotivating and corrosive. Start of hostel life without close parental supervision at the same time, further worsens it with also a poor daily routine.

To come out of this situation, a multi-pronged approach is needed. One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them

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1A Committee of IIT Directors was setup in the 152nd Meeting of IIT Directors on 6th September 2015 at IIT Patna, on how to motivate undergraduate students at IITs towards studies, and to develop verbal ability. The Committee submitted its report on 19th January 2016. It was considered at the 153rd Meeting of all IIT Directors at IIT Mandi on 26 March 2016, and the accepted report came out on 31 March 2016. The Induction Program was an important recommendation, and its pilot was implemented by three IITs, namely, IIT(BHU), IIT Mandi and IIT Patna in July 2016. At the 50th meeting of the Council of IITs on 23 August 2016, recommendation on the Induction Program and the report of its pilot implementation were discussed and the program was accepted for all IITs.

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work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

2 Induction Program :

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awarness, sensitivity and understanding of the self, people around them, society at large, and nature. 2

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

2Induction Program as described here borrows from three programs running earlier at different institutions: (1) Foundation Program running at IIT Gadhinagar since July 2011, (2) Human Values course running at IIIT Hyderabad since July 2005, and (3) Counselling Service or mentorship running at several IITs for many decades. Contribution of each one is described next.

(1) IIT Gandhinagar was the first IIT to recognize and implement a special 5-week Foundation Program for the incoming 1st year UG students. It took a bold step that the normal classes would start only after the five week period. It involved activities such as games, art, etc., and also science and other creative workshops and lectures by resource persons from outside.

(2) IIIT Hyderabad was the first one to implement a compulsary course on Human Values. Under it, classes were held by faculty through discussions in small groups of students, rather than in lecture mode. Moreover, faculty from all departments got involved in conducting the group discussions under the course. The content is non-sectarian, and the mode is dialogical rather than sermonising or lecturing. Faculty were trained beforehand, to conduct these discussions and to guide students on issues of life.

(3) Counselling at some of the IITs involves setting up mentor-mentee network under which 1st year students would be divided into small groups, each assigned a senior student as a student guide, and a faculty member as a mentor. Thus, a new student gets connected to a faculty member as well as a senior student, to whom he/she could go to in case of any difficulty whether psychological, financial, academic, or otherwise.

The Induction Program defined here amalgamates all the three into an integrated whole, which leads to its high effectiveness in terms of building physical activity, creativity, bonding, and character. It develops sensitivity towards self and one's relationships, builds awareness about others and society beyond the individual, and also in bonding with their own batch-mates and a senior student besides a faculty member. Scaling up the above amalgamation to an intake batch of 1000 plus students was done at IIT(BHU), Varanasi starting from July 2016.

Physical Activity :

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

Creative Arts :

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program.

These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

Universal Human Values :

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them.3

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

3The Universal Human Values Course is a result of a long series of experiments at educational institutes starting from IIT-Delhi and IIT Kanpur in the 1980s and 1990s as an elective course, NIT Raipur in late 1990s as a compulsory one-week off campus program. The courses at IIT(BHU) which started from July 2014, are taken and developed from two compulsory courses at IIIT Hyderabad first introduced in July 2005.

Literary

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

Proficiency Modules

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

Lectures by Eminent People

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

Familiarization to Dept./Branch & Innovations

The students should be told about different method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilties.

3 Schedule

The activities during the Induction Program would have an Initial Phase, a Regular Phase and a Closing Phase. The Initial and Closing Phases would be two days each.

Initial Phase

Time	***Activity***
Day 0	
Whole day	*Students arrive - Hostel allotment. (Preferably do preallotment)*
Day 1 *09:00 am - 03:00 pm*	*Academic registration*
04:30 pm - 06:00 pm	Orientation
Day 2 09:00 am - 10:00 am	Diagnostic test (for English etc.)
10:15 am - 12:25 pm	Visit to respective depts.
12:30 pm - 01:55 pm	*Lunch*
02:00 pm - 02:55 pm	Director's address
03:00 pm - 05:00 pm	Interaction with parents
03:30 pm - 05:00 pm	Mentor-mentee groups - Introduction within group. (Same as Universal Human Values groups)

Regular Phase

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

Daily Schedule

Some of the activities are on a daily basis, while some others are at specified periods within the Induction Program. We first show a typical daily timetable.

Sessn.	***Time***	***Activity***	***Remarks***
	Day 3 onwards *06:00 am*	*Wake up call*	
I	06:30 am - 07:10 am	Physical activity (mild exercise/yoga)	
	07:15 am - 08:55 am	*Bath, Breakfast, etc.*	
II	09:00 am - 10:55 am	Creative Arts / Universal Human Values	Half the groups do Creative Arts
III	III 11:00 am - 12:55pm	Universal Human Values / Creative Arts	Complementary alternate
	01:00 pm - 02:25 pm	*Lunch*	
IV	02:30 pm - 03:55 pm	Afternoon Session	See below.
V	04:00 pm - 05:00 pm	Afternoon Session	See below.
	05:00 pm - 05:25 pm	*Break / light tea*	
VI	05:30 pm -06:45pm	Games / Special Lectures	
	06:50 pm - 08:25 pm	*Rest and Dinner*	
VII	08:30pm - 09:25pm	Informal interactions (in hostels)	

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Sundays are off. Saturdays have the same schedule as above or have outings.

Afternoon Activities (Non-Daily)

The following five activities are scheduled at different times of the Induction Program, and are not held daily for everyone:

1. Familiarization to Dept./Branch & Innovations
2. Visits to Local Area
3. Lectures by Eminent People
4. Literary
5. Proficiency Modules

Here is the approximate activity schedule for the afternoons (may be changed to suit local needs):

Activity	***Session***	***Remarks***
Familiarization with Dept/Branch & Innovations	IV	For 3 days (Day 3 to 5)
Visits to Local Area	IV, V and VI	For3 days-interspersed(e.g.,3 Saturdays)
Lectures by Eminent People	IV	As scheduled - 3-5 lectures
Literary (Play / Book Reading / Lecture)	IV	*For 3-5 days*
Proficiency Modules	V	Daily, but only for those who need it

Closing Phase

Time	***Activity***
Last But One Day 08:30 am - 12 noon	Discussions and finalization of presentation within each group
02:00 am - 05:00 pm	Presentation by each group in front of 4 other groups besides their own (about 100 students)
Last Day Whole day	Examinations (if any). May be expanded to last 2 days, in case needed.

Follow Up after Closure

A question comes up as to what would be the follow up program after the formal 3-week Induction Program is over? The groups which are formed should function as mentormentee network. A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychological etc. (For every 10 undergraduate first year students, there would be a senior student as a *student guide*, and for every 20 students, there would be a *faculty mentor*.) Such a group should remain for the entire 4-5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/disciplin e4.

Here we list some important suggestions which have come up and which have been experimented with.

Follow Up after Closure – Same Semester

It is suggested that the groups meet with their faculty mentors once a month, within the semester after the 3-week Induction Program is over. This should be a scheduled meeting shown in the timetable. (The groups are of course free to meet together on their own more often, for the student groups to be invited to their faculty mentor's home for dinner or tea, nature walk, etc.)

Follow Up – Subsequent Semesters

It is extremely important that continuity be maintained in subsequent semesters. It is suggested that at the start of the subsequent semesters (upto fourth semester), three days be set aside for three full days of activities related to follow up to Induction Program. The students be shown inspiring films, do collective art work, and group discussions be conducted. Subsequently, the groups should meet at least once a month.

4 Summary

Engineering institutions were set up to generate well trained manpower in engineering with a feeling of responsibility towards oneself, one's family, and society. The incoming undergraduate students are driven by their parents and society to join engineering without understanding their own interests and talents. As a result, most students fail to link up with the goals of their own institution.

The graduating student must have values as a human being, and knowledge and metaskills related to his/her profession as an engineer and as a citizen. Most students who get demotivated to study engineering or their branch, also lose interest in learning.

The *Induction Program* is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and building of character.

The *Universal Human Values* component, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and

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4We are aware that there are advantages in mixing the students from different depts. However, in mixing, it is our experience that the continuity of the group together with the faculty mentor breaks down soon after. Therefore, the groups be from the same dept. but hostel wings have the mixed students from different depts. For example, the hostel room allotment should be in alphabetical order irrespective of dept.

nature, and character to follow through. It also makes them reflect on their relationship with their families and extended family in the college (with hostel staff and others). It also connects students with each other and with teachers so that they can share any difficulty they might be facing and seek help.

References:

Motivating UG Students Towards Studies,
Rajeev Sangal, IITBHU Varanasi, Gautam Biswas, IIT Guwahati, Timothy Gonsalves, IIT Mandi, Pushpak Bhattacharya, IIT Patna, (Committee of IIT Directors), 31 March 2016, IIT Directors' Secretariat, IIT Delhi.

Contact:

Prof. Rajeev Sangal
Director, IIT(BHU), Varanasi
(director@iitbhu.ac.in)
18 June 2017

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NOTIFICATION

No. 89/2020 Date : 26/10//2020

Subject : Implementation of new Syllabi of Semester III & IV of B.E. (C.B.C.S.) as per A.I.C.T.E. Model Curriculum…

It is notified for general information of all concerned that the authorities of the University have accepted to implement new Syllabi of Semester III & IV of B.E./B.Text. E./B.Tech. (Chem.Tech.) (Food, Pulp & Paper, Oil & Paint and Petrochemical Tech.) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2020-21 & onwards as per "**Appendix – A**" as given below:

Sd/-
(Dr.T.R.Deshmukh)
Registrar

"**Appendix – A**"

SYLLABUS OF B.E. [MECH.] SEM. III & IV {C.B.C.S.}

Semester-III

3ME01 MATHEMATICS-III

Course Learning Objectives :

1. To provide the knowledge to solve ordinary Linear Differential equations with constant coefficient and its reducible equation using particular integral and complementary function and apply method of variation of parameter to solve ordinary Linear differential equations
2. To understand the Laplace transform and its inverse transform for the basic functions. Locate the Laplace transform of periodic function. Apply the Laplace transform to solve differential equation
3. To provide knowledge to apply False Position, Newton Raphson method to solve nonlinear & polynomial equations, Apply Gauss Elimination method, Gauss Seidal iterative method, Relaxation method to solve system of linear equations, Apply Eulers method, Runge-Kutta method, Picards method to solve differential equations
4. To understand the Gradient, divergent and curl of vector point functions. To find the directional derivatives of scalar point functions. To discuss the Irrotational and solenoidal vector fields. To define line surface and volume integrals.

Course Outcomes :

Students will be able to -

1. Demonstrate the knowledge to solve ordinary Linear Differential equations with constant coefficient and its reducible equation using particular integral and complementary function and apply method of variation of parameter to solve ordinary Linear differential equations
2. Define the Laplace transform and its inverse transform for the basic functions. Locate the Laplace transform of periodic function. Apply the Laplace transform to solve differential equation
3. Apply False Position, Newton Raphson method to solve nonlinear & polynomial equations Apply Gauss Elimination method, Gauss Seidal iterative method, Relaxation method to solve system of linear equations, Apply Eulers method, Runge-Kutta method, Picards method to solve differential equations
4. Define Gradient, divergent and curl of vector point functions. Finds the directional derivatives of scalar point functions. Discuss the Irrotational and solenoidal vector fields. Define line surface and volume integrals

SECTION-A

UNIT-I : Ordinary differential equations:- Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. (10 Hrs)

UNIT-II: Laplace transforms : Definition, standard forms, properties of Laplace transform, inverse Laplace transform, initial and final value theorem, convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function. Solution of Linear differential equations. (10 Hrs)

UNIT-III :a) Partial differential equation of first order of following form- (i) f (p,q)=0; (ii) f (p,q,z)=0; (iii)f (x,p)=g(y,q); (iv) Pp+Qq=R (Lagranges form); (v) z=px+qy+f (p,q) (Clairaut form)

b) Statistics : Curve fitting by method of least squares (Straight and parabola only), Correlation, Regression.

c) Probability Distribution:– Binomial distribution, Poisson and normal Distribution. (10 Hrs.)

SECTION-B

UNIT-IV: Complex Analysis :- Functions of complex variables, Analytic function, Cauchy-Reimann conditions, Harmonic function, Harmonic conjugate functions, Milne's method, conformal mappings (translation, rotation, magnification, inversion, bilinear transformation), singular points, expansion of function in Tayler's and Laurent's series. Cauchy's integral theorem and formula, Residue theorem. (12 Hrs.)

UNIT-V: Numerical Analysis : Solution of algebric and transcendental equations by Newton-Raphson method & method of false position. Solution of system of linear equations by Gauss-Seidal method, Relaxation method. Solution of first order ordinary differential equations by Picard's, modified Euler's, Runge-Kutta and Taylor's method. (10 Hrs.)

UNIT-VI: Vector Calculus :- Scalar and vector point functions, Differentiation of vectors, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, line, surface, volume integrals, irrotational and solenoidal vector fields, Stoke's and Divergence theorem (without proof). (10 Hrs.)

Books Recommended :-

Text Books:

1. Text book on Applied Engineering Mathematics, Vol. II, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
2. Higher Engineering Mathematics, B.S Grewal, Himalaya Publishing House.
3. Applied Mathematics, Vol. III, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

Reference Book : Advanced Engineering Mathematics, Erwin Kreyzig, John Wiley.

3ME02 MANUFACTURING PROCESSES

Course Learning Objectives :

1. To study the manufacturing processes in sand casting industries, tooling and equipment
2. To study the metal melting process, melting furnaces and defects in casting
3. To study the various types of casting processes
4. To study the mechanical working of metals and allied processes
5. To study the mechanical joining processes and fastenings
6. To study welding processes and surface treatment processes

Course Outcomes :

Students will understand the :

1. basic concept of foundry process and related activities
2. concept of complete sand casting process with advance casting methods
3. fundamentals of welding processes
4. various processes like electroplating, anodizing etc and their importance in industries

SECTION- A

Unit-I : Introduction to manufacturing processes & classification; Introduction to pattern making Pattern materials, pattern making tools, allowances, Types of patterns, functions of patterns, General properties of moulding sands, Mold hardness. Preparation of sand moulds of different types, Moulding processes, core making, core prints, core boxes. Sand casting Processes - Basic principle and Terminology of sand casting, design of gating and riser system – by numerical approach. (9Hrs)

Unit-II : Technology of melting and casting - Melting furnaces, crucibles, pit, open hearth, gas fired cupola, cupola operation and electric hearth furnaces, Electric furnaces - Direct Arc, Indirect arc and electric induction furnace.

Defects in castings and its types, Causes and remedies of casting defects. Origin and classification of defects, shaping faults, Inclusion and sand defects, Gas defects, shrinkage defects, contraction defects, dimensional errors. Inspection and testing of castings:- Radiography, ultrasonic, Eddy current testing, fluorescent penetrant test. (7 Hrs)

Unit III: Casting processes and their principle of operation and applications permanent mold casting, slush casting, shell molding, Investment or lost wax casting, vacuum process, centrifugal casting, continuous casting, Die casting equipment and processes for Gravity, pressure and vacuum casting methods, cleaning of castings, Modernisation & Mechanisation of Foundries. (8 Hrs)

SECTION – B

Unit IV: Mechanical working of metals: Principle of hot and cold working process and its types, Extrusion, piercing, pipe and tube production, manufacture of seamless pipe and tubing. Shearing operations, tube drawing, wire drawing, spinning, embossing and coining, squeezing and bending operations, rotary swaging, load estimation for bulk forming (forging and drawing), rolling and types of rolling mills. (8 Hrs)

Unit V: Joining processes:- Mechanical joining processes, Mechanical fastening, riveting, soldering, brazing Welding, Types of welding processes-Arc welding: principle and working, Gas welding- principle and working Types and purpose of Electrodes, Electrode coatings(flux). TIG & MIG processes – Working principles and its applications, shielding gases, MIG-Spray transfer and dip transfer processes. (6 Hrs.)

Unit VI: Submerged arc welding & resistance welding :- Heat generation in resistance welding, operational characteristics of resistance welding processes such as spot welding, projection welding, butt welding.
Principle of operation of friction welding, forge welding, plasma arc, thermit welding. Welding defects, Testing and Inspection of welds, Ultrasonic, Electroslag, Electron Beam, laser welding, weldability.
Surface Treatment-Electroplating, electroforming, and iodising, metal spraying, shot peening, polishing, mechanical cleaning. (9 Hrs)

Books Recommended :

Text Books:-

1. Workshop Technology Vol. I by Bawa, Tata Mc-Graw Hill Publication.
2. Workshop Technology Vol I by Hajra Chaudhary, Dhanpat Rai & Sons 2001.

References:-

1. Workshop Technology Vol I by Raghuwanshi.
2. Manufacturing Processes by J.P. Kaushish; PHI
3. Processes and Materials of Manufacture by R.A.Lindberg, PHI Pub 2001.
4. Manufacturing technology Vol. I, by P. N. Rao.

3ME07 MANUFACTURINGPROCESSES - LAB

Practices:-

1. Study of safety precautions in workshop practices.
2. Foundary:- Any two of the following jobs Sand preparation and practice in moulding of various types of patterns:- Pattern making - one job, Moulding - one job Casting - one job.
3. Joining Processes :Two composite jobs involving electric welding, gas welding and resistance welding process.
4. One job on Mechanical Working of Metals like piercing / drawing / bending/ embossing/ spinning/ upsetting, etc.

A journal should be prepared and submitted on above term work.

The practical examination shall consist of a job preparation and college assessment should be based upon the jobs, term work and viva examination.

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3ME03 MECHANICS OF MATERIALS

Course Learning Objectives :

1. To develop theoretical basis for stress, strain concept in various components under study
2. To study mechanical behavior of engineering material
3. To familiarize about finding shear force, bending moment, torsion, slope and deflection of various types of beams with different loading conditions
4. To build the necessary background to apply the knowledge of mechanics of materials on engineering applications

Course Outcomes :

Students will be able to -

1. Determine the stress & strain in the member subjected to axial, bending & torsional load
2. To observe different types of material behavior such as elastic, plastic, ductile and brittle
3. Apply SF and BM diagrams to analyse resistance offered by the beam and able to solve practical problems in real world
4. Apply deflection criteria to check the stability of beam

SECTION-A

Unit-I: 1. Mechanical properties: Concept of direct, bending and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, and other metals, factor of safety, stress and strain of bar due to self weight.

2. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only, introduction to theory of elasticity and photoelasticity. (10 Hrs.)

Unit-II: 1. Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment and shear force for all types of loadings for simply supported beams, cantilevers, relation between shear force, bending moment and loading intensity.

2. Simple or pure bending theory: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section, leaf springs. (7 Hrs.)

Unit-III: 1.Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load.

2. Shear stress distribution on beam rectangular and circular cross sections. (7 Hrs.)

SECTION– B

Unit-IV: Thin and thick cylinders and thin spherical shells subjected to internal pressures. (4 Hrs.)

Unit –V: 1. Strain energy under uniaxial tension and compression impact loads and instantaneous stresses.
2. Principal Stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses.
3. Strain energy and resilience : proof resilience, shear resilience, strain energy due to self load (7 Hrs.)

Unit-VI: Deflection in simplysupported beam, cantilever beam subjected to point loads, uniformly distributed loads, moments by Macauley's method. (7 Hrs.)

Books Recommended:

Text Books :

1. Ramamruthm : Strength of Materials, Danpat Rai and Sons, New Delhi .
2. R. S. Khurmi: Strength of Material, S. Chand Publication, Delhi.

Reference Books :

1. E.P.Popov : Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S. Timoshenko and O.H.Young : Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
3. Shames, I. H. : Introduction to Solid Mechanics, Prentice Hall of India, New Delhi
4. Beer and Johston : Mechanics of Materials, McGraw Hill.
5. D. S. Prakash Rao : Strength of Material : APractical Approach, University Press, Hyderabad.

3ME08 MECHANICS OF MATERIALS - LAB

Practicals:

Minimum Six to Eight out of the following:

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

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3ME04 ENGINEERING THERMODYNAMICS

Course Learning Objectives :

1. To study the basic concepts of thermodynamics, thermodynamic systems, work and heat
2. To study the laws of thermodynamics and their applications
3. To study the properties of steam, work done and concept of heat transfer
4. To study the air standard cycles

Course Outcomes :

Students will be able to

1. Understand the basic concepts of thermodynamics, thermodynamic systems, work and heat
2. Apply first law of thermodynamics and application of first law to flow and non-flow processes
3. Apply second law of thermodynamics and understand concept of entropy
4. Understand the properties of steam, work done and heat transfer during various thermodynamics processes with steam as working fluid
5. Understand the concept of air standard cycles

SECTION–A

Unit-I: Introduction to basic concepts of thermodynamics, Macroscopic and microscopic approaches, properties of system, state, processes and cycle, thermodynamic equilibrium, types of thermodynamic systems, Temperatures and Zeroth law of thermodynamics, Quasi-static process, Gas Laws and Ideal gas equation of states, gas constant and universal gas constant.
Work and Heat: Definition of work, thermodynamic work, displacement work and other forms of work, Definition of Heat, Work and heat transfer as path function, comparison of work and heat, work done during various processes, P-V diagrams (10 hrs)

Unit-II: First law of thermodynamics: Energy of a system, classification of energy, law of conservation of energy law, Joules experiment. Energy a property of system, internal energy-a function of temperature, Enthalpy, specific heat at constant volume and constant pressure. Application of first law to non-flow processes, Change in internal energy, work done and Heat transfer during various non-flow processes. (7 hrs)

Unit-III: First Law applied to flow processes: Steady state, steady flow process, equation for work done in steady flow process and its representation on P-V diagram, mass balance and energy balance in steady flow process, steady flow energy equation and its application to nozzles and diffusers, turbine and compressor pumps, heat exchangers, Throttle valve etc. work done and Heat transfer during steady flow processes. (9 hrs)

SECTION–B

Unit-IV: Second Law of thermodynamics: Limitations of First law, Thermal energy reservoir, heat engines refrigerator and heat pumps, COP and tonne of refrigeration, COP for heat pump and refrigerator, Kelvin-Plank and Clausious statements, their equivalence, reversible and irreversible processes, Carnot cycle, Carnot theorem and its corollary, The thermodynamic temperature scale, Reverse Carnot cycle, Inequality of Clausius.
Introduction to Entropy, availability and irreversibility. Principle of increase of entropy. (8Hrs)

Unit-V: Properties of Steam: Triple point and critical point, Sensible heat, latent heat, superheat and total heat of steam. Wet steam, dryness fraction, Internal energy of steam, External work of evaporation, internal latent hear, Specific volume, enthalpy, internal energy and entropy of steam. T-S diagram Mollier chart, Steam tables and their use. Work done and heat transfer during various thermodynamics processes with steam as working fluid. Throttling of steam, determination of dryness fraction using various calorimeters. (8 Hrs)

Unit VI : Air Standard Cycles: Ottto, diesel, semidiesel, Brayton, Sterling and joule cycles etc., their efficiencies and mean effective pressure, comparison of auto, diesel and duel cycles.
Vapour Cycles:- Rankine and Modified Rankine Cycle. Comparison of Rankine and Carnot cycle, representation on P-V, T-S and H-S diagram. (No numerical on this unit) (numerical on air standard cycle) (8 Hrs)

BOOKSRECOMMENDED:

Text Books :

1. Engineering Thermodynamic - by P. K. Nag.
2. Fundamentalsof EngineeringThermodynamics; R. Yadav;
3. Thermodynamics Basics and Applied: by V. Ganeshan
4. Thermal Engineerirng: by Mahesh M. Rathore.

Reference Books :

1. Basic Engineering Thermodynamics - by Reyner Joel
2. Thermodynamics - by C.P. Arora.
3. Fundamentals of Classical Thermodynamics - by G. J.Vanwylen.
4. Engineering Thermodynamics; P. Chattopadhyay; Oxford
5. Engineering Thermodynamics; Gordon Rogers, Yon Mayhew; Pearson.

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3ME05 FLUID MECHANICS

Course Learning Objectives :

1. To introduce and explain the fundamentals of Fluid Mechanics used in applications of Hydraulics, Aerodynamics, Gas dynamics, etc.
2. To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
3. To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
4. To imbibe basic laws and equations used for analysis of static and dynamic fluids.
5. To inculcate the importance of boundary layer flow and its applications
6. To determine the losses in a flow system, flow through pipes, impact of jet

Course Outcomes :

The student will be able to:

1. identify importance of various fluid properties at rest and in motion
2. derive and apply general governing equations for various fluid flows
3. understand the concept of boundary layer theory and flow separation.
4. calculate energy losses in pipe flow.
5. evaluate the performance characteristics of hydraulic jets

SECTION – A

UNIT-I : 1. Basic properties of fluid such as Density, Specific weight, Specific Volume, Specific gravity, Viscocity of fluid, Surface Tension, Capilarity, vapour pressure & cavitation.

2. pressure & its measurement: Pascals law, Hydrostatic law of pressure & pressure variation in fluid, measurement of pressure by Manometer. (10 Hours)

UNIT-II : 1. Hydrostatic pressure force on plane & curved surfaces. Measurment of total pressure & centre of pressure.

2. Buoyancy & floatation: Concept of buoyancy, centre of buoyancy. Stability of floating body, Metacentre & metacentric height. Condition of equilibrium of floating & sub-merged body. (08 Hours)

UNIT III : 1. Kinematics of fluid flow, Methods of describing fluid motion, Types of flow, rate of flow, streamline, potential line, flow net, velocity & acceleration, continuity equation in three dimensional flow.

2. Dynamics of fluid flow : Eulers equation of motion, Bernoullis equation measurement of fluid flow with venture meter. (08 Hours)

UNIT-IV : Flow through pipes: Losses in pipe, major losses, Darcy's Weisbach equation, monor losses due to sudden enlargement, contraction, entry, exit & pipe fitting. Hydraulic gradient & total energy line, flow through series & parallel pipes, concept of water hammer in pipes. (08 Hours)

UNIT-V : Motion of viscous fluid: Introduction to Laminar & Turbulent flow, Concept of Boundary layer & its type. Drag & Lift force on object. Boundary layer separation, Reynolds number & its significance. (08 Hours)

UNIT-VI : Principal of fluid machinery : Force exerted by fluid jet on plane, curved, stationary & moving vanes. Velocity diagrams, work done & efficiency. (08 Hours)

Books Recommended :-Text

Books:-

1. Fluid Mechanics & Machinery by Modi & Sheth.
2. Fluid Mechanics and Hydraulic Machines by R. K. Bansal.
3. Engineering fluid Mechanics by R. K. Rajput.
4. Fluid mechanics & Machinery by CRSP. Ojha, R. Berndtsson.
5. Fluid Mechanics by Strecter; Tata Macgraw Hill.

Reference Books:-

1. R.K.Rajput; Engineering Fluid Mechanics; S. Chand publications.
2. Dr. Mody & Seth; Hydraulics and Fluid Mechanics; Standard book house
3. S. Ramamrutham, Hydraulic, Fluid Mechanics & Fluid Machines, Dhanpatrai publishing company.
4. Strecter, Fluid Mechanics, Tata Mc-Graw Hill.

3ME09 FLUID MECHANICS - LAB

Practical Term Work:-

At least six (6) practicals (study/Trials) based on above syllabus, as given below shall be performed and a report there of submitted by the students :

1. Measurement of fluid pressure by manometer.
2. Determination of metacentric height.
3. Verification of Bernoulli's equation.
4. Determination of co-efficient discharge by Venturimeter.
5. Calculation of Reynolds number for Laminar & Turbulent flow.
6. Determination of co-efficient of friction (Major losses in Pipes) through pipe.
7. Determination of head loss due to sudden enlargement.
8. Determination of head loss due to sudden contraction.
9. Determination of loss of head in bends & in elbows.
10. Verification of momentum equation.

Note :- Practical examination shall consist of oral or Experimentation based on above term work.

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3ME10 Machine Drawing - Lab

Course Learning Objectives :

1. To study the techniques of sectioning and visualizing the objects
2. To imagine and develop the missing views of objects
3. To seek the knowledge of development of surfaces
4. To seek the knowledge of intersection of solid objects
5. To know the conventions for materials and parts used in industries
6. To prepare the drawings for machine assembly

Course Outcomes :

Student will be able to -

1. Demonstrate the techniques of sectioning and visualizing the objects
2. Imagine, understand and sketch the missing views
3. Develop surfaces of objects and apply knowledge during their fabrication
4. Understand the concept of intersection of solid objects
5. Understand and apply the conventions for materials and parts used in industries
6. Prepare detail machine assembly drawings

List of Practicals :

1. Conversion of pictorial view into Sectional Orthographic Projection
2. Missing Views
3. Development of surfaces of Cubes / Prisms / Cylinders / Pyramids / Cones & their cut sections
4. Intersections of Solids – Prism & Prism /Cylinder & Cylinder /Cylinder & Prism / Cone & Prism
5. Conventions for various materials & parts
6. Preparation of detail drawings of simple machine assembly
7. Preparation of assembly drawing of simple machines

Books recommended:

Text Books:

1. Engineering drawing by N.D. Bhatt; Charactor Publications.
2. Machine Drawing by A. M. Bisen; New Edge International publication.
3. Machine Drawing by R. K. Dhawan, S. Chand
4. Machine Drawing by Basant Agrawal, McGraw Hill.
5.

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B.E. (MECHANICAL) SEMESTER FOURTH

4ME01 MATERIAL SCIENCE

Course Learning Objectives:

1. To study the basic concepts of metallurgy and classification of materials
2. To study the process of formation of microstructures of metal materials and composites
3. To study the alloying elements, their effects and applications
4. To study the ferrous and non-ferrous metals and respective alloys
5. To study the various heat treatment processes and their industrial applications
6. To study the mechanical working of metals and process of powder metallurgy

Course Outcomes:

Students will understand the -

1. Basic concepts of metallurgy and types of materials.
2. Iron-Carbon Equilibrium Diagram, critical temperatures, formation of microstructures and they will get the knowledge of alloys.
3. Uses and practical applications of ferrous & non ferrous materials
4. Various heat treatment processes, powder metallurgy and industrial applications.

SECTION - A

UNIT-I: Introduction to metallurgy: Basic concept of process metallurgy, physical metallurgy, and mechanical metallurgy, Classification of materials & their application, Structure of metals and alloys, formation of Alloys, Solid solutions, types and their formation, lever rule for phase mixtures. Solidification of pure metals, nucleation and growth, ingot structure, dendritic solidification. (8 Hrs)

UNIT II: Study of binary equilibrium diagram and invariant reactions, Construction and study of Iron-carbon Equilibrium Diagram, Critical temperatures, Microstructure of slowly cooled steel, Estimation of carbon from microstructure, structure property relation, Introduction to composite materials, advantages and applications. (8 Hrs)

UNIT III: **Alloy Steels:** Purpose of alloying, Classification of alloy steels, classification of alloying elements, Effect of alloying elements on eutectoid composition, Eutectoid temperature, and on the S curve, , alloying elements and their effect on properties of steels, OHNS steels, Hadfield'S Manganese steels, High speed steels, their heat treatments and applications, Ferritic, Austenitic and Martensitic stainless steels, their properties and applications, weld decay in stainless steel. (8 Hrs)

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SECTION - B

UNIT IV: Cast irons **:** Factors governing condition of carbon in cast iron, Maurer's diagram, Solidification of grey and white cast iron, Malleabalizing, Constitution and properties of white, gray, Nodular and Malleable cast irons, their applications, Alloy cast irons.

Non Ferrous Metals and Alloys : Types, Properties and uses of Brasses and Bronzes. Important alloys of Aluminium, Lead, Tin and Zinc, their applications. Bearing materials, Season cracking, precipitation hardening. (8 Hrs)

UNIT V: Principles of Heat Treatment: - Annealing, Normalizing, Tempering Iso-thermal transformation diagrams(S-curve), super imposition of continuous cooling curves on 's' Curve, pearlite, bainite and martenste transformation, Quenching media, severity of quench, Austempering, Martempering and patenting, Retained austenite and sub-zero treatment. Hardenability. (8 Hrs)

UNIT VI: Methods of surface hardening: Carburizing, Nitriding, Cyaniding, Flame and Induction Hardening. Mechanical working of Metals: - Hot and cold working, Relative advantages and disadvantages, study of stress strain curve, Luder's bands, Work hardening, strain Ageing; Recovery, Recrystallization and grain growth. Metallurgical factors affecting various Mechanical working processes, preferred orientation, Deformation mechanisms-Slip& twining, critical resolved shear stress.

Powder Metallurgy: Concept, Methods of Manufacture of metal powders, compaction Process- Single die and double die, sintering, stages of sintering, Manufacture of porous bearings & cemented carbide tip tools by P.M.T. Advantages, limitations and applications of powder metallurgy. (8 Hrs)

BOOK RECOMMENDED :-

Text Books :-

1. Introduction to physical metallurgy ;Sidney H Avner, TATA Mc-Grawhill
2. Engineering materials & metallurgy R.K.Rajput, S chand publication.
3. Material nScience & Mettalurgy, by V.D. Kodgire. Everest Publication House.

Reference Books:

1. Mechanical Metallurgy, G. E. Dieter, Mc- Graw Hill International, London 3rd Edn. 1999
2. Physical metallurgy for engineers, Clarke and Varney, second Edn.,1987.
3. Power metallurgy, A.K Sinha First Edn. 1991.
4. Material Science and Metallurgy; V.D. Kodgire; Everest Publishing House
5. Engineering physical Metallugrgy, Y Lakhtin, Mir Publications. Second Ed. 1999
6. Material Science and Meallurgy- C Daniel Yesudian, Scitech Publication.

4ME07 MATERIAL SCIENCE - LAB

List of Practicals: - (At least eight (8) practicals out of the following list.)

1. Study of metallurgical microscope.
2. Preparation of specimen for micro-examination.
3. Moulding of specimen for micro-examination.
4. Study of micro structures of Annealed and normalized plain carbon steels.
5. Study of micro structures of alloy steels and H.S.S.
6. Study of micro structures of various cast irons.
7. Study of micro structures of non ferrous metals.(brasses, bronzes)
8. Study of micro structures of hardened and tempered steels.
9. Study of Iron carbon Equilibrium diagram & Allotropic forms of iron.

10. Study different Heat Treatment Process for steel.
11. Study of different surface Hardening processes for steels.
12. Study of effect of alloying elements on the properties of steels.
13. Measurement of hardenability by Jominy end quench test apparatus.
14. Study of hardness tester and conversion of Hardness number
15. Industrial visit to study heat treatment plant.
16. Measurement of particle size, grain size, nodularity, coating thickness etc. by using some software like Metzer Microcam 4.0

Practical Examination:

Note : Practical examination shall consist of viva voce/performance based on the above syllabus and practical work.

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4ME02 ENERGY CONVERSION - I

Course Learning Objectives:

1. To study the properties of steam and its behavior for different thermodynamic process.
2. To study different types of boilers, their mountings, accessories, performance of boilers and different efficiencies.
3. To study the various fuel handling and ash handling system in power plant.
4. To study various types of condensers and cooling towers.
5. To study various thermodynamic aspects of flow of steam through nozzle and diffuser.
6. To study flow of steam through steam turbine and concept of compounding.

Course Outcomes:

1. Students will study the concept steam and steam power plant, mounting and accessories.
2. Students will demonstrate the calculation of various efficiency & related parameters.
3. Student will show the adequate knowledge of fuel & ash handling systems.
4. Students will demonstrate the knowledge of condenser & application.
5. Students will understand the concepts of steam nozzles & steam turbine.

SECTION – A

Unit I : Flow diagram for steam power plant with basic units such as steam generator, turbine, condenser and pump. Steam power plant layout, site selection. Boilers: Introduction to water tube and fire tube boilers used in thermal power plants, packaged Boilers, High pressure boilers; Loeffler, Benson, Lamont Boilers, Boiler mountings and accessories—devices for improving Boiler efficiency. Principle of fluidized bed combustion. Concept of co-generation. (7 Hrs.)

Unit II : Boiler draught; Types of draught, expression for diameter & height of chimney, condition for maximum discharge, efficiency of chimney, reasons for draught loss. Boiler performance:- Boiler rating, boiler power, equivalent evaporation, efficiency. Effect of accessories on boiler efficiency and heat balance. (7 Hrs)

Unit III : CONDENSERS : Need, Types of condensers, quantity of cooling water required. Dalton's law of partial pressure, condenser and vacuum efficiency. Sources of air in condensers and its effect on performance. cooling towers: Natural and mechanical wet type cooling tower.

Steam nozzles : Flow of steam through nozzles & diffusers, Maximum discharge, critical pressure ratio, chocking in nozzles, Effect of friction. Determination of throat & exit areas, Nozzle efficiency, no numerical on concept of super saturated flow & Wilson line. (7 Hrs.)

SECTION – B

UNIT IV : Steam Turbines:- Principle of working, Types of steam turbines such as impulse, reaction, axial & radial flow, back pressure & condensing turbines. Compounding. Reheat, regenerative cycles, bleeding. Analysis limited to two stages only. Analysis of steam Turbines : Flow of steam through impulse & impulse reaction turbine blades, Velocity diagrams. Graphical & analytical methods for work & power developed, axial thrust and efficiency. Height of turbine blades. losses in steam turbines:- blade friction, partial admission, disc friction, gland leakage losses and velocity losses. Governing of steam turbines. (7Hrs)

UNIT V : NUCLEAR POWER:- Fusion, fission, Chain reaction, conversion and breeding in nuclear fission. Components of Nuclear Power Plant such as Reactor, Steam generator, turbine, Moderator, Control Rods etc., Types of nuclear reactors like BWR, PWR, CANDU and liquidized metal cooled thermal reactors. (7 Hrs.)

UNIT VI : Introduction to renewable energy, Wind Energy, solar, fuel cell, bio-gas, MHD, Geothermal, OTEC, tidal power plants, Applications of Non conventional energy. (7 Hours)

RECOMMENDED BOOKS:

Text books :

1. Thermal engineering; Mahesh M Rathore; Tata McGraw-Hill
2. Thermal Engineering R.Yadav; Central publication
3. Non-conventional Energy Sources B. H. Khan Tata McGraw-Hill
4. Non-conventional Energy Sources G. D. Rai.

Reference books:

1. Steam Turbine; Kearton; Oscar Publications.
2. Thermal Power Engineering; Mathur Mehta; Tata McGraw-Hill
3. Power Plant Engineeirng. P. K. Nag
4. Power Plant Engineeirng; R. K. Rajput ; Laxmi Publications
5. Thermal Engineering, P.L.Ballaney; Laxmi Publications.

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4ME03 MANUFACTURING TECHNOLOGY

Course Learning Objectives :

1. To study the mechanics of metal cutting, tool characteristics and cutting forces
2. To study the turning operations using lathe and CNC machines
3. To study the working of drilling and boring machines
4. To study the working of milling and gear cutting machines
5. To study the machining operations using grinding, shaper, planer and slotter machines
6. To study the unconventional machining processes

Course Outcomes :

Students will be able to -

1. Apply the knowledge of theory of metal cutting, tool selection & calculate cutting forces
2. Demonstrate the knowledge of basics of turning operations
3. Understand the drilling and boring operations and working of drilling & boring machines
4. Understand the milling and gear cutting operations and working of respective machines
5. Understand the working of grinding, shaper, planer and slotter machines
6. Understand the knowledge of unconventional machining processes

SECTION – A

UNIT I : Theory of Metal cutting: Mechanics of Metal cutting, Tool material, Tool Geometry, Cutting tool classification, Tool life, Tool wear, Calculation of Cutting forces, Machinability, Cutting fluids, Chip thickness ratio, Merchant circle. (8 Hrs)

UNIT II : Construction, Operations and accessories of centre lathe, introduction of capstan & turret lathe, indexing mechanism, bar feeding mechanism, Machine tool classification. Numerical approach. Taper turning & Screw cutting & basic concept of CNC. Introduction, working principal & CNC turning operation. (10 Hrs)

UNIT III : a) Drilling operation : Drilling M/cs general purpose, Mass production and special purpose drilling M/cs.
b) Introduction & types of Boring. Boring M/c :- Horizontal, Vertical and jig Boring M/c. Introduction to Broaching and its types, broach terminologies, etc. (8 Hrs)

SECTION - B

UNIT IV : (a) Calculation of machining time for Milling.
(b)Milling M/c :- Types, Types of Milling Cutters, Dividing head, Compound and differential idexing.
c) Gear producing M/cs. (6 Hrs)

UNIT V : a)Grinding Machines: Bench grinders, surface grinders, centreles grinders, types of bonds & Abrasive modification of grinding wheels.
b) Study of various part & Operation of Shaper, Planer, Slotter. (6 Hrs)

UNIT VI : Unconventional Machining Processes:-

a) Mechanical Processes:- Ultrasonic Machining - principle and applications. process parameters; Abrasive and water parameters involved.
b) Thermal processes:- Election Beam Machining – Generation of beam, principle and applications : Laser Beam machining applications : Plasma-arc machining- Concept and generation of plasma, principle of PAM, applications.

c) Electric discharge Machining - Types die-sinking, wire cut EDM, Mechanism of material removal, process parameters, advantages and applications. (8 Hrs)

BOOKS RECOMMENDED :

Text Books:

1. Manufacturing Technology-Vol 1 & 2; R.L.Timings, S.P. Wilkinson; Pearson Publication.
2. Workshop Technology - By Hajra Choudhaury Vol II.
3. Manufacturing Technology Vol. II P. N. Rao, McGraw Hill Publication

References:-

1. Pandya & Shah, Modern Machining process, Tata McGraw Hill 1998.
2. Workshop Technology, O.P. Khanna, Dhanpatrai & Sons.
3. Workshop Technology - By Raghuwanshi. Vol II.

4ME08 MANUFACTURING TECHNOLOGY - LAB

Practicals:-

1. Demonstration of operations related to lathe, shaper, slotter, drilling & grinding m/cs.
2. One job on lathe covering taper turning and threading.
3. One job on shaping covering plane and inclined surfaces.

The above jobs should include drilling, grinding, tapping etc. Term work should be submitted in the form of journal.

N.B. :- The practical examination shall consists of preparation of practical jobs and assessment by external and internal examiner.

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4ME04 BASIC ELECTRICAL DRIVES AND CONTROL

Course Learning Objectives :

1. To study the working of electrical drives and their components
2. To study the basics of DC motors and their characteristics
3. To study the working of AC motors, Induction motors and concept of braking
4. To study the different speed control methods of A.C. and D.C. motors
5. To study and design of transducers and their applications
6. To study the industrial applications of different drives

Course Outcomes :

Students will be able to -

1. Understand the working of electrical drives and their components
2. Understand the basics of DC motors and their characteristics
3. Understand the working of AC motors, induction motors and concept of braking
4. Understand the different speed control methods of A.C. and D.C. motors
5. Understand the design of transducers and their applications
6. Understand the industrial applications of different drives

SECTION-A

Unit I : Concept of general electric drives, classification and comparison of electrical drive system, Cooling and heating of electric motors. Introduction to mechatronics, Theory and principle of Power Transistor, SCR. **(**8 Hrs**)**

Unit II : Basic characteristics of D.C. motor, Torque equation, Modified speed – Torque characteristics. Starting and braking of Electrical D.C. motors, comparison of mechanical and electrical braking methods. Introduction, Principle, construction and working of Servo motors, stepper motors, Brushless D.C. motors. **(**8 Hrs**)**

Unit III : Classification of A.C. motors, construction, types, principle of working and characteristics of 3 phase Induction motors, applications. Starting and braking of 3 phase induction motors. Classification of single phase induction motors. construction, principle and working and applications. Principle and working of universal motor. **(**8 Hours**)**

SECTION-B

Unit IV : Conventional methods of speed control of A.C. and D.C. motors. Thyristorized stator voltage control of 3 phase induction motor, (v/f) control method, slip-power recovery scheme. Thyristorized armature voltage control of D.C. motors using phase control & Thyristorized chopper. **(**8 Hours**)**

Unit V : Basic principle, construction & applications of sensors and transducers, contact - non- contact type, optical proximity sensors. Switches, contact type, magnet type, electromagnetic type, sound, light, pressure, vibration transducers, Hall effect-sensors A.C./D.C. Tachogenerators. **(**8 Hours**)**

Unit VI: Industrial applications - classes of duty selection of an electric drive for particular applications such as steel mill, paper mill, cement mill, textile mill, sugar mill, electric traction, coal mining, etc. Induction heating, surface hardening & Dielectric heating. **(8 Hours)**

BOOKS RECOMMENDED :

Text Books:

1. A First Course on Electrical Drives - S.K. Pillai.
2. Basic Electrical Technology (Vol. 11) - B.L. Theraja

Reference Books :

1. Drives and Control - N. Dutta
2. Mechatronics - W. Bolton, Addison Wesley, Longman Ltd.
3. A Course in Electrical, Electronics Measurement and Instrumentation, By A.K.Sawhney, Dhanpat Rai & Sons,

4ME09 BASIC ELECTRICAL DRIVES AND CONTROL - LAB

List of Experiments :

Any EIGHT practicals from the following list :

1. To study the Specification of Various Electrical Machines.
2. To study the D.C. Motor Starters.
3. To study the Running and Reversing of D.C. Motor.
4. Speed Measurements using Magnetic Pick-up.
5. To study the Speed reversal of counter Current Breaking of 3-phase Induction Motor.
6. To control the speed of D.C. Motor by a) Armature Control b) Field Control.
7. To perform Load Test on Induction Motor.
8. To study Dynamic/Rheostatic Breaking of D.C. Motor.
9. To study Characteristics of Thyristor.
10. To study the speed -Torque Characteristic of Servo Motor.

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4ME05 HYDRAULIC AND PNEUMATIC SYSTEMS

Course Learning Objectives:

1. To get fundamental background about the hydroelectric power plants
2. To study operation, working principle & performance characteristics of hydraulic turbines
3. To study operation, working principle & performance characteristics of centrifugal pump, reciprocating pump and other hydraulic pumps
4. To study the behavior of compressible fluid flow
5. To study different hydrostatic & hydro kinematics industrial applications

Course Outcomes:

Students will be able to -

1. Demonstrate basic concepts of prime movers and turbines
2. Utilize the knowledge of centrifugal and reciprocating pumps for applications
3. Reveal the importance of other water lifting devices
4. Solve the elementary treatment on compressible fluid flow
5. Understand the concept of hydrostatic and hydrokinetic systems
6. Use the knowledge of hydraulics & pneumatics in developing project work.

SECTION - A

Unit I : Hydraulic Turbines - Theory of impulse and reaction turbines. Pelton, Francis and Kaplan turbines, their construction, classification, analysis, characteristics and governing, draft tube. (10 Hours)

Unit II : Centrifugal pumps :- Basic Theory, classification, construction, operation, characteristics, multistage, NPSH and cavitations in pumps. (7 Hours)

Unit III:

1. Axial flow pump :- Basic theory, construction, & operation.
2. Other water lifting devices :- (a) Air lift pump. (b) Jet Pump. (c) Hydraulic Ram.
3. Computational Fluid Dynamics (CFD)
4. Introduction to CFD: Necessity, limitations, philosophy behind CFD, applications (6 Hours)

SECTION - B

Unit IV : Positive Displacement and other Pumps: Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels. Comparison of centrifugal and reciprocating pumps, performance characteristics. (9 Hours)

Unit V : Compressible fluid flow :- Perfect gas relationship, speed of sound wave, mach number, Isothermal and isotropic flows, shock waves. (8 Hours)

Unit VI : Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift, hydraulic coupling, hydraulic torque converter. (8 Hours)

BOOKS RECOMMENDED :-

Text Books:-

1. CSP Ojha, R. Berndtsson, Fluid mechanics and machinery; Oxford University.
2. Bansal R.K., Fluid mechanics and fluid machines; Laxmi publications.

Reference Books:-

1. Jagdish Lal, Hydraulic machines; Metropolitan Book Co. Pvt. Ltd.
2. Dr. Modi & Seth, Hydraulics and Fluid Mechanics; Standard house book.
3. Sen gupta, Computational fluid dynamics; Pearson Publishers.
4. Sameer sheikh, Iliyas Khan, Treaties on Hydraulics; Pneumatics, R.K. Publication.

4ME10 HYDRAULIC & PNEUMATIC SYSTEMS - LAB

List of Practicals:- At least **SIX** (6) practicals based on following :

1) Trial/Study of Pelton wheel
2) Trial/Study of Francis Turbine
3) Trial/Study of Kaplan Turbine
4) Trial/Study of centrifugal pump
5) Trial/Study of reciprocating pump
6) Trial/Study of axial flow pump
7) Trial/Study of hydraulic ram
8) Trial/Study of multistage pump
9) Trial/Study of special pumps (air lift pump/ jet pump)
10) Trial/Study of Gear pump
10) Any one practical based on CFD software

Note : Practical Examination : Practical examination shall consist of Viva Voce/performance based on above syllabus & practical work.

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SYLLABUS OF SEM. III & IV B.E. (ELECTRONICS & TELECOMMUNICATION ENGG.)

Semester-III

3ETC1 - ENGINEERING MATHEMATICS-III

Course Requisite: 1. (IA1) Engineering Mathematics-I 2. (IB1) Engineering Mathematics-II

Course Objectives:

1. To deal with linear differential equations.
2. Understand Laplace transforms .
3. Introduction to geometry of curves, two and three-dimensional regions and calculus of vector valued functions.
4. To equip students with necessary knowledge and skills to enable them to handle mathematical operations of complex analysis .

5. . Understand the computational details behind certain numerical methods and their convergence.
6. To deal with system of differential and difference equations in the study of electrical/electronic and systems.

Outcomes: After successfully completing the course, the students will be able to

1 . Demonstrate the knowledge of differential equations to solve engineering problems of analog systems.
2 . Apply Laplace transform to solve differential equations.
3. Apply knowledge of vector calculus.
4. Comprehend knowledge of complex analysis in terms of complex variables, harmonic functions and conformal mapping.
5. Apply numerical methods to obtain approximate solutions to mathematical problems.
6. Identify and solve certain forms of partial difference equations as applied to discrete systems.

SECTION - A

Unit-I : Ordinary Differential Equations: - Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. (7)

Unit-II: Laplace transforms: definition, standard forms, properties of Laplace transform, inverse Laplace transform, Laplace transform of some basic functions, initial and final value theorem, convolution theorem, Solution of linear differential equations using Laplace transform. (7)

Unit III : Vector Calculus: - Scalar and Vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, expansion formulae (without proof), irrotational and solenoidal vector fields. Fourier transforms: Fourier sine and Fourier cosine transforms and integrals . (7)

SECTION- B

Unit IV : Complex Analysis: - Functions of complex variables, Analytic function, CauchyReimann conditions, Harmonic function, Harmonic conjugate functions, Milne's method. Conformal Mappings: Translation, Rotation, Magnification, Inversion and Bilinear Transformation, expansion of function in Taylor's and Laurent's series. (7)

Unit V : Numerical Methods: Solution of Nonlinear and Polynomial Equations : False Position, Newton Raphson Method. Solution of Linear Systems Equations: Gauss Elimination method, Gauss Seidel Iterative Method, Relaxation method Solution of Differential Equations: Euler's method, Runge-Kutta method, Picards method. (7)

Unit VI : (a) Difference Equation:- solution of difference equations of first order, solution of difference equations of higher order with constant coefficient.
(b) **Partial differential equation of first order of following form**- (i) f (p, q) = 0; (ii) f (p, q, z)=0; (iii) f(x, p) = g (y, q); (iv) Pp + Qq =R (Lagrange's Form); (v) Z=px+qy+f(p, q) (Clairaut form) (7)

Text Books:

1. Elements of Applied Mathematics by P. N. Wartikar and J. N. Wartikar. Poona Vidhyarthi Publisher
2. Higher Engineering Mathematics by B.S.Grewal. Khanna Publishers
3. Introduction to method of Numerical Analysis- S. S. Shastry, Second Edition, PHI Pvt. Ltd.,New Delhi.

References:

1. A Mathematical Companion for Science and Engineering Students – Brettenbach, Oxford University Press, 2008
2. Advancing Engg. Mathematics, E.K.Kreyzig, John Wiley
3. Numerical Method for Mathematics Science and Engineering, John H. Mathew, PHI 4. Numerical Methods - Principles, Analysis & Algorithms Pal, Oxford.

3ETC02 - Electronic Devices & circuits Max. Marks: 80

Course Requisite:

1. Engineering Physics

Course Objectives:

1. To understand detail analysis of Electronic devices.
2. To understand use of electronic devices for various applications in Electronic circuits.
3. To analyze various electronic circuits.

Course Outcomes:

After successfully completing the course, the students will be able to

1. Comprehend the knowledge of diode and its applications in rectifier and regulator circuits.
2. Understand basics of BJT, JFET, MOSFET, UJT and their operational parameters.
3. Understand feedback concept, topologies and their applications.
4. Implement and analyze various electronic circuits.

	Subject: Electronic Devices & circuits	L
Unit-1	**PN junction diode:** Formation of p-n junction, biasing the diode, current equation and V-I characteristics of diode, static and dynamic resistance, Analysis of Half Wave Rectifier (HWR), Full Wave Rectifier (FWR), introduction to filters C, L,LC and CLC filters, working of diode as a Switch, Zener diode and its application as voltage regulator.	06
Unit-2	**Waveshaping:** Analysis of RC low pass, and high pass filters for Sinusoidal, Step, Pulse, Square signal, analysis of clipping and clamping circuits using diodes.	06
Unit-3	**Bipolar Junction Transistors:** Operation of PNP and NPN transistor, CB, CE and CC configurations with characteristics and parameters, transistor as a switch, Transistor switching times, dc load line, transistor biasing methods, bias stability, Introduction to voltage divider biased CE amplifiers using h-parameter model.	06
Unit-4	**Feedback amplifiers**: Feedback concept, effects of negative feedback, basic feedback topologies **Sinusoidal oscillators**: Barkhausen's criteria, Hartley, Colpitts, RC Phase shift, Wein bridge and crystal oscillators.	06
Unit-5	**Multistage Amplifiers**: Need of multistage, direct coupled amplifier, RC coupled amplifier, transformer coupled amplifier, emitter follower, Darlington emitter follower, bootstrapping principle (analysis not expected).	06
Unit-6	**JFET:** Theory, construction and characteristics: parameters (μ, gm & rd) **MOSFET**: Theory, construction and characteristics of enhancement & depletion type MOSFET. **UJT:** Theory, construction and characteristics; UJT as relaxation oscillator.	06
	Total	**36**

Text Books:

1. David Bell: Electronic Devices and Circuits, Oxford University Press, 2010.
2. Milliman and Halkias: Integrated Electronics, Tata McGraw Hill, New Delhi.

References:

1. Robert L.Boylestad, "Electronic Devices and Circuit theory", Publ. Pearson Education.
2. Floyd, "Electron Devices" Pearson Asia 5th Edition, 2001.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.

3ETC06 - ELECTRONIC DEVICES AND CIRCUITS - LAB

Course Requisite:

1. Engineering Physics
2. 3ETC02 Electronic Devices and Circuits

Course Objectives:

1. To verify characteristics of various semiconductor devices.
2. To determine and verify various performance parameters of electronic devices and circuits.
3. To provide basic experimental exposure about operation and applications of electronic devices.

Course Outcomes:

1. Acquiring basics of parameters and operation of various semiconductor devices.
2. Implementation of basic circuits using electronic devices.
3. Verification and analysis of performance of electronic circuits.

List of Experiments :

Experiment No.	Aim of Experiment
Expt - 1	To verify V-I characteristics of p-n junction diode and obtain static and dynamic resistance values.
Expt – 2	To calculate efficiency and ripple factor of Half wave, Full wave and Bridge wave rectifier.
Expt - 3	To study different types of filter circuits and calculate its ripple factor for C-filter.
Expt - 4	To study Zener diode as a voltage regulator.
Expt – 5	To observe the response of RC Low pass circuit for a square wave input for different time Constant i) RC >>T ii) RC = T iii) RC <<T.
Expt - 6	To observe the response of RC High pass circuit for a square wave input for different time Constants i) RC>>T ii) RC = T iii) RC<<T.
Expt – 7	To obtain output characteristics of the clipping circuits for different reference voltages and to verify the responses.
Expt – 8	To study and observe the performance of various clamper circuit.
Expt – 9	To verify characteristics of CE mode of BJT and compute its parameters such as gain(β),input and output Impedance.
Expt – 10	To compare calculate and observe frequencyresponse of oscillationsof 3 stage RC phase shift oscillator.
Expt - 11	Tocomparecalculateand observefrequencyresponse ofoscillationsofRC Wein Bridge oscillator.
Expt – 12	To plot frequency response of RC coupled amplifier and determine its bandwidth.
Expt – 13	To plot frequency response of Transformer coupled amplifier and determine its Bandwidth.
Expt – 14	To sketch the drain and transfer characteristics of n-channel JFET and determine ac drain resistance, trans-conductance and amplification factor
Expt – 15	To sketch V-I characteristics of UJT and determine Intrinsic stand-off ratio
Expt – 16	To analyze the response of Rectifier, Amplifier, Oscillator, using simulation software.

* Minimum 08 experiments should be conducted out of above enlisted.

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3ETC03 - DIGITAL SYSTEM DESIGN Max. Marks: 80

Course Requisite:

1. Engineering Physics

Course Objectives:

1. To study basic concepts of Boolean algebra, number systems and codes.
2. To study techniques of minimization of Boolean expression.
3. To study the formal procedures for the analysis and design of combinational circuits.
4. To study the formal procedures for the analysis and design of sequential circuits.
5. To learn digital logic families, Programmable logic Devices.
6. To learn the semiconductor memories and mapping.

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Use Boolean algebra to solve logic functions, minimization techniques, number systems and its conversion, arithmetic functions.
2. Identify, analyze and design combinational and sequential circuits.
3. Understand digital logic families and their characteristics.
4. Use the knowledge of semiconductor memories and mapping of memories, programmable logic devices in digital design.

	Subject: DIGITAL SYSTEM DESIGN	L
Unit-1	**Number systems and codes:-** Number system and their conversions, BCD codes, Octal codes, Hexadecimal codes, Excess-3 code, Gray Code, Arithmetic Operations using 1's complement and 2's complement Introduction, Basic Digital Circuits: AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR.	06
Unit-2	**Logic gates, Boolean Algebra and Minimization Techniques:-** Boolean Algebra, Demorgans Theorem, Simplifications using Boolean Algebra , SOP and POS form, K-map representation and minimization of logical functions upto 4 variables, don't care conditions, Quine McCluskey method.	06
Unit-3	**Combinational logic design using 74XX/54XX MSI chip:-** Adders, Subtractors, 4-bit parallel adder, look ahead carry BCD adder, MUX, DEMUX, Decoders, Encoders, Code Converters, Comparators, Parity Generator/Checker, BCD to 7 segment decoder, combinational logic design using ROM, PLA, PAL.	06
Unit-4	**Flip-flops, Registers and Counters:-** S-R, J-K, Master slave J-K, D-type, T-type. Shift Registers: Mode of operations of shift registers, Universal Shift Register. Counters: Asynchronous and Synchronous counter, up/down counter, MOD-N counter, Ring counter, Johnson counter, Frequency Division Counter.	06
Unit-5	**Logic families and Memories:-** TTL NAND gate, specification noise margin, propagation delay, fan-in, fan-out, tri-state TTL, ECL, CMOS. Semiconductor Memories: - RAM, ROM, EPROM, EEPROM, SRAM, DRAM.	06
Unit-6	**Analysis of Clocked Sequential Networks**:- Moore and Mealy Machine, State table, State Assignment, State Reduction, State Transition diagram, Sequence Generator, Sequence Detector.	06
	Total	**36**

Text Books:

1. M.Morris Mano and M.D.Ciletti, "Digital Design", Pearson Education.
2. R P Jain, "Modern Digital Electronics", TMH.

Reference Books:

1. Wakerly, "Digital Design: Principles and Practices", 3rd edition, Pearson Education, 2004.
2. Charles H. Roth, "Fundamentals of Logic Design", 4th Edition, Jaico Publication
3. Lee S.C, "Digital Circuits and Logic Design", PHI
4. Richard S. Sandige, "Modern Digital Design", McGraw-Hill Series in Electrical Engineering.

3ETC07 - DIGITAL SYSTEM DESIGN - Lab

Course Requisite:

1. Engineering Physics lab

Course Objectives:

1. To impart the concepts of digital electronics.
2. To provide students basic experimental experiences in the operation of various digital logic Families.
3. To learn the operation of various logic gates and their implementation using digital IC's.
4. To learn the realization of various combinational and sequential circuits.
5. To learn Semiconductor memories and mapping.

Course Outcomes:

After successfully completion of the lab course the students will be able to:

1. Apply practically the concepts of digital electronics.
2. Explain the operation and characteristics of various digital logic families.
3. Understand the operation of various logic gates and their implementation using digital IC's.
4. Design and implement various combinational logic circuits.
5. Design and implement various sequential logic circuits.
6. Design and mapping of various types of memories.

Expt. No.	Experiment List
Expt-1	To study and verify the operation of various digital logic families.
Expt -2	To study and verify the operation of logic gates.
Expt -3	Design and implementation of Adders and Subtractors using logic gates.
Expt -4	Design and implementation of code converters using logic gates.
Expt -5	Design and implementation of multiplexer using logic gates and IC.
Expt -6	Design and implementation of demultiplexer using logic gates and IC.
Expt -7	Design and implementation of code converters using logic gates.
Expt -8	Design and implementation of Magnitude Comparator using logic gates and IC.
Expt -9	Design and implementation of odd/even parity checker /generator using IC.
Expt -10	Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops.
Expt -11	Construction and verification of ripple counters.
Expt -12	Design and implementation of 3-bit synchronous up/down counter

* Minimum 08 experiments should be conducted out of above enlisted.

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3ETC04 - ELECTROMAGNETIC WAVES Max. Marks: 80

Course Requisite:

1. Engineering Mathematics-I
2. Engineering Mathematics-II
3. Engineering Mathematics-III

Course Objectives:

The objectives of the course are,

1. To introduce basic mathematical concept of coordinate system and vector integrals.
2. To impart knowledge of the basic concepts of electric fields.
3. To impart knowledge of the basic concepts of magnetic fields.
4. To understand the Maxwell's Equations for Electric & Magnetic Field, Boundary conditions and their interpretation.
5. To introduce concept of propagation of electromagnetic waves in free space, conductors and dielectrics.
6. To understand, analyze and evaluate the radiation of electromagnetic wave from theoretical and practical antennas.

Course Outcomes:

At the end of this course students will demonstrate the ability to :

1. Understand the coordinate systems and vector integrals.
2. Evaluate Electric Field Intensity for different charge distributions.
3. Evaluate Magnetic Field Intensity due to current carrying conductors.
4. Understand scientifically about Maxwell's equations & Boundary conditions.
5. Characterize uniform plane wave & can calculate reflection and transmission coefficient of waves at media interface.
6. Understand principle of radiation and radiation characteristics of theoretical & practical antennas.

	Subject: Electromagnetic Waves	L
Unit-1	**Introduction to Vector analysis:** Coordinate systems, Basics of Vectors: Vector products, Projection of vectors, Gradient, Divergence & Curl, Vector integrals, Divergence Theorem & Stokes Theorem.	06
Unit-2	**Electrostatics:** Introduction to Coulomb's law &Electric Field Intensity, Evaluation of Electric Field Intensity due to point charge, line charge & surface charge distribution. Introduction to Electric Flux, Electric Flux Density, Electrostatic potential, Potential gradient &Electric dipole.	06
Unit-3	**Magnetostatics:** Introduction to Biot Savart's law, Ampere's circuital law, Magnetic Field Intensity (without numericals), Evaluation of Magnetic Field intensity due to infinite, finite & circular current carrying conductors. Introduction to Magnetic Flux, Magnetic Flux Density, Magnetic dipole.	06
Unit-4	**Maxwell Equations & Boundary Conditions:** Derivation of Maxwell's Equations for Electric & Magnetic Field (without numericals). Boundary condition at dielectric-dielectric interface, dielectric-conductor interface &Boundary conditions for magnetic materials interface.	06
Unit-5	**Electromagnetic Wave Propagation:** Uniform plane wave, Propagation of wave, Formulation of wave equation in free space, dielectric &conducting medium, Skin depth, Poynting Theorem, Reflection and refraction of electromagnetic waves with normal incidence at dielectric interface.	06
Unit-6	**Radiation:** Scalar & Vector magnetic potential, Retarded Potential, Radiation of Electromagnetic wave from the Hertzian Dipole ,Quarter wave Monopole and Half-wave Dipole antennas.	06
	Total	**36**

Text Books:

1. William H.Hayt,Jr and John A.Buck., "Engineering Electromagnetics", Tata McGraw-Hill Publishing Ltd.
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India

Reference Books :

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997. 4. David Cheng, Electromagnetics, Prentice Hall Course

3ETC05: OBJECT ORIENTED PROGRAMMING Max. Marks: 80

Course Requisite:

4. Computer Programming

Course Objectives:

1. To learn object-oriented concepts and build simple applications using C++ and Java.
2. To understand the basic concepts and techniques which form the object-oriented programming paradigm

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Justify the basic concepts of object-oriented programming such as data types, functions, classes, objects, constructors, inheritance, overloading etc.
2. Design, implement, test, and debug simple programs in C++.
3. Describe how the class mechanism supports encapsulation and information hiding.
4. To know the concept of operator overloading
5. Understand inheritance in C++
6. Design and test the implementation of Java programming concepts

	Subject: OBJECT ORIENTED PROGRAMMING	L
Unit-1	Principles of object-oriented Programming: OOP'S paradigm, basic concept of OOP'S, benefits of OOP'S, Four pillars of OOP, structure of C++ programming, basic data types.	06
Unit-2	User defined data type, derived data type, Abstract data types in C++, operators and control statement, Functionsin C++: Functions, Function over loading, Friend Functions and virtual functions.	06
Unit-3	Classes and objects in C++: Types of classes and its use, concept of object and its implementation, constructor and destructors.	06
Unit-4	Operator and their definition, overloading unary and binary operator, rules for overloading operators, overloading binary operators using friends and string manipulation.	06
Unit-5	Inheritance in C++: Extending classes: Multilevel Inheritance, Multiple inheritances, Hierarchical inheritance, Hybrid inheritance, Virtual base classes and Abstract classes.	06
Unit-6	Introduction to Java programming, JVM, Java programming constructs: variables, primitive data types, identifier, literals, operators, expressions, primitive type conversion and casting, Basics of classes, objects, creating objects, and methods in Java.	06
	Total	**36**

Text Books:

1. E Balagurusamy, "Object Oriented Programming Using C++ and JAVA", Tata McGraw-Hill.
2. E Balagurusamy, "Object Oriented Programming Using C++" ,Tata McGraw-Hill.

Reference Books :

1. Bjarne Stroustrup, "C++ Programming Language", Pearson Education.
2. H.M.Dietel and P.J.Dietel, "Java How to Program" Pearson Education/PHI, Sixth Edition.
3. Robert Lafore, "Object-Oriented Programming in C++ ", Pearson Education India, (4th Edition).
4. Herbert Schildt , "Java : The Complete Reference" Tata McGraw-Hill (7th Edition).
5. Yeshwant Kanetkar "Let us C++", BPB Publications.
6. Dr. N.B. Vekateswarlu, Dr. E.V. Prasad, "Learn Object Oriented Programming Using Java: An UML Based", S. Chand Publication.

3ETC08 : OBJECT ORIENTED PROGRAMMING -LAB.

Course Requisite:

1. Computer Programming
2. 3ETC05 Object Oriented Programming

Course Objectives:

1. Design, implement, test, and debug simple programs in an object-oriented programming language.
2. Design and test the implementation of C++ programming concepts.
3. Design and test the implementation of java programming concepts.

Course Outcomes:

After successfully completing the course, the students will be able to

1. Justify the basics of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism.
2. Design, implement, test, and debug simple programs in an object-oriented programming language.
3. Describe how the class mechanism supports encapsulation and information hiding.
4. Design and test the implementation of C++ and java programming concepts.

List of Experiments :

Experiment No.	Aim of Experiment
Expt - 1	Write a C++ program to swap two variables a) Using third variable b) Without using third variable.
Expt – 2	Write a program in C++ to print the area and perimeter of a rectangle.
Expt - 3	Write a C++ program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
Expt - 4	Develop programs to implement the concepts of classes and object, accessing members: e.g. a. Design an EMPLOYEE class to contain Data members: Employee_Number, Employee_Name, Basic_Salary, All_Allowances, IT, Net_Salary. Member functions: to read the data of an employee, to calculate Net_Salary and to print the values of all the data members.
Expt – 5	Write a program in C++ to implement parameterized constructor and copy constructor.
Expt - 6	Write a C++ program to implement function overloading.
Expt – 7	Write a program in C++ illustrating the use of virtual functions in a class.
Expt – 8	Write a C++ program to overload unary operator for inverting the value of data variable using member function.
Expt – 9	Write a program in C++ to demonstrate multiple inheritances.
Expt – 10	Write a program in C++ to demonstrate multilevel inheritance.
Expt - 11	Write a program in C++ to implement virtual base class.
Expt – 12	Write a java program to Calculate Circle Area.
Expt – 13	Write a program in Java that reads a number in meters, converts it to feet, and displays the result.

* Minimum 08 experiments should be conducted out of above enlisted.

Semester - IV

4ETC02 - ANALOG CIRCUITS Max. Marks: 80

Course Requisite:

1. (3ETC02) Electronic Devices and Circuits

Course Objectives:

1. To understand the basics and internal structure of Op-Amp.
2. To analyze and design linear and non-linear applications of Op-Amp.
3. To understand and design concepts of voltage regulators.
4. To study and synthesize the waveform generators using IC 555 and IC 565.
5. To demonstrate applications of Op-Amp in temperature monitoring.

Course Outcomes:

After successfully completing the course, the students will be able to

1. Perform evaluation of the switching behavior of semiconductor devices.
2. Comprehend the knowledge of basic concepts and performance parameters of Op-Amp.
3. Use Op-Amp for implementation of linear and non-linear applications.
4. Comprehend the knowledge of PLL, its applications and data converters.

	Subject: Analog Circuits	L
Unit-1	**Operational amplifier** Block diagram of Op-Amp, differential amplifier configurations using BJT, constant current source, level shifting, transfer characteristics, frequency response, study of ICuA741, Op-Amp parameters, Inverting and non inverting amplifiers	06
Unit-2	**Linear applications of Op-Amp:** Theory & Design of scaling, summing, differential amplifier, integrator and differentiator, sinusoidal RC oscillators: RC-phase shift, Wein bridge oscillator using IC 741.	06

Unit-3	**Non Linear Applications of Op-Amp:** Theory & Design of Op-amp IC 741 based comparator, zero-crossing detector, window detectors, Schmitt trigger, astable multivibrator as square and triangular wave generator, monostable multivibrator	06
Unit-4	Design of Voltage regulators using IC 723 and LM 317, Design of instrumentation amplifier, bridge amplifier, temperature Controller/indicator using RTD.	06
Unit-5	Introduction to IC 555, IC 555 based design of Astable, Monostable multivibrator and their applications, A to D converters: Successive approximation & Dual Scope, D to A converters : Weighted Register & R-2R Ladder.	06
Unit-6	PLL: Operation of phase lock loop system, transfer characteristics, lock range and capture range, study of PLL IC LM 565 and its applications as AM detector, FM detector, Design of Butterworth first and second order low pass, high pass, all pass filter, design of notch filter.	06
	Total	**36**

Text Books:

1. R.A. Gayakwad, "OP-AMP and Linear Integrated Circuits", Prentice Hall/ Pearson Education Publications.
2. K R Botkar "Integrated Circuits" Khanna Publications.
3. Sergio Franco, "Design with Linear Integrated Circuits & Op-Amps",TMH Publications.

References:

1. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley Intl. Publication.
2. Paul Horowitz, W. Hill, "The art of Electronics", Cambridge Publications.

4ETC07 – ANALOG CIRCUITS LAB

Course Requisite:

1. (3ET3) Electronic Devices and Circuits.
2. (4ETC02) Analog Circuits

Course Objectives:

1. To verify operation of various wave shaping circuits.
2. To demonstrate linear and non-linear applications of Op-Amp.
3. To analyze multivibrator circuits using BJT and Op-Amp.
4. To understand functions and characteristics of PLL.

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Implement wave shaping circuits using passive components, diode and BJT and perform their analysis.
2. Demonstrate linear and non-linear applications of Op-Amp.
3. Implement PLL in certain applications.

List of Experiments :

Experiment No.	Aim of Experiment
Expt - 1	To verify Op-Amp IC 741 as an inverting and non- inverting amplifier with a specific gain value.
Expt – 2	To demonstrate integrator and differentiator circuit using Op-Amp IC 741.
Expt - 3	To verify RC- phase shift oscillator using Op-Amp IC 741.
Expt - 4	To verify Op-Amp IC 741 as a Schmitt trigger and calculate the hysteresis voltage.
Expt – 5	To verify operation of astable multivibrator using Op-Amp IC 741.
Expt - 6	To plot frequency response of first order Butterworth LPF for a specific pass-band gain and cut-off frequency.

Expt – 7 To verify characteristics of PLL.

Expt – 8 Application of PLL as AM detector/FM detector/frequency translator (Any one application)

Expt – 9 Design transistorized series voltage regulator

Expt – 10 Design a low voltage variable regulator to 7 V using IC 723.

Expt - 11 Design of summing amplifier using IC 741.

Expt – 12 Design of Schmitt trigger.

Expt – 13 Design of integrator and differentiator.

Expt – 14 Design of sinusoidal RC phase shift oscillator.

Expt – 15 Design and setup a Wien-bridge oscillator.

Expt – 16 Design the square and triangular wave generator using IC 741.

Expt – 17 Design a Butterworth high pass filter with specifications.

* Minimum 08 experiments should be conducted out of above enlisted.

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4ETC03 - NETWORK THEORY Max. Marks: 80

Course Requisite:

1. Electrical Engineering.
2. Engineering Mathematics.

Course Objectives:

1. To understand fundamental concepts of Node and Mesh analysis for linear circuits.
2. To study Network Theorems for circuit analysis.
3. To study Graph Theory for network analysis.
4. To apply Laplace Transform Technique for analysis of linear circuits.
5. To study Two Port Network parameters.
6. To study Network Functions.

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Analyze electrical circuits using Mesh and Node analysis.
2. Apply suitable Network Theorem to analyze electrical circuits.
3. Draw oriented Graph of the network to determine their currents and voltages.
4. To implement the concept of Laplace Transform for electrical circuit analysis.
5. To apply Two-Port network theory for electrical network analysis.
6. To evaluate different Network Functions.

	NETWORK THEORY	L
Unit-1	**Node and Mesh analysis**: Circuit components, assumptions for circuit analysis, Sources of electrical energy, Source transformation, Kirchoff's laws, Node and Mesh analysis, Matrix approach of network containing voltage and current sources and reactances, Network equations for RLC networks.	08
Unit-2	**Network Theorems**: Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Compensation theorem, Tellegen's theorem as applied to AC cicuits.	08
Unit-3	**Graph theory and network equations**: Graph of a network, Trees, cotrees and loops, Incidence matrix, Tie set and Cut set of a network, Analysis of a network using Tie set and Cut set matrix, Network equilibrium equations (without magnetic coupling), Duality.	08

Unit-4	**Network Analysis using Laplace Transform**: Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL and RLC networks with and without initial conditions. Initial and Final value theorems.	08
Unit-5	**Two port networks**: Open circuit impedance parameters, Short circuit admittance parameters, Transmission parameters, Inverse transmission parameters, Hybrid and Inverse hybrid parameters, Condition for reciprocity and symmetry of a two port network, Interconnection of two port networks.	08
Unit-6	**Network functions**: Ports and terminal pairs, Network functions, poles and zeros, Necessary conditions for driving point function, Necessary conditions for transfer function, Application of network analysis in deriving functions, Time domain behaviour from pole-zero plot, driving point and transfer impedance functions of LC networks.	08
	Total	**48**

Text Book: D. Roy Choudhary, "Networks and Systems", New Age International.

Reference Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall,3rd Edition.
2. Sudhakar A., Shyammohan S. P. "Circuits and Network" ; Tata McGraw-Hill New Delhi, 1994
3. W. H. Hayt, J. E. Kemmerly and S. M. Durbin, "Engineering Circuit Analysis", 7th Edition, Tata McGraw-Hill education private Limited, New Delhi.
4. Abhijit Chakrabarti, "Circuit theory, Analysis and Synthesis",Dhanpat Rai and Co. Pub.

4ETC08 - NETWORK THEORY - LAB

Course Objectives:

1. To apply knowledge of Mesh and Node analysis for a given network.
2. To learn various network theorems and apply them to solve networks.
3. To apply knowledge of Two Port network and Network Functions to analyze given network.

Course Outcomes:

After successfully completion of the lab course the students will be able to:

1. To apply knowledge of Mesh and Node analysis for a given network.
2. To apply various network theorems to solve networks.
3. To apply knowledge of Two Port network and Network Functions to analyze given network.

Expt. No.	Experiment List
Expt-1	To verify Node Analysis for electric circuit.
Expt -2	To verify Mesh Analysis for electric circuit.
Expt -3	To verify Superposition theorem for a given network.
Expt -4	To verify Thevenin's theorem for a given network.
Expt -5	To verify Norton's theorem for a given network.
Expt -6	To verify Reciprocity theorem for a given network.
Expt -7	To verify Maximum Power Transfer theorem for a given network.
Expt -8	To determine and verify open circuit (Z) Impedance parameters of a given Two Port network.
Expt -9	To determine and verify short circuit (Y) Admittance parameters of a given Two Port network.
Expt -10	To determine and verify Transmission (ABCD) parameters of a given Two Port network.
Expt -11	To determine and verify Hybrid (h) parameters of a given Two Port network.
Expt -12	To find the driving point Impedance for a given network.
Expt -13	To find the Voltage Transfer Ratio for a given network.
Expt -14	To study RLC series circuit using any simulation Tool.
Expt -15	To study RLC parallel circuit using any simulation Tool.

- Minimum 08 experiments should be conducted out of above enlisted.

4ETC04 – SIGNALS AND SYSTEMS Max. Marks: 80

Course Requisite: Engineering Mathematics-III

Course Objectives:

1. Understand the fundamental characteristics of signals and systems.
2. Understand signals and systems in terms of both the time and transform domains.
3. Develop the mathematical skills to solve problems involving convolution and sampling.

Course Outcomes:

After successfully completing the course, students will be able to

1. Understand the continuous time signals and systems mathematically and their classification along with the mathematical operations that can be performed on them.
2. Understand the spectral characteristics of continuous-time periodic signals using Fourier series.
3. Analyze the spectral characteristics of continuous-time aperiodic signals and systems using Fourier Transform.
4. Apply the Laplace transform for analysis of continuous-time systems.
5. Understand the Discrete Time signals and systems mathematically and understand their classification along with the mathematical operations that can be performed on them.
6. Analyze the spectral characteristics of Discrete Time signals and systems using Discrete Time Fourier Transform.

	Subject: Signals and Systems.	L
Unit-1	**Continuous time signals and systems**: Signal Classification, Energy and Power Signal, Signal Operations, Signal models, Even and Odd functions, convolution, System Classification	06
Unit-2	**Continuous-Time Signal Analysis -The Fourier Series:** Periodic Signal Representation by Trigonometric Fourier Series, Existence and Convergence of Fourier Series, Gibbs Phenomenon, Exponential Fourier Series, Magnitude and phase plots of Fourier coefficients.	06
Unit-3	**Continuous-Time Signal Analysis-The Fourier Transform:** Aperiodic Signal Representation by Fourier Integral, Properties of Fourier Transform, Signal Transmission Through LTIC Systems, Signal energy, Inverse Fourier Transform, plotting Fourier Spectrum.	06
Unit-4	**Continuous-Time System Analysis Using Laplace Transform**: Laplace Transform, Region of convergence, Inverse Laplace transforms Application of Laplace transform for determination of solution of differential equation and System realization up to second order, Frequency response of LTIC system.	06
Unit-5	**Time-Domain Analysis of Discrete-Time Signals & Systems:** Signal Operations, Classification of Discrete-Time Systems, Discrete-Time System Equations, System response to Internal condition, Unit Impulse Response, System response to External Input, Classical Solution of Linear Difference Equations.**Sampling and Reconstruction:** Sampling theorem, signal reconstruction spectral.	06
Unit-6	**Fourier Analysis of Discrete-Time Signals:** Discrete-Time Fourier Series (DTFS), Aperiodic Signal Representation by Fourier Integral, Properties of DTFT, Relationship between DTFT & CTFT.	06
	Total	**36**

Text Books:

1. Lathi B. P., "Principles of Linear Systems and Signals" Second Edition (International Version) Oxford University Press.
2. Alan V. Oppenheim & Alan S. Willsky with S. Hamid Nawab, "Signals & Systems" PHI Publication, Second Edition.

Reference Books:

1. Ambardar A., "Analog And Digital Signal Processing", Thomson Learning-2005.
2. Simon Haykin, Barry Van Veen, "Signals & Systems", IInd Edition, Wiley Pub.
3. Michael J. Roberts, "Signals and Systems Analysis Using Transform Methods and MATLAB", Mc Hill Publication.

4ETC09 – SIGNALS AND SYSTEMS - LAB

Course Requisite:

4ETC04 Signals & Systems.

Course Objectives:

1. To use software to visualize analysis of Signals and System.
2. To manipulate the time signals and identify the type of given system.

Course Outcomes:

1. After successful completion of this course, students will be able to
2. Generate different plots and explore results to draw valid conclusions and inferences in Signal Processing.
3. Enable on how to approach for requirement of signal processing and system design using simulation tools.
4. Familiarize with the concepts of sampling.

List of Experiments :

Experiment No.	Aim of Experiment
Expt - 1	Study of Signal Processing Functions used in MATLAB/SCILAB.
Expt – 2	Program to generate standard continuous Time Signals.
Expt - 3	Program to generate standard discrete Time Signals.
Expt - 4	Program to perform basic operations on Signals.
Expt – 5	Program to find Even And Odd parts of a signal.
Expt - 6	Program to check Periodicity of signals.
Expt – 7	Program to find the Energy and Power of a Signal.
Expt – 8	Program to identify a given system as linear/ non-linear, time variance/ invariance property of a given system.
Expt – 9	Program to demonstrate the time domain sampling of band limited signals (Nyquist theorem).
Expt – 10	Program to find Fourier transform of given signal.
Expt - 11	Implement system equation using Simulnk/Xcos to find output of system for different input signals.
Expt – 12	Find unit step response of system described by transfer function using Simulink/Xcos.

* Minimum 08 experiments should be conducted out of above enlisted.

4ETC05 – VALUES & ETHICS (HS) Max. Marks: 80

Course Requisite:

Course Objectives:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society, and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcomes:

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship, and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

	Subject: Values & Ethics	L
Unit-1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validations the process for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels.	06
Unit-2	**Understanding Harmony in the Human Being - Harmony in Myself** Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity.	06
Unit-3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship Incorporating Universal Human Values in Technical Education (An AICTE Initiative), Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.	06
Unit-4	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence** Understanding the harmony in the Nature, Interconnectedness, and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.	06
Unit-5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics** Natural acceptance of human values, Definitiveness of Ethical Human Conduct , Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production systems.	06
Unit-6	Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations. (6 Hrs) Note: Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.	06
	Total	**36**

Text Books and Teachers Manual :

1. A Foundation Course in Human Values and Professional Ethics, R.R. Gaur, R. Asthana, G.P. Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R.R. Gaur, R. Asthana, G.P. Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

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B.E. COMPUTER SCIENCE & ENGG. SEM. III & IV

Syllabus of B.E. Sem. III (Computer Science & Engineering)

3 KS01/3IT01/3KE01 ENGINEERING MATHEMATICS-III

Course Objectives:-

- Find general solutions of linear differential equations with constant coefficients using the roots of the auxiliary equation.
- Calculate the Laplace Transform of basic functions using the definition.
- Apply Laplace transform to find solution of linear differential equations. And solve problems related to Fourier Transform
- Compute and interpret the correlation coefficient.
- Compute the Analytic function and Complex Analysis.
- Perform vector differentiation and integration to analyze the vector fields and apply to compute line, surface and volume integrals.

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Demonstrate the knowledge of differential equations and linear differential equations .
2. Apply Laplace transform to solve differential equations.
3. Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.
4. Demonstrate the basic concepts of probability and statistics.
5. Apply the knowledge of Complex Analysis.
6. Apply the knowledge of vector calculus to solve physical problems.

SECTION-A

UNIT-I: **Ordinary differential equations**:- Complete solution, Operator D, Rules for finding commplementary function, the inverse operator, Rules for finding the particular integral, Method of variation of parameters, Cauchy's and Legendre's linear differential equations. (7)

UNIT-II: **Laplace Transform:-** Definition, standard forms, properties of Laplace transform, inverse Laplace transform, Initial and final value theorem, Convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function . (7)

UNIT-III: **a) Applications of Laplace Transform:-** Solution of Linear differential equations, Simultaneous differential equation by Laplace transform method

b) Fourier Transform:- Definition, standard forms, Fourier transforms, properties of Fourier transforms, Convolution theorem, Fourier sine and Fourier cosine transforms and integrals, inverse Fourier transforms.(7)

SECTION-B

UNIT-IV: **a) Partial differential equation** of first order of following form:- (i)f (p,q) = 0; (ii) f (p,q,z) = 0; (iii) f (x, p) = g (y,q); (iv) P p + Qq = R (Lagranges Form); (v) z = px + qy + f(p,q) (Clairauts form)

b) Statistics Curve fitting: Least Square Method, Coefficient of Correlations, Lines of Regression. (7)

UNIT-V: Complex Analysis: - Functions of complex variables, Analytic function, Cauchy- conditions, Harmonic function, Harmonic conjugate functions, Milne's Method, conformal mappings (translation, rotation, magnification and bilinear transformation), Expansion of function in Taylor's and Laurent's series. (7)

UNIT–VI: Vector calculus:- Scalar and vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, expansion Formulae (without proof), line, surface, volume integrals, irrotational Solenoidal Vector fields. (7)

TEXT BOOKS:

1. Elements of Applied Mathematics Vol. II by P. N. Wartikar and J.N. Wartikar,
2. Higher Engg. Mathematics by B.S. Grewal.

REFERENCE BOOKS:

1. Advancing Engg. Mathematics by E.K.Kreyzig.
2. A text book of Differential Calculus by Gorakh Prasad.
3. A Text Book of Applied Mathematics by P.N.Wartikar and J.N.Wartikar.
4. Engineering Mathematics by Ravish R Singh, Mukul Bhatt.

3KS02 DISCRETE STRUCTURE AND GRAPH THEORY

Course Pre-requisite: Basic knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Discrete Structure and Graph Theory by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Apply logical reasoning to solve a variety of problems.

Course Outcomes : On completion of the course, the students will be able to

1. Analyze and express logic sentence in terms of predicates, quantifiers, and logical connectives.
2. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.
3. Classify algebraic structure for a given mathematical problem.
4. Perform combinatorial analysis to solve counting problems.
5. Develop the given problem as graph net works and solve with techniques of graph theory

Unit I: Foundations: Logic and Proofs (Hours: 7)

Propositions, Truth Tables, Compound Propositions, Logical Operators, Logic and Bit Operations; Logical Equivalences, De Morgan's Laws, Predicates, Quantifiers: Restricted Domains, Precedence, Logical Equivalences; Rules of Inference for Propositional Logic, Use to Build Arguments, Resolution, Combination for Propositions and Quantified Statements; Proofs Terminology, Methods, Direct Proofs, Proof by Contraposition and Contradiction;

Unit II: Sets, Functions and Relations (Hours: 7)

Introduction, Venn Diagrams, Subsets, Size of a Set, Power Sets, Cartesian Products, Set Notation with Quantifiers, Truth Sets and Quantifiers, Set Operations; Inverse Functions, Compositions and Graphs of Functions, Important Functions, Partial Functions; Sequences, Recurrence Relations, Special Integer Sequences, Summations; Countable Sets, An Uncountable Set; Functions as Relations, Relations on a Set, Properties of Relations, Combining Relations; n-ary Relations, Operations on n- ary Relations; Representing Relations Using Matrices; Closures, Transitive Closures

Unit III: Number Theory and Induction (Hours: 6)

Division, The Division Algorithm, Modular Arithmetic, Arithmetic Modulo m; Primes, Trial Division, Conjectures and Open Problems About Primes, GCD and LCM, The Euclidean Algorithm, gcds as Linear Combinations; Linear Congruences, The Chinese Remainder Theorem, Fermat's Little Theorem, Pseudoprimes, Primitive Roots and Discrete Logarithms, Applications: Hashing Functions, Mathematical Induction and Examples of Proofs, Mistaken Proofs, Guidelines for Proofs; Strong Induction, Examples of Proofs.

Unit IV: Algebraic Structures (Hours: 7)

Algebraic Systems: Examples and General Properties; Semigroups and Monoids: Homomorphism of Semigroups and Monoids, Subsemigroups and Submonoids; Groups: Definitions, Subgroups and Homomorphisms, Cosets and Lagrange's Theorem, Normal Subgroups, algebraic Systems with Two Binary Operations.

Unit V: Counting (Hours: 7)

Basic Counting Principles, Complex Counting Problems, Subtraction and Division Rule, The Pigeonhole Principle, The Generalized Pigeonhole Principle, Applications; Permutations, Combinations, Generating Permutations, Generating Combinations.

Unit VI: Graphs (Hours: 6)

Graph Models; Basic Terminology, Special Simple Graphs, Bipartite Graphs, Matchings, Applications of Special Types of Graphs, New Graphs from Old; Graph Representation, Adjacency and Incidence Matrices, Isomorphism of Graphs, Determining Isomorphism; Paths, Connectedness in Undirected Graphs and Directed Graphs, Paths and Isomorphism, Counting Paths Between Vertices; Euler Paths and Circuits, Hamilton Paths and Circuits, Applications of Hamilton Circuits; Planar Graphs: Euler's Formula, Kuratowski's Theorem; Graph Coloring: Introduction, Applications of Graph Colorings.

Text Book: Kenneth H. Rosen: Discrete Mathematics and Its Applications, 7th Edition, McGraw-Hill.

Reference Books:

1. J. P. Tremblay and R. Manohar: Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill Edition, McGraw-Hill.
2. Norman L. Biggs: Discrete Mathematics, 2nd Edition, Oxford University Press.
3. Seymour Lipschutz and Marc Lars Lipson: Schaum's Outline of Theory and Problems of Discrete Mathematics, 3rd Edition, Schaum's Outlines Series, McGraw-Hill.
4. C. L. Liu and D. P. Mohapatra: Elements of Discrete Mathematics: A Computer Oriented Approach, 3rd Edition, Tata McGraw-Hill, McGraw-Hill.

3KS03 OBJECT ORIENTED PROGRAMMING

Course Pre-requisite: Computer Programming

Course Objectives:

1. To explore the principles of Object Oriented Programming (OOP) such as data abstraction, encapsulation, inheritance and polymorphism.
2. To use the object-oriented paradigm in program design.
3. To Provide programming insight using OOP constructs.
4. To lay a foundation for advanced programming

Course Outcomes : On completion of the course, the students will be able to

1. Apply Object Oriented approach to design software.
2. Implement programs using classes and objects.
3. Specify the forms of inheritance and use them in programs.
4. Analyze polymorphic behaviour of objects.
5. Design and develop GUI programs.
6. Develop Applets for web applications

Unit I: Introduction to Object Oriented Programming (Hours:7)

Introduction, Need of OOP, Principles of Object-Oriented Languages, Procedural Language Vs OOP, Application of OOP, Java Virtual Machine, Java features, Program Structures. Java Programming Constructs: Variables, Primitive data types, Identifier, Literals, Operators, Expressions, Precedence Rules and Associativity, Primitive Type Conversion and Casting, ,Flow of Control.

Unit II: Classes and Objects (Hours:7)

Classes, Objects, Creating Objects, Methods, Constructors, Cleaning up Unused Objects, Class Variable and Methods, this keyword, Arrays, Command Line Arguments.

Unit III:Inheritance, Interfaces and Packages (Hours:6)

Inheritance: Inheritance vs. Aggregation, Method Overriding, super keyword, final keyword, Abstract class. Interfaces: Defining interfaces, Implementing interfaces, Accessing interface variables, Extending interfaces. Packages: Packages, java.lang package, Enum type.

Unit IV: Exception handling and Input /Output (Hours:7)

Exception: Introduction, Exception handling Techniques, User-defined exception, Exception Encapsulation and Enrichment. Input/Output: The java.io.file Class, Reading and Writing data, Randomly Accessing a file, Reading and Writing Files using I/O Package.

Unit V: Applets (Hours:7)

Introduction, Applet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint (), update () and repaint (), More about applet tag, get Document Base() and get Code Base () methods, Applet Context Interface, Audio clip, Graphic Class, Color, Font, Font Metrics.

Unit VI: Unit Title: Event Handling (Hours:6)

Introduction, Event delegation Model, java.awt.event Description, Sources of events, Event Listeners, Adapter classes, Inner Classes. Abstract Window Toolkit: Introduction, Components and Containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Textfield and Textarea, Container Class, Layouts, Menu, Scrollbar.

Text Books:

1. Sachin Malhotra and Saurabh Choudhary: Programming in Java, Oxford University Press 2010.
2. Herbert Schildt: Java Complete References (McGraw Hill)

Reference Books:

1. H.M.Dietel and P.J.Dietel, "Java How to Program" Pearson Education/PHI, Sixth Edition.
2. E. Balagurusamy: Programming with Java (McGraw Hill)
3. Dr. R. NageswaraRao: Core Java An Integrated Approach (Dreamtech)
4. Khalid Mughal: A Programmer's Guide to Java Certification, 3rd Edition (Pearson)
5. Sharnam Shah and Vaishali Shah: Core Java for Beginners, (SPD), 2010.

3KS04/3KE04 DATA STRUCTURES

Course Pre-requisite: Fundamentals of programming Language & Logic Building Skills

Course Objectives:

1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching and traversing.
3. To understand various data searching and sorting methods with its complexity.
4. To introduce various techniques for representation of the data in the real world.

Course Outcomes: On completion of the course, the students will be able to

1. Apply various linear and nonlinear data structures
2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain

Unit I: Introduction to Data Structures (Hours: 7)

Introduction to Data structures, Data Structure Operations, Algorithmic Notation, Complexity of algorithms.String processing: storing strings, character data type, string operations, word processing, and pattern matching algorithms.

Unit II: Array & Record Structure (Hours: 7)

Linear arrays : Memory Representation of arrays, traversing linear arrays, insertion & deletion operations, Bubble sort, Linear search and Binary search algorithms. Multi dimensional arrays, Pointer arrays.Record structures and Matrices.

Unit III: Linked lists (Hours: 6)

Linked lists: Memory Representation of Linked List, traversing a linked list, searching a linked list. Memory allocation & garbage collection.Insertion & deletion operations on linked lists. Header linked lists, Two- way linked lists.

Unit IV: Stack & Queue (Hours: 7)

Stacks: Sequential Memory Representation of Stack, Arithmetic expressions: Polish notation. Quick sort, Recursion, Tower of Hanoi.

Queues: Sequential Memory Representation of Queue, DeQueue, Priority queues.

Unit V: Trees (Hours: 7)

Introduction to Trees, Binary trees, Memory Representation of Binary Tree, Traversing binary trees, Header nodes, Binary Search Tree, Heap and heap sort, Path length & Huffman's algorithm.

Unit VI: Graphs & Sorting Algorithms (Hours: 6)

Introduction to Graphs, Memory representation of graphs, Warshalls' algorithm, operations on Graphs, Breadth First Search, Depth First Search.

Sorting : Insertion Sort, Selection Sort, Radix sort, Merge Sort.

Text Books:

1. Seymour Lipschutz: Data Structures, Schaum's Outline Series, McGraw-Hill, International Editions.
2. Trembley, Sorenson: An Introduction to Data Structures with Applications, McGraw Hill.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni: Fundamentals of Data Structures, CBS Publications.
2. Data Structure Using C, Balagurusamy.
3. Standish: Data Structures in Java, Pearson Education.

3KS05 ANALOG& DIGITAL ELECTRONICS

Course Prerequisite: Basic Physics.

Course Objectives:

1. To get the introductory knowledge of PN Junction Diode, Bipolar Junction Transistor, Field Effect Transistor.
2. To understand number systems and conversion between different number systems.
3. To get basics knowledge about digital ICs and digital systems.
4. To study the design of combinational circuits and sequential circuits

Course Outcomes : At the end of course students will able to

1. Explain basic concepts of semiconductor devices and its application.
2. Compare different Number System and basics of conversion of number systems.
3. Realize different minimization technique to obtain minimized expression.
4. Design Combinational Circuits.
5. Design and Develop Sequential Circuits.

Unit I: PN Junction Diode and Bipolar Junction Transistor (Hours: 7)

PN-Junction Diode, Characteristics and Parameters, BJT operation, BJT Voltages and Currents, BJT Amplification: Current and Voltage, BJT Switching, Common-Base Characteristics, Common-Emitter Characteristics, Common- Collector Characteristics

Unit II: Field Effect Transistors (Hours: 7)

Junction Field Effect Transistors, n-Channel and p-Channel JFET, JFET Characteristics, JFET Parameters, FET Amplifications and Switching, MOSFETs: Enhancement MOSFET, Depletion_Enhancement MOSFET, Comparison of p-channel and n-channel FETs, Introduction to CMOS.

Unit III: Number System (Hours: 6)

Binary Number System, Signed and unsigned Number, Octal Number System, Hexadecimal Number System, Conversions between Number Systems, r's and (r-1)'s Complements Representation, Subtraction using 1's and 2's Complements, BCD, Gray Code, Excess 3 Code and Alpha numeric codes.

Unit IV: Minimization Techniques (Hours: 7)

Logic Gates, Boolean Algebra, Logic Operation, Axioms and Laws of Boolean Algebra, Reducing Boolean Expression, Boolean Functions and their representation, SOP Form, POS Form, Karnaugh Map (up to 5 variable), Limitation of Karnaugh Map, Quine- McCluskey Minimization Technique (up to 5 variable).

Unit V: Combinational Circuits (Hours: 7)

Introduction, Design Procedure, Adders, Subtractors, Binary Parallel Adder, 4 Bit Parallel Subtractor, Look-ahead-carry Adder, BCD adder, BCD Subtractor, Multiplexer, De-multiplexer, Decoder, Encoder, Comparator, Parity bit Generator/Checkers, Boolean Expression Implementation using these ICs.

Unit VI: Sequential Circuits (Hours: 6)

Flip-flops: S-R, J-K, Master slave J-K, D-type, T-type, Flip flop Excitation Table, Conversion of Flip Flops, Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register. Counters: Asynchronous and Synchronous counter, Up/Down counter, MOD-N counter, Ring counter, Johnson counter.

Text Books:

1. David A. Bell: "Electronic Devices and Circuits", 5e , Oxford University Press.
2. Jain R.P. "Modern Digital Electronics", 3e, TMH.

Reference Books:

1. Millman & Halkies: "Electronic Devices & Circuits", 2e, McGraw Hill.
2. Sedra& Smith: "Microelectronics Circuits", 5e, Oxford University Press.
3. Anand Kumar: "Switching Theory and Logic Design", 3e, PHI Learning Private Limited
4. Wakerly, "Digital Design: Principles and Practices", 3 e, Pearson Education, 2004.

3KS06 OBJECT ORIENTED PROGRAMMING - LAB

Course Pre-requisite: Basic Computer Programming

Course Objectives: Design, implement, test, and debug simple programs in an object-oriented programming language.

1. To develop the knowledge of object-oriented paradigm in the Java programming language.
2. To evaluate classical problems using java programming.
3. To develop software development skills using java programming for real world applications.

Course Outcomes : On completion of the course, the students will be able to

1. Design, implement, test, and debug simple programs in an object-oriented programming language.
2. Interpret the basics of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism
3. Build applications in Java by applying concepts like interfaces, packages and exception handling.
4. Make use of Java concepts like API, Applets, AWT.

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Introduction to Object Oriented Programming and installation of JDK. Write a program to print a message "Hello World..."
2. Develop a program to explain use of Operators in java.
3. Develop a Program to study and implement Looping Statements belonging to Java**.**
4. Develop a Program to study and implement Selection Statements belonging to Java**.**
5. Develop a program to study and implement some Pyramid.
6. Develop a program to demonstrate the concept of Class, Method and Object.
7. Develop a program to study and implement the concept of Method Overloading.
8. Develop a program to study and implement concept of Constructor in Java.
9. Develop a program to study and implement concept of Constructor Overloading in Java.
10. Develop a program to study and implement the Array in Java.

11. Develop a Program on various ways to accept data through keyboard(Command Line Argument)
12. Develop a program to study and implement the concept of Inheritance.
13. Develop a program to study and implement the concept of Method Overriding.
14. Develop a program to study and implement the Abstract Class.
15. Develop a program to study and implement the concept of Interface in Java.
16. Develop a program to study and implement Exception Handling Mechanism in Java.
17. Develop a program to study and implement Java I/O.
18. Develop a program to study and implement simple Applet in java.
19. Develop a program on Applet to demonstrate Graphics, Font and Color class.
20. Develop a Program on passing parameters to applets
21. Develop a Program to create GUI application without event handling using AWT controls
22. Develop a Program to create GUI application with event handling using AWT controls
23. Develop a program on Multithreading
24. Develop a Program to create GUI application with event handling using Swing controls
25. Mini Project based on content of the syllabus. (Group of 2-3 students)

3KS07 DATA STRUCTURE - LAB

Course Pre-requisite: Basics of programming Language & Logic Building Skills

Course Objectives:

1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching and traversing.
3. To understand various data searching and sorting methods with its complexity.
4. To introduce various techniques for representation of the data in the real world.

Course Outcomes : On completion of the course, the students will be able to

1. Apply various linear and nonlinear data structure.
2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Write a program to find out largest number from the array and also find it's location.
2. Write a program to traverse an array and find the sum and average of data elements from an array.
3. Write a Program to a) insert an element in an array b)delete an element from an array.
4. To study and execute the Linear search method
5. To study and execute the Binary Search method
6. To study and execute the Pattern matching Algorithms(Slow and Fast)
7. To study and execute Bubble sort method.
8. To study and implement various operations on singly linked list
    (a) Traversing the linked list.
    (b) Insert a node at the front of the linked list.
    (c) Delete a last node of the linked list.
    (d) Searching a Linked list.
9. To study and implement following operations on the doubly linked list.
    (a) Insert a node at the front of the linked list.
    (b) Insert a node at the end of the linked list.
    (c) Delete a last node of the linked list.
    (d) Delete a node before specified position.
10. To study and implement following operations on the circular linked list.
    (a) Insert a node at the end of the linked list.
    (b) Insert a node before specified position.
    (c) Delete a first node of the linked list.
    (d) Delete a node after specified position.
11. Understand the stack structure and execute the push, pop operation on it.
12. Understand the Queue structure and execute the insertion, deletion operation on it.
13. Formulate and demonstrate Transforming Infix Expressions to Postfix Expression using Stack.
14. Formulate and demonstrate the Evaluation of Postfix Expression using Stack.
15. To study and execute Quick sort method.
16. Understand the Tree structure and implement the Pre-order, In-order, post-order traversingoperations on it.
17. Understand the concept of Recursion and write a program to calculate factorial of a numberusing Recursion.
18. Understand the Heap sort and implement it on given data.
19. Understand the Insertion sort and implement it on given data.

20. Understand the Selection sort and implement it on given data.
21. To study and execute Merge sort method.
22. To study and execute Radix sort method.
23. Write a Program to implement the concept of BFS algorithm.
24. Write a Program to implement the concept of DFS algorithm.
25. To study and execute Josephus problem.

3KS08 ANALOG & DIGITAL ELECTRONICS - LAB

Course Pre-requisite: Students should have the knowledge of Basic Physics.

Course Objectives:

1. To impart the concepts of analog and digital electronics practically.
2. To provide students basic experimental experiences in the operation of semiconductor device and Digital ICs.
3. To learn the operation of various logic gates and their implementation using digital IC's.
4. To learn the realization of various combinational and sequential circuits.

Course Outcomes : After successfully completing the lab, the students will be able to

1. Apply practically the concepts of analog and digital electronics.
2. Explain the operation and characteristics of semiconductor devices.
3. Illustrate the operation of various logic gates and their implementation using digital IC's.
4. Design and implement various combinational logic circuits.
5. Design and implement various sequential logic circuits

List of Experiments:

This is a sample list of Experiments; **minimum 10 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. To study V-I characteristics of a PN Junction diode in Forward and Reverse bias.
2. To Sketch and Study the input and output characteristics of transistor connected in Common Emitter (CE) configuration..
3. To Sketch and Study the input and output characteristics of transistor connected in Common Base (CB) configuration
4. To Sketch and Study the input and output characteristics of transistor connected in Common Collector (CC) configuration.
5. To plot static characteristics of FET & calculate its parameters g_m, r_d and μ.
6. To implement Logic gates using TTL ICs (7400, 7402, 7404, 7408, 7410, 7411, 7420, 7427, 7432, 7486).
7. Study and verify the truth table of half adder and full adder using logic gates.
8. Study and verify the truth table of half subtractor and full subtractor using logic gates
9. To compare two 4 bits number and verify the output using 4-bit comparator IC 7485.
10. Implementation of 4×1 multiplexer using logic gates.
11. Implementation and verification of Demultiplexer and Encoder using logic gates.
12. Implementation of 4bit parallel adder using 7483 IC.
13. Design and verify the 4 bit synchronous counter.
14. Design and verify the 4 bit asynchronous counter.
15. Verification of truth table of SR, JK, T and D Flip Flops.

List of Experiments beyond syllabus:

1. Design and Implementation of Op-amp as an inverting amplifier.
2. Design and Implementation of Op-amp as a non-inverting amplifier.
3. To design and find frequency of A stable multi-vibrator using IC 555.

3KS09 C SKILL - LAB - I

Course Prerequisite: Basic knowledge of any Programming Language

Course Objectives:

1. To be able to program design with functions using Python.
2. To understand data and information processing techniques.
3. To understand to Design a program to solve the problems.
4. To be able to access database using python programming.
5. To be able to design web applications using python programming.

Course Outcomes : On completion of the course, the students will be able to

1. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
2. Interpret different Decision Making statements, Functions, Object oriented programming in Python
3. Summarize different File handling operations
4. Explain how to design GUI Applications in Python and evaluate different database operations
5. Develop applications using Django framework or Flask

List of Experiments:

This is a sample list of Experiments, **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Write python program to store data in list and then try to print them.
2. Write python program to print list of numbers using range and for loop
3. Write python program to store strings in list and then print them.
4. Write python program in which an function is defined and calling that function prints Hello World.
5. Write a python script to print the current date in the following format "Sun May 29 02:26:23 IST 2017"
6. Write a program to create, append, and remove lists in python.
7. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
8. Write a program to demonstrate working with tuples in python.
9. Write a program to demonstrate working with dictionaries in python.
10. Write a python program to find largest of three numbers.
11. Write python program in which an function(with single string parameter) is defined and calling that function prints the string parameters given to function.
12. Write python program in which an class is define, then create object of that class and call simple print function define in class.
13. Write a Python script that prints prime numbers less than 20.
14. Write a python program to find factorial of a number using Recursion.
15. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
16. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
17. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
18. Write a Python class to convert an integer to a roman numeral.
19. Write a Python class to implement pow(x, n)
20. Write a Python class to reverse a string word by word.
21. Accessing and working with databases using Python.
22. Create data frame from .csv files and operations on it.
23. Plotting various graphs using Python.
24. Developing basic GUI using Python.
25. Developing web applications using Django framework or Flask

Reference Books :

1. "Core Python Programming", R. NageswaraRao, dreamtech press.
2. "Python Programming A Modular Approach With Graphics, Database, Mobile and WebApplications", SheetalTaneja, Naveen Kumar, Pearson.
3. Python Web Development with Django By Jeff Forcier, Paul Bissex, Wesley J Chun, Addison-Wesley Professional.
4. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning
5. Allen B. Downey , " Think Python: How to Think Like a Computer Scientist", Second Edition, Shroff/O'Reilly Publishers
6. John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India
7. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley
8. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT)

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SEMESTER - IV

4KS01 ARTIFICIAL INTELLIGENCE

Course Pre-requisite: Basic concepts of Data Structures, Algorithms, Programming

Course Objectives:

1. To present an overview of Artificial Intelligence (AI) principles and approaches.
2. To understand the historical evolution of Artificial Intelligence.
3. To learn various searching techniques and identify to address a particular problem).

Course Outcomes : On completion of the course, the students will be able to

1. Explain concepts of Artificial Intelligence and different types of intelligent agents and their architecture.
2. Formulate problems as state space search problem & efficiently solve them.
3. Summarize the various searching techniques, constraint satisfaction problem and example problems - game playing techniques.

4. Apply AI techniques in applications which involve perception, reasoning and learning.
5. Compare the importance of knowledge, types of knowledge, issues related to knowledge acquisition and representation.

Unit I: Introduction to AI (Hours: 7)

Introduction : What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Risks and Benefits of AI,

Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents

Unit II: Problem Solving Through AI (Hours: 7)

Introduction, Representation the AI Problems, Production System, Algorithm of Problem Solving, Examples of AI Problems, Nature of AI Problems

Unit III: Uninformed Search Strategies (Hours: 6)

Problem-Solving Agents, Example Problems, Search Algorithms, **Uninformed Search Strategies**: Breadth-First Search, Uniform-Cost Search, Depth First Search, Bidirectional Search, Depth Limited Search, Iterative Deepening Depth-First Search

Unit IV: Informed Search Strategies (Hours: 7)

Basic Concept of Heuristic Search and Knowledge, Designing of Heuristic Function, **Heuristic Search Strategies:** Generate-And-Test, Best-First Search, Problem Reduction, Hill Climbing, Constraint Satisfaction, Means-Ends-Analysis

Unit V: Adversarial Search & Games (Hours: 7)

Game Theory, Optimal Decisions in Games, Mini-Max Search, Alpha Beta Pruning, Additional Refinements, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms

Unit VI: Introduction to Knowledge (Hours: 6)

Introduction, Types of Knowledge, Knowledge Representation, Knowledge Storage, Knowledge Acquisition, Knowledge Organization and Management, Basic Concepts of Knowledge Engineering

Text Books:

1. Artificial Intelligence: A Modern Approach by Stuart Russell & Peter Norvig (Pearson - 4th Ed.)
2. Artificial Intelligence by Ela Kumar (IK International Publishing House Pvt. Ltd.)

Reference Books:

1. Artificial Intelligence by Elaine Rich and Kevin Knight (Tata McGraw Hill - 3rd Ed.)
2. A First Course in Artificial Intelligence by Deepak Khemani (Tata McGraw Hill - 1st Ed.)
3. Artificial Intelligence and Expert Systems by Patterson (PHI)
4. Introduction to Artificial Intelligence by RajendraAkerkar (PHI Learning Pvt. Ltd.)

4KS02 DATA COMMUNICATION AND NETWORKING

Course Prerequisite: Computer and Data Communication Requirements

Course Objectives:

1. To understand the building blocks of digital communication system.
2. To prepare mathematical background for communication signal analysis.
3. To understand and analyze the signal flow in a digital communication system
4. To analyze error performance of a digital communication system in presence of noise and other interferences.
5. To evaluate the errors using various error detection & correction techniques.
6. To understand network based protocols in data communication and networking.

Course Outcomes : On completion of the course, the students will be able to

1. Describe data communication Components, Networks, Protocols and various topology based network architecture
2. Design and Test different encoding and modulating techniques to change digital –to- digital conversion, analog-to-digital conversion, digital to analog conversion, analog to analog conversion,
3. Explain the various multiplexing methods and evaluate the different error detection & correction techniques.
4. Illustrate and realize the data link control and data link protocols.
5. Describe and demonstrate the various Local area networks and the IEEE standards.

Unit I: Introduction to Data Communication (Hours: 7)

Introduction: Data Communication, Components, Networks, Network types: Local Area Network,Wide Area Network, Switching, The Internet, Accessing the Internet, Standards and Administration: Internet Standards, Internet Administration, Network Models:TCP/IP Protocol Suite,TheOSI Model, Transmission media: Introduction, Guided media & Unguided media-Wireless. Switching: Introduction, Circuit Switched Networks, Packet Switching.

Unit II: Data link Layer (Hours: 6)

Data Link Layer: Introduction, Nodes & Links, Services , Two categories of link, Two sub-layers, Error detection and correction: Introduction, Block Coding, Cyclic codes, Checksum, Forward Error Correction, Data link control: DLC services, Data-Link Layer Protocol, HDLC, Point-To-Point Protocol, Media Access Control (MAC): Random Access, Controlled Access, Channelization.

Unit III: Network Layer (Hours: 7)

Introduction to Network layer Network Layer Services: Packetizing, Routing and Forwarding, Other Services Packet Switching: Datagram Approach: Connectionless Service, Virtual-Circuit Approach: Connection-Oriented Service , Network Layer performance: Delay, Throughput, Packet Loss, Congestion Control, IPV4 Address: Address Space, Classful Addressing, Classless Addressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution (NAT), Forwarding of IP packets: Forwarding Based on Destination Address, Forwarding Based on Label, Routers as Packet Switches

Unit IV: Network Layer Protocol (Hours: 7)

Network Layer Protocols: Internet Protocol (IP),Datagram Format, Fragmentation, Security of IPv4 Datagrams,ICMPV4: Messages, Debugging Tools, ICMP Checksum,Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP,Routing algorithms: Distance Vector routing, Link State Routing, IPV6 Addressing: Representation, Address Space, Address Space Allocation, Auto configuration, Renumbering, Transition from IPV4 to IPV6: Strategies, Use of IP Addresses

Unit V: Transport Layer (Hours: 6)

Introduction to Transport layer: Introduction, Transport-Layer Services, Connectionless and Connection-Oriented Protocols, Transport-Layer Protocols: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol (GBN), Selective-Repeat Protocol, Bidirectional Protocols: Piggy backing, User Datagram Protocols: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features , Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers, Options, SCTP: SCTP Services, SCTP Features

Unit VI: Application layer (Hours: 7)

Introduction to Application layer: Providing Services, Application-Layer Paradigms, Client-Server Programming: Application Programming Interface, Using Services of the Transport Layer, Iterative Communication Using UDP, Iterative Communication Using TCP, Concurrent Communication, World wide web and HTTP: World Wide Web, Hyper-Text Transfer Protocol (HTTP) FTP: Two Connections, Control Connection, Data Connection, Security for FTP, Electronic Mail: Architecture, Web-Based Mail, E-Mail Security, Domain Name System (DNS):Name Space, DNS in the Internet, Resolution, Caching, Resource Records, DNS Messages, Registrars, Security of DNS, Network Management: Introduction. Configuration Management, Fault Management, Performance Management, Security Management, Accounting Management, SNMP: Managers and Agents, Management Components, ASN.1: Language Basics, Data Types, Encoding.

Text Book: Behrouz A. Forouzan: Data Communication and Networking, (5/e) (TMH).

Reference Books:

1. William Stallings: Data & Computer Communications, 6/e, Pearson Education
2. William L. Schweber : Data Communication, McGraw Hill
3. J.Freey : Computer Communication & Networks, AEW Press
4. D. Corner: Computer Networks & Internet, Pearson Education.

4KS03 OPERATING SYSTEM

Course Pre-requisite: Discrete Structures, Data Structure, Any programming Language

Course Objectives:

1. To make students aware of the kernel and shell structure of the operating systems.
2. To make students aware of the purpose, structure and functions of operating systems
3. To equip students with understanding of the various scheduling algorithms in OS.
4. To make students aware of understanding of memory management in different OS.

Course Outcomes : On completion of the course, the students will be able to

1. Explain memory management issues like external fragmentation, internal fragmentation.
2. Illustrate multithreading and its significance.
3. List various protection and security mechanisms of OS.
4. Analyze and solve the scheduling algorithms.
5. Analyze the deadlock situation and resolve it.
6. Compare various types of operating systems

Unit I: Introduction to OS (Hours: 7)

Introduction: Operating System definition, OS Evolution, Components and Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Threads Overview, Multithreading Models, Threading Issues, Java Threads

Unit II: Process Scheduling (Hours: 7)

Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue Scheduling

Unit III: Process Synchronization (Hours: 6)

Process Synchronization Basics: The Critical-Section Problem, Synchronization Hardware, Semaphores, Monitors, Deadlocks: Definition & Characterization, Deadlocks Prevention, Avoidance, Detection and Recovery from Deadlock

Unit IV: Memory Management (Hours: 7)

Memory Management Background, Swapping, Contiguous Memory Allocation Schemes, Paging, Segmentation, Virtual Memory Management: Background, Demand paging scheme, Process Creation, Page Replacement Policies, Allocation of Frames, Thrashing

Unit V: Unit Title: File System (Hours: 7)

File-System Interface; Directory Structure, File-System Mounting, File Sharing &Protection, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management. File Recovery

Unit VI: Unit Title: I/O System (Hours:6)

I/O Systems : Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations , Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure.

Text Book : Avi Silberschatz, P.B.Galvin, G.Gagne: "Operating System Concepts" (9/e) John-Wiley & Sons.

Reference Books:

1. A.S.Tanenbaum "Modern Operating Systems" Pearson Education.
2. William Stallings "Operating Systems" Prentice-Hall.
3. D. M. Dhamdhere "Operating Systems" Tata McGraw-Hill.
4. P. Balkrishna Prasad: "Operating Systems" Scitech Publications (I) Pvt. Ltd.

4KS04 MICROPROCESSOR & ASSEMBLY LANGUAGE PROGRAMMING

Course Pre-requisite: Computer Programming and Computer Fundamentals

Course Objectives:

1. To explore 8086 microprocessor and its architecture.
2. To introduce interfacing techniques of 8086 microprocessor.
3. To introduce basics of Internet of Things

Course Outcomes : On completion of the course, the students will be able to

1. Describe 8086 microprocessor and its architecture; also understand instruction processing during the fetch-decode-execute cycle.
2. Design and Test assembly language programs using 8086 microprocessor instruction set.
3. Demonstrate the implementation of standard programming constructs, including control structures and functions, in assembly language.
4. Illustrate and realize the Interfacing of memory & various I/O devices with 8086 microprocessor.
5. Explain the basic concepts of Internet of Things

Unit I: 8086 Architecture (Hours: 7)

8086 architecture and pin configuration, Software model of 8086 microprocessor. Memory addresses space and data organization. Data types. Segment registers, memory segmentation. IP & Data registers, Pointer, Index registers. Memory addresses generation.

Unit II: 8086 Instruction Set (Hours: 7)

8086 Instruction set overview, addressing modes. 8086 instruction formats. 8086 programming: Integer instructions and computations: Data transfer instructions, Arithmetic instructions and their use in 8086 programming.

Unit III: 8086 Instruction Set (Hours: 6)

8086 programming: logical instructions. Shift and rotate instructions and their use in 8086 programming. 8086 flag register and Flag control instructions, compare instruction, control flow and jump instructions, Loops & loop handling instructions. 8086 programming using these instructions.

Unit IV: Subroutines& Macros (Hours: 7)

The 8086 stack segment and stack related instructions. 8086 I/O Address space.Subroutines and related instructions, Parameter passing, Concept of Macros, Status saving on stack.Concept of recursion at assembly program level.8086 Programming using subroutines, recursion and macros.

Unit V: 8086 Interrupt (Hours: 7)

8086 Interrupts types, priority and instructions. Interrupt vector table, External hardware-interrupt interface signals & interrupts sequence. Software interrupts. Non-maskable interrupts. 8086 microprocessor interrupt programming.

Unit VI: Internet of Things (IoT) (Hours: 6)

Internet of things: An overview, IoT conceptual framework, IoT Architectural View, Technology behind IoT, Sources of IoT, M2M communication, Examples of IoT.

Text Book:

1. A. K. Ray & K. M. Bhurchandi: Advanced Microprocessors & Peripherals, Third Edition (TMH).
2. Raj Kamal: Internet of Things, Architecture and Design Principals, McGraw Hill Education (India) Private Limited

Reference Books:

1. W. A. Triebel& Avatar Singh: The 8088/8086 Microprocessors (4e) (PHI /Pearson Education)
2. Liu & Gibson: The 8088/8086 Microprocessor Architecture Programming and Interface (6/e) (PHI)

4KS05 THEORY OF COMPUTATION

Course Pre-requisite: Discrete Mathematics, Data Structures

Course Objectives:

1. To understand different automata theory and its operation.
2. To understand mathematical expressions for the formal languages
3. To study computing machines and comparing different types of computational models
4. To understand the fundamentals of problem decidability and Un-Decidability

Course Outcomes: On completion of the course, the students will be able to

1. To construct finite state machines to solve problems in computing.
2. To write regular expressions for the formal languages.
3. To construct and apply well defined rules for parsing techniques in compiler
4. To construct and analyze Push Down, Turing Machine for formal languages
5. To express the understanding of the Chomsky Hierarchy.
6. To express the understanding of the decidability and un-decidability problems.

Unit I: Finite State Machines (Hours: 8)

Alphabet, String, Formal and Natural Language, Operations, Definition and Design DFA (Deterministic Finite Automata), NFA (Non Deterministic Finite Automata), Equivalence of NFA and DFA: Conversion of NFA into DFA, Conversion of NFA with epsilon moves to NFA, Minimization Of DFA, Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines. Minimization of Finite Automata. (Construction of Minimum Automaton)

Unit II: Regular Expression and Regular Grammar (Hours: 8)

Definition and Identities of Regular Expressions, Construction of Regular Expression of the given Language, Construction of Language from the RE, Conversion of FA to RE using Arden's Theorem, Inter-conversion RE to FA, Pumping Lemma for RL, Closure properties of RLs(proofs not required), Regular grammar, Equivalence of RG (RLG and LLG) and FA.

Unit III: Context Free Grammar and Languages (Hours: 8)

Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, Derivation Trees, Construction of Context-Free Grammars and Languages, Pumping Lemma for CFL, Simplification of CFG, Normal Forms (CNF and GNF), Chomsky Hierarchy.

Unit IV: Pushdown Automata (Hours: 8)

Introduction and Definition of PDA, Construction of PDA, Acceptance of CFL, Equivalence of CFL and PDA: Inter-conversion , Introduction of DCFL and DPDA, Enumeration of properties of CFL, Context Sensitive Language, Linear Bounded Automata.

Unit V: Turing Machines (Hours: 8)

Formal definition of a Turing Machine, Design of TM, Computable Functions, Church's hypothesis, Counter machine, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine.

Unit VI: Decidability and Un-Decidability (Hours: 8)

Decidability of Problems, Halting Problem of TM, Un-Decidability: Recursive enumerable language, Properties of recursive & non-recursive enumerable languages, Post Correspondence Problem, Introduction to Recursive Function Theory

Text Books:

1. Hopcraft H.E. & Ullman J: Introduction to Automata Theory, Languages and Computation
2. Peter Linz: An Introduction to Formal Languages and Automata

Reference Books:

1. Rajesh K. Shukla: Theory of Computation, CENGAGE Learning, 2009.
2. K V N Sunitha and N Kalyani: Formal Languages and Automata Theory, McGraw Hill,2010
3. Lewis H.P. and Papadimition C.H.: Elements of Theory of Computation
4. Mishra &Chandrashekharan: Theory of Computation
5. C.K.Nagpal: Formal Languages and Automata Theory, Oxford University Press, 2011.
6. VivekKulkarni : Theory of Computation, OUP India, 2013.

4KS06 DATA COMMUNICATION & NETWORKING LAB

Course Pre-requisite: Computer and Data Communication Requirements

Course Objectives:

1. To understand the working principle of various communication protocols
2. To understand and analyze the signal flow in a digital communication system.
3. To analyze error performance of a digital communication system in presence of noise and other interferences.
4. To evaluate the errors using various error detection & correction techniques.
5. To understand network based protocols in data communication and networking.

Course Outcomes : On completion of the course, the students will be able to

1. Analyze performance of various communication protocols
2. Implement Configure various network protocols.
3. Compare IP Address classes of networks

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. To study various LAN topologies and their creation using network devices, cables and computers. .
2. To connect the computers in Local Area Network.
3. Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, Routers etc.
4. Write a program of bit stuffing used by Data Link Layer
5. Write a program to implement CRC(Cyclic Redundancy Check)
6. Write a program to implement Checksum
7. Write a program to implement Sliding window
8. Configure Internet connection and use IP-Config, PING / Tracer and Net stat utilities to debug the network issues.
9. Configuration of TCP/IP Protocols in Windows and Linux.
10. Transfer files between systems in LAN using FTP Configuration, install Print server in a LAN and share the printer in a network.
11. Write a C Program to determine if the IP Address is in Class A, B, C, D, or E
12. Write a C Program to translate Dotted Decimal IP Address into 32 Bit Address.
13. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN(TCP/IP Configuration)

4KS07 OPERATING SYSTEM - LAB

Course Pre-requisite: Basic computer programming

Course Objectives:

1. To make students aware of the kernel and shell structure of the operating systems.
2. To make students aware of the purpose, structure and functions of operating systems
3. To equip students with understanding of the various scheduling algorithms in OS.
4. To make students aware of understanding of memory management in different OS.

Course Outcomes : On completion of the course, the students will be able to

1. Explain memory management issues like external fragmentation, internal fragmentation.
2. Illustrate multithreading and its significance.
3. List various protection and security mechanisms of OS.
4. Analyze and solve the scheduling algorithms.
5. Analyze the deadlock situation and resolve it.
6. Compare various types of operating systems

List of Experiments:

This is a sample list of Experiments, **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. To study Linux Operating System along with its installation.
2. To Study and Execute basic file commands and process related open source Ubuntu commands
    a. Commands to view all executing, block and suspended process.
    b. Command to check and change the priority of process CPU utilization for executing processes.
    c. Commands to check for child process, sub-processes, process tree, abort & end process and all other basics commands related to processes
3. Write a program for multithreading using C.
4. To simulate First Come First Serve & Shortest Job First process scheduling algorithm
5. To simulate Shortest Job First process scheduling algorithm
6. To simulate Preemptive Shortest Job First process scheduling algorithm
7. To implement Round Robin Process scheduling Algorithm
8. To implement Priority Based Process scheduling Algorithm
9. To implement and analyze multi-level queue scheduling algorithm
10. To implement the following file allocation strategies.
11. To simulate paging technique of memory management.
12. To implement theFIFO page replacement policy
13. To implement the LRU page replacement policy
14. To implement the optimalpage replacement policy
15. To simulate producer-consumer problem using semaphores.
16. To implement Dining-Philosophers problem to deal with concurrency control mechanism.
17. To implement contiguous memory allocation strategies to detect fragmentation using: First Fit, Best Fit and Worst Fit.
18. To implement FCFS Disk Scheduling algorithm
19. To implement SCAN Disk Scheduling algorithm
20. To implement C-SCAN Disk Scheduling algorithm
21. To simulate Bankers algorithm for deadlock avoidance
22. To implement following memory management techniques
    Implement MVT and MFT where memory block size is 100 for 5 processes. Enter no. of blocks for each process and calculate internal fragmentation.
23. To simulate LFU page replacement algorithms
24. To simulate the Single level directory file organization techniques.
25. To Simulate bankers algorithm for Dead Lock Avoidance (Banker‘s Algorithm)

4KS08 MICROPROCESSOR & ASSEMBLY LANG. PROG. - LAB

Course Pre-requisite: Computer Programming, Number System

Course Objectives: In this lab student will learn about’ Microprocessor and Interfacing’ in regards to digital computer, microprocessor architecture, programming with 8086 microprocessor and different peripherals**.**

Course Outcomes On completion of the course, the students will be able to

1. Analyze the internal workings of the microprocessor
2. Design and develop programs in Assembly Language Programming
3. Describe 8086 microprocessor and its architecture; also understand instruction processing during the fetch-decode-execute cycle.
4. Design and Test assembly language programs using 8086 microprocessor instruction set.
5. Demonstrate the implementation of standard programming constructs, including control structures and functions, in assembly language
6. Illustrate and realize the Interfacing of memory & various I/O devices with 8086 microprocessor.

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Installation and Introduction of TASM Assembler.
2. Write a program for addition of two 8-bits numbers and two 16-bits numbers.
3. Write a program for subtraction of two 8-bits numbers and two 16-bits numbers.
4. Write a program for multiplication of two 8-bits numbers.
5. Write a program for division of two 8-bits numbers
6. Write a program to check whether a given number is even or odd.
7. Write a program to demonstrate Logical Group and Shift Rotate Instructions.
8. Write a program to check whether a given number is positive or negative.
9. Write a program to find greatest of two 8-bits signed &unsigned numbers.
10. Block Transfer Program
11. Write a program to find Factorial of a number using loop instruction.

12. Write a program to find cube of a given number using Subroutine.
13. Write a program to find square of a given number using Subroutine.
14. Write a program to find square of a given number using Macro.
15. Write a program to find whether the string is palindrome or not.
16. To convert BCD Number Program
17. Write a program to perform Reverse of the String
18. Write a program to transfer 10-bytes from one memory bank to another memory bank.
19. Program for sorting an array for 8086 microprocessor.
20. To write an assembly language program to arrange the given numbers in descending order.
21. Program for searching for a number/character in a string for 8086 microprocessor.

4KS09 C-SKILL-LAB II

Course Pre-requisite: Basic knowledge of scripting language, Programming language.Basic understanding of Electronic concepts.

Course Objectives: To develop an ability to design and implement static and dynamic website and to develop embedded systems with the help of Raspberry Pi/Ardino.

Course Outcomes : On completion of the course, a student will be able to

1. Develop client server program and web applications
2. Make use of project-based experience for web application development.
3. Create embedded systems using Raspberry Pi/Ardino

List of Experiments:

This is a sample list of experiments, **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Introduction to PHP and configure it to work with Apache Web Server.
2. Design web pages for your college containing a description of the courses, departments, faculties, library etc, use href, list tags.
3. Create your class timetable using table tag.
4. Create user Student feedback form (use textbox, text area , checkbox, radio button, select box etc.)
5. Create your resume using HTML tags also experiment with colors, text , link , size and also other tags you studied.
6. Design a web page of your home town with an attractive background color, text color, an Image, font etc. (use internal CSS).
7. Develop a JavaScript to display today's date.
8. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
9. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).
10. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
11. Write a PHP program to display a digital clock which displays the current time of the server.
12. Write the PHP programs to do the following: a. Implement simple calculator operations. b. Find the transpose of a matrix.
13. Write a PHP program to sort the student records which are stored in the database using selection sort.
14. Study and Install IDE of Arduino and different types of Arduino.
15. Write program using Arduino IDE for Blink LED.
16. Write Program for RGB LED using Arduino.
17. Study the Temperature sensor and write a Program for monitor temperature using Arduino.
18. Study and Implement RFID, NFC using Arduino. • Study and implement MQTT protocol using Arduino.
19. Study and Configure Raspberry Pi.
20. WAP for LED blink using Raspberry Pi.
21. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
22. Create Smart Plugs with Arduino and Raspberry Pi.
23. Interfacing digital sensors with raspberry pi.
24. Creating a webpage to control I-O devices, Reading data from sensor and passing to web page.
25. Implement a program to access Analog sensor via wifi with HTML Web server.

SYLLABUS OF B.E. SEM. III & IV [COMPUTER ENGINEERING] (C.B.C.S.)
Semester-III

3KE02 DISCRETE MATHEMATICS

Course Prerequisite: Basic knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Discrete Structure and Graph Theory by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Apply logical reasoning to solve a variety of problems.

Course Outcomes : On completion of the course, the students will be able to

1. Analyze and express logic sentence in terms of predicates, quantifiers, and logical connectives.
2. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.
3. Classify algebraic structure for a given mathematical problem.
4. Perform combinatorial analysis to solve counting problems.
5. Develop the given problem as graph net works and solve with techniques of graph theory

Unit I: Foundations: Logic and Proofs

Propositions, Truth Tables, Compound Propositions, Logical Operators, Logic and Bit Operations; Logical Equivalences, De Morgan's Laws, Predicates, Quantifiers: Restricted Domains, Precedence, Logical Equivalences; Rules of Inference for Propositional Logic, Use to Build Arguments, Resolution, Combination for Propositions and Quantified Statements; Proofs Terminology, Methods, Direct Proofs, Proof by Contraposition and Contradiction. **(Hours 7)**

Unit II: Sets, Functions and Relations

Introduction, Venn Diagrams, Subsets, Size of a Set, Power Sets, Cartesian Products, Set Notation with Quantifiers, Truth Sets and Quantifiers, Set Operations; Inverse Functions, Compositions and Graphs of Functions, Important Functions, Partial Functions; Sequences, Recurrence Relations, Special Integer Sequences, Summations; Countable Sets, An Uncountable Set; Functions as Relations, Relations on a Set, Properties of Relations, Combining Relations; n-ary Relations, Operations on n- ary Relations; Representing Relations Using Matrices; Closures, Transitive Closures. **(Hours 7)**

Unit III: Number Theory and Induction

Division, The Division Algorithm, Modular Arithmetic, Arithmetic Modulo m; Primes, Trial Division, Conjectures and Open Problems About Primes, GCD and LCM, The Euclidean Algorithm, gcds as Linear Combinations; Linear Congruences, The Chinese Remainder Theorem, Fermat's Little Theorem, Pseudoprimes, Primitive Roots and Discrete Logarithms, Applications: Hashing Functions, Mathematical Induction and Examples of Proofs, Mistaken Proofs, Guidelines for Proofs; Strong Induction, Examples of Proofs. **(Hours 6)**

Unit IV: Algebraic Structures

Algebraic Systems: Examples and General Properties; Semigroups and Monoids: Homomorphism of Semigroups and Monoids, Subsemigroups and Submonoids; Groups: Definitions, Subgroups and Homomorphisms, Cosets and Lagrange's Theorem, Normal Subgroups, algebraic Systems with Two Binary Operations. **(Hours 7)**

Unit V: Counting

Basic Counting Principles, Complex Counting Problems, Subtraction and Division Rule, The Pigeonhole Principle, The Generalized Pigeonhole Principle, Applications; Permutations, Combinations, Generating Permutations, Generating Combinations. **(Hours 6)**

Unit VI: Graphs

Graph Models; Basic Terminology, Special Simple Graphs, Bipartite Graphs, Matchings, Applications of Special Types of Graphs, New Graphs from Old; Graph Representation, Adjacency and Incidence Matrices, Isomorphism of Graphs, Determining Isomorphism; Paths, Connectedness in Undirected Graphs and Directed Graphs, Paths and Isomorphism, Counting Paths Between Vertices; Euler Paths and Circuits, Hamilton Paths and Circuits, Applications of Hamilton Circuits; Planar Graphs: Euler's Formula, Kuratowski's Theorem; Graph Coloring: Introduction, Applications of Graph Colorings.

Text Book: Kenneth H. Rosen: Discrete Mathematics and Its Applications, 7th Edition, McGraw-Hill.

Reference Books:

1. J. P. Tremblay and R. Manohar: Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill Edition, McGraw-Hill.
2. Norman L. Biggs: Discrete Mathematics, 2nd Edition, Oxford University Press.
3. Seymour Lipschutz and Marc Lars Lipson: Schaum's Outline of Theory and Problems of Discrete Mathematics, 3rd Edition, Schaum's Outlines Series, McGraw-Hill.
4. C. L. Liu and D. P. Mohapatra: Elements of Discrete Mathematics: A Computer Oriented Approach, 3rd Edition, Tata McGraw-Hill, McGraw-Hill.

3KE03 PROGRAMMING METHODOLOGY

Course Prerequisite: Computer Programming

Course Objectives:

1. To explore the principles of Object Oriented Programming (OOP) such as data abstraction, encapsulation, inheritance and polymorphism.
2. To use the object-oriented paradigm in program design.
3. To Provide programming insight using OOP constructs.
4. To lay a foundation for advanced programming

Course Outcomes: On completion of the course, the students will be able to

1. Apply Object Oriented approach to design software.
2. Implement programs using classes and objects.
3. Specify the forms of inheritance and use them in programs.
4. Analyze polymorphic behaviour of objects.
5. Design and develop GUI programs.
6. Develop Applets for web applications

Unit I: Introduction to Object Oriented Programming:

Introduction, Need of OOP, Principles of Object-Oriented Languages, Procedural Language Vs OOP, Application of OOP, Java Virtual Machine, Java features, Program Structures. Java Programming Constructs: Variables, Primitive data types, Identifier, Literals, Operators, Expressions, Precedence Rules and Associativity, Primitive Type Conversion and Casting, ,Flow of Control. **(Hours: 7)**

Unit II: Classes and Objects:

Classes, Objects, Creating Objects, Methods, Constructors, Cleaning up Unused Objects, Class Variable and Methods, this keyword, Arrays, Command Line Arguments. **(Hours: 6)**

Unit III: Inheritance, Interfaces and Packages

Inheritance: Inheritance vs. Aggregation, Method Overriding, super keyword, final keyword, Abstract class. Interfaces: Defining interfaces, Implementing interfaces, Accessing interface variables, Extending interfaces. Packages: Packages, java.lang package, Enum type. **(Hours: 7)**

Unit IV: Exception handling and Input / Output

Exception: Introduction, Exception handling Techniques, User-defind exception, Exception Encapsulation and Enrichment. Input/Output: The java.io.file Class, Reading and Writing data, Randomly Accessing a file, Reading and Writing Files using I/O Package. **(Hours: 7)**

Unit V: Applets

Introduction, Applet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint (), update () and repaint (), More about applet tag, getDocumentBase() and getCodeBase () methods, Applet Context Interface, Audio clip, Graphic Class, Color, Font, Font Metrics. **(Hours: 7)**

Unit VI: Event Handling

Introduction, Event delegation Model, java.awt.event Description, Sources of events, Event Listeners, Adapter classes, Inner Classes. Abstract Window Toolkit: Introduction, Components and Containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Textfield and Textarea, Container Class, Layouts, Menu, Scrollbar. **(Hours: 6)**

Text Books:

1. SachinMalhotra and SaurabhChoudhary: Programming in Java, Oxford University Press 2010.
2. Herbert Schildt: Java Complete References (McGraw Hill)

Reference Books:

1. H.M.Dietel and P.J.Dietel, “Java How to Program” Pearson Education/PHI, Sixth Edition.
2. E. Balagurusamy: Programming with Java (McGraw Hill)
3. Dr. R. NageswaraRao: Core Java An Integrated Approach (Dreamtech)
4. Khalid Mughal: A Programmer’s Guide to Java Certification, 3rdEdition (Pearson)
5. Sharnam Shah and Vaishali Shah: Core Java for Beginners,(SPD),2010.

3KE04 / 3KS04 DATA STRUCTURES

Course Prerequisite: Fundamentals of programming Language & Logic Building Skills

Course Objectives:

1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching and traversing.
3. To understand various data searching and sorting methods with its complexity.
4. To introduce various techniques for representation of the data in the real world.

Course Outcomes: On completion of the course, the students will be able to

1. Apply various linear and nonlinear data structures
2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain.

Unit I: Introduction to Data Structures

Introduction to Data structures, Data Structure Operations, Algorithmic Notation, Complexity of algorithms.String processing: storing strings, character data type, string operations, word processing, and pattern matching algorithms. **(Hours: 7)**

Unit II: Array & Record Structure

Linear arrays : Memory Representation of arrays, traversing linear arrays, insertion & deletion operations, Bubble sort, Linear search and Binary search algorithms. Multi dimensional arrays, Pointer arrays.Record structures and Matrices. **(Hours: 7)**

Unit III: Linked lists

Linked lists: Memory Representation of Linked List, traversing a linked list, searching a linked list. Memory allocation & garbage collection.Insertion & deletion operations on linked lists. Header linked lists, Two- way linked lists. **(Hours: 6)**

Unit IV: Stack & Queue)

Stacks: Sequential Memory Representation of Stack, Arithmetic expressions: Polish notation. Quick sort, Recursion, Tower of Hanoi.

Queues: Sequential Memory Representation of Queue, DeQueue, Priority queues. **(Hours: 7)**

Unit V: Trees

Introduction to Trees, Binary trees, Memory Representation of Binary Tree, Traversing binary trees, Header nodes, Binary Search Tree, Heap and heapsort, Path length & Huffman's algorithm.

(Hours:7)

Unit VI: Graphs & Sorting Algorithms

Introduction to Graphs, Memory representation of graphs, Warshalls' algorithm, operations on Graphs, Breadth First Search, Depth First Search

Sorting : Insertion Sort, Selection Sort, Radix sort, Merge Sort. **(Hours: 6)**

Text Books:

1. SeymourLipschutz: Data Structures ,Schaum's Outline Series,McGraw-Hill, International Editions.
2. Trembley, Sorenson: An Introduction to Data Structures with Applications, McGraw Hill.

Reference Books:

1. Ellis Horowitz, SartajSahni: Fundamentals of Data Structures, CBSPublications.
2. Data Structure Using C, Balagurusamy.
3. Standish: Data Structures in Java, Pearson Education.

3KE05 ANALOG ELECTRONICS & DIGITAL LOGIC DESIGN

Course Pre-requisite: Basic Physics.

Course Objectives:

1. To get the introductory knowledge of PN Junction Diode, Bipolar Junction Transistor, Field Effect Transistor.
2. To understand number systems and conversion between different number systems.
3. To get basics knowledge about digital ICs and digital systems.
4. To study the design of combinational circuits and sequential circuits.

Course Outcomes: At the end of course students will able to

1. Explain basic concepts of semiconductor devices and its application.
2. Compare different Number System and basics of conversion of number systems.
3. Realize different minimization technique to obtain minimized expression.
4. Design Combinational Circuits.
5. Design and Develop Sequential Circuits.

Unit I: PN Junction Diode and Bipolar Junction Transistor (Hours: 7)

PN-Junction Diode, Characteristics and Parameters, BJT operation, BJT Voltages and Currents, BJT Amplification: Current and Voltage, BJT Switching, Common-Base Characteristics, Common-Emitter Characteristics, Common- Collector Characteristics

Unit II: Field Effect Transistors (Hours: 7)

Junction Field Effect Transistors, n-Channel and p-Channel JFET, JFET Characteristics, JFET Parameters, FET Amplifications and Switching, MOSFETs: Enhancement MOSFET, Depletion_Enhancement MOSFET, Comparison of p-channel and n-channel FETs, Introduction to CMOS.

Unit III: Number System (Hours: 6)

Binary Number System, Signed and unsigned Number, Octal Number System, Hexadecimal Number System, Conversions between Number Systems, r's and (r-1)'s Complements Representation, Subtraction using 1's and 2's Complements, BCD, Gray Code, Excess 3 Code and Alpha numeric codes.

Unit IV: Minimization Techniques (Hours: 7)

Logic Gates, Boolean Algebra, Logic Operation, Axioms and Laws of Boolean Algebra, Reducing Boolean Expression, Boolean Functions and their representation, SOP Form, POS Form, Karnaugh Map (up to 5 variable), Limitation of Karnaugh Map, Quine- McCluskey Minimization Technique (up to 5 variable).

Unit V: Combinational Circuits (Hours: 7)

Introduction, Design Procedure, Adders, Subtractors, Binary Parallel Adder, 4 Bit Parallel Subtractor, Look-ahead-carry Adder, BCD adder, BCD Subtractor, Multiplexer, De-multiplexer, Decoder, Encoder, Comparator, Parity bit Generator/Checkers, Boolean Expression Implementation using these ICs.

Unit VI: Sequential Circuits (Hours: 6)

Flip-flops: S-R, J-K, Master slave J-K, D-type, T-type, Flip flop Excitation Table, Conversion of Flip Flops, Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register. Counters: Asynchronous and Synchronous counter, Up/Down counter, MOD-N counter, Ring counter, Johnson counter.

Text Books:

1. David A. Bell: "Electronic Devices and Circuits", 5e , Oxford University Press.
2. Jain R.P. "Modern Digital Electronics", 3e, TMH.

Reference Books:

1. Millman & Halkies: "Electronic Devices & Circuits", 2e, McGraw Hill.
2. Sedra & Smith: "Microelectronics Circuits", 5e, Oxford University Press.
3. Anand Kumar: "Switching Theory and Logic Design", 3e, PHI Learning Private Limited
4. Wakerly, "Digital Design: Principles and Practices", 3 e, Pearson Education, 2004.

3KE06 PROGRAMMING METHODOLOGY - LAB

Course Prerequisite: Basic Computer Programming

Course Objectives: Design, implement, test, and debug simple programs in an object-oriented programming language.

1. To develop the knowledge of object-oriented paradigm in the Java programming language.
2. To evaluate classical problems using java programming.
3. To develop software development skills using java programming for real world applications.

Course Outcomes : On completion of the course, the students will be able to

1. Design, implement, test, and debug simple programs in an object-oriented programming language.
2. Interpret the basics of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism
3. Build applications in Java by applying concepts like interfaces, packages and exception handling.
4. Make use of Java concepts like API, Applets, AWT.

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Introduction to Object Oriented Programming and installation of JDK. Write a program to print a message "Hello World..."
2. Develop a program to explain use of Operators in java.
3. Develop a Program to study and implement Looping Statements belonging to Java**.**
4. Develop a Program to study and implement Selection Statements belonging to Java**.**
5. Develop a program to study and implement some Pyramid.
6. Develop a program to demonstrate the concept of Class, Method and Object.
7. Develop a program to study and implement the concept of Method Overloading.
8. Develop a program to study and implement concept of Constructor in Java.
9. Develop a program to study and implement concept of Constructor Overloading in Java.
10. Develop a program to study and implement the Array in Java.
11. Develop a Program on various ways to accept data through keyboard(Command Line Argument)
12. Develop a program to study and implement the concept of Inheritance.
13. Develop a program to study and implement the concept of Method Overriding.
14. Develop a program to study and implement the Abstract Class.
15. Develop a program to study and implement the concept of Interface in Java.
16. Develop a program to study and implement Exception Handling Mechanism in Java.
17. Develop a program to study and implement Java I/O.
18. Develop a program to study and implement simple Applet in java.
19. Develop a program on Applet to demonstrate Graphics, Font and Color class.
20. Develop a Program on passing parameters to applets
21. Develop a Program to create GUI application without event handling using AWT controls
22. Develop a Program to create GUI application with event handling using AWT controls
23. Develop a program on Multithreading
24. Develop a Program to create GUI application with event handling using Swing controls
25. Mini Project based on content of the syllabus. (Group of 2-3 students)

3KE07 DATA STRUCTURE - LAB

Course Prerequisite: Basics of programming Language & Logic Building Skills

Course Objectives:

1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching and traversing.
3. To understand various data searching and sorting methods with its complexity.
4. To introduce various techniques for representation of the data in the real world.

Course Outcomes : On completion of the course, the students will be able to

1. Apply various linear and nonlinear data structure.
2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Write a program to find out largest number from the array and also find it's location.
2. Write a program to traverse an array and find the sum and average of data elements from an array.
3. Write a Program to a) insert an element in an array b)delete an element from an array.
4. To study and execute the Linear search method
5. To study and execute the Binary Search method
6. To study and execute the Pattern matching Algorithms(Slow and Fast)
7. To study and execute Bubble sort method.
8. To study and implement various operations on singly linked list
   (a) Traversing the linked list.
   (b) Insert a node at the front of the linked list.
   (c) Delete a last node of the linked list.
   (d) Searching a Linked list.

9. To study and implement following operations on the doubly linked list.
    (e) Insert a node at the front of the linked list.
    (f) Insert a node at the end of the linked list.
    (g) Delete a last node of the linked list.
    (h) Delete a node before specified position.
10. To study and implement following operations on the circular linked list.
    (e) Insert a node at the end of the linked list.
    (f) Insert a node before specified position.
    (g) Delete a first node of the linked list.
    (h) Delete a node after specified position.
11. Understand the stack structure and execute the push, pop operation on it.
12. Understand the Queue structure and execute the insertion, deletion operation on it.
13. Formulate and demonstrate Transforming Infix Expressions to Postfix Expression using Stack.
14. Formulate and demonstrate the Evaluation of Postfix Expression using Stack.
15. To study and execute Quick sort method.
16. Understand the Tree structure and implement the Pre-order, In-order, post-order traversing operations on it.
17. Understand the concept of Recursion and write a program to calculate factorial of a number using Recursion.
18. Understand the Heap sort and implement it on given data.
19. Understand the Insertion sort and implement it on given data.
20. Understand the Selection sort and implement it on given data.
21. To study and execute Merge sort method.
22. To study and execute Radix sort method.
23. Write a Program to implement the concept of BFS algorithm.
24. Write a Program to implement the concept of DFS algorithm.
25. To study and execute Josephus problem.

3KE08 ANALOG ELECTRONICS & DIGITAL LOGIC DESIGN - LAB

Course Prerequisite: Basic Physics.

Course Objectives:

1. To impart the concepts of analog and digital electronics practically.
2. To provide students basic experimental experiences in the operation of semiconductor device and Digital ICs.
3. To learn the operation of various logic gates and their implementation using digital IC's.
4. To learn the realization of various combinational and sequential circuits.

Course Outcomes : After successfully completing the lab, the students will be able to

1. Apply practically the concepts of analog and digital electronics.
2. Explain the operation and characteristics of semiconductor devices.
3. Illustrate the operation of various logic gates and their implementation using digital IC's.
4. Design and implement various combinational logic circuits.
5. Design and implement various sequential logic circuits

List of Experiments:

This is a sample list of Experiments; **minimum 10 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. To study V-I characteristics of a PN Junction diode in Forward and Reverse bias.
2. To Sketch and Study the input and output characteristics of transistor connected in Common Emitter (CE) configuration..
3. To Sketch and Study the input and output characteristics of transistor connected in Common Base (CB) configuration
4. To Sketch and Study the input and output characteristics of transistor connected in Common Collector (CC) configuration.
5. To plot static characteristics of FET & calculate its parameters g_m, r_d and μ.
6. To implement Logic gates using TTL ICs (7400, 7402, 7404, 7408, 7410, 7411, 7420, 7427, 7432, 7486).
7. Study and verify the truth table of half adder and full adder using logic gates.
8. Study and verify the truth table of half subtractor and full subtractor using logic gates
9. To compare two 4 bits number and verify the output using 4-bit comparator IC 7485.
10. Implementation of 4×1 multiplexer using logic gates.
11. Implementation and verification of Demultiplexer and Encoder using logic gates.
12. Implementation of 4bit parallel adder using 7483 IC.

13. Design and verify the 4 bit synchronous counter.
14. Design and verify the 4 bit asynchronous counter.
15. Verification of truth table of SR, JK, T and D Flip Flops.

List of Experiment beyond syllabus:

1. Design and Implementation of Op-amp as an inverting amplifier.
2. Design and Implementation of Op-amp as a non-inverting amplifier.
3. To design and find frequency of A stable multi-vibrator using IC 555.

3KE09 C-SKILL-LAB I

Course Pre-requisite: Basic knowledge of any Programming Language

Course Objectives:

1. To be able to program design with functions using Python.
2. To understand data and information processing techniques.
3. To understand to Design a program to solve the problems.
4. To be able to access database using python programming.
5. To be able to design web applications using python programming.

Course Outcomes: On completion of the course, the students will be able to

1. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
2. Interpret different Decision Making statements, Functions, Object oriented programming in Python
3. Summarize different File handling operations
4. Explain how to design GUI Applications in Python and evaluate different database operations
5. Develop applications using Django framework or Flask

List of Experiments:

This is a sample list of experiments, **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Write python program to store data in list and then try to print them.
2. Write python program to print list of numbers using range and for loop
3. Write python program to store strings in list and then print them.
4. Write python program in which an function is defined and calling that function prints Hello World.
5. Write a python script to print the current date in the following format “Sun May 29 02:26:23 IST 2017”
6. Write a program to create, append, and remove lists in python.
7. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
8. Write a program to demonstrate working with tuples in python.
9. Write a program to demonstrate working with dictionaries in python.
10. Write a python program to find largest of three numbers.
11. Write python program in which an function(with single string parameter) is defined and calling that function prints the string parameters given to function.
12. Write python program in which an class is define, then create object of that class and call simple print function define in class.
13. Write a Python script that prints prime numbers less than 20.
14. Write a python program to find factorial of a number using Recursion.
15. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
16. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
17. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
18. Write a Python class to convert an integer to a roman numeral.
19. Write a Python class to implement pow(x, n)
20. Write a Python class to reverse a string word by word.
21. Accessing and working with databases using Python.
22. Create data frame from .csv files and operations on it.
23. Plotting various graphs using Python.
24. Developing basic GUI using Python.
25. Developing web applications using Django framework or Flask

Reference Books :

1. “Core Python Programming”, R. NageswaraRao, dreamtech press.
2. “Python Programming A Modular Approach With Graphics, Database, Mobile and Web Applications”, Sheetal Taneja, Naveen Kumar, Pearson.
3. Python Web Development with Django By Jeff Forcier, Paul Bissex, Wesley J Chun, Addison-Wesley Professional.
4. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning
5. Allen B. Downey , “ Think Python: How to Think Like a Computer Scientist”, Second Edition, Shroff/O’Reilly Publishers
6. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India.

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SEMESTER IV

4KE01 ARTIFICIAL INTELLIGENCE

Course Prerequisite: Basic concepts of Data Structures, Algorithms, Programming

Course Objectives:

1. To present an overview of Artificial Intelligence (AI) principles and approaches.
2. To understand the historical evolution of Artificial Intelligence.
3. To learn various searching techniques and identify to address a particular problem).

Course Outcomes : On completion of the course, the students will be able to

1. Explain concepts of Artificial Intelligence and different types of intelligent agents and their architecture.
2. Formulate problems as state space search problem & efficiently solve them.
3. Summarize the various searching techniques, constraint satisfaction problem and example problems - game playing techniques.
4. Apply AI techniques in applications which involve perception, reasoning and learning.
5. Compare the importance of knowledge, types of knowledge, issues related to knowledge acquisition and representation.

Unit I: Introduction to AI (Hours: 7)

Introduction : What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Risks and Benefits of AI,

Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents

Unit II: Problem Solving Through AI (Hours: 7)

Introduction, Representation the AI Problems, Production System, Algorithm of Problem Solving, Examples of AI Problems, Nature of AI Problems

Unit III: Uninformed Search Strategies (Hours: 6)

Problem-Solving Agents, Example Problems, Search Algorithms, **Uninformed Search Strategies**: Breadth-First Search, Uniform-Cost Search, Depth First Search, Bidirectional Search, Depth Limited Search, Iterative Deepening Depth-First Search

Unit IV: Informed Search Strategies (Hours: 7)

Basic Concept of Heuristic Search and Knowledge, Designing of Heuristic Function, **Heuristic Search Strategies:** Generate-And-Test, Best-First Search, Problem Reduction, Hill Climbing, Constraint Satisfaction, Means-Ends-Analysis

Unit V: Adversarial Search & Games (Hours: 7)

Game Theory, Optimal Decisions in Games, Mini-Max Search, Alpha Beta Pruning, Additional Refinements, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms

Unit VI: Introduction to Knowledge (Hours: 6)

Introduction, Types of Knowledge, Knowledge Representation, Knowledge Storage, Knowledge Acquisition, Knowledge Organization and Management, Basic Concepts of Knowledge Engineering

Text Books:

1. Artificial Intelligence: A Modern Approach by Stuart Russell & Peter Norvig (Pearson - 4th Ed.)
2. Artificial Intelligence by Ela Kumar (IK International Publishing House Pvt. Ltd.)

Reference Books:

1. Artificial Intelligence by Elaine Rich and Kevin Knight (Tata McGraw Hill - 3rd Ed.)
2. A First Course in Artificial Intelligence by Deepak Khemani (Tata McGraw Hill - 1st Ed.)
3. Artificial Intelligence and Expert Systems by Patterson (PHI)
4. Introduction to Artificial Intelligence by RajendraAkerkar (PHI Learning Pvt. Ltd.)

4KE02 COMPUTER NETWORKS

Course Prerequisite: Computer and Data Communication Requirements

Course Objectives:

1. To understand the building blocks of digital communication system.
2. To prepare mathematical background for communication signal analysis.
3. To understand and analyze the signal flow in a digital communication system
4. To analyze error performance of a digital communication system in presence of noise and other interferences.
5. To evaluate the errors using various error detection & correction techniques.
6. To understand network based protocols in data communication and networking.

Course Outcomes: On completion of the course, the students will be able to

1. Describe data communication Components, Networks, Protocols and various topology based network architecture
2. Design and Test different encoding and modulating techniques to change digital –to- digital conversion, analog-to-digital conversion, digital to analog conversion, analog to analog conversion,
3. Explain the various multiplexing methods and evaluate the different error detection & correction techniques.
4. Illustrate and realize the data link control and data link protocols.
5. Describe and demonstrate the various Local area networks and the IEEE standards.

Unit I: Introduction to Data Communication (Hours: 7)

Introduction: Data Communication, Components, Networks, Network types: Local Area Network,Wide Area Network, Switching, The Internet, Accessing the Internet, Standards and Administration: Internet Standards, Internet Administration, Network Models:TCP/IP Protocol Suite,TheOSI Model, Transmission media: Introduction, Guided media & Unguided media-Wireless. Switching: Introduction, Circuit Switched Networks, Packet Switching.

Unit II: Data link Layer (Hours: 6)

Data Link Layer: Introduction, Nodes & Links, Services , Two categories of link, Two sub-layers, Error detection and correction: Introduction, Block Coding, Cyclic codes, Checksum, Forward Error Correction, Data link control: DLC services, Data-Link Layer Protocol, HDLC, Point-To-Point Protocol, Media Access Control (MAC): Random Access, Controlled Access, Channelization.

Unit III: Network Layer (Hours: 7)

Introduction to Network layer Network Layer Services: Packetizing, Routing and Forwarding, Other Services Packet Switching: Datagram Approach: Connectionless Service, Virtual-Circuit Approach: Connection-Oriented Service , Network Layer performance: Delay, Throughput, Packet Loss, Congestion Control, IPV4 Address: Address Space, Classful Addressing, Classless Addressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution (NAT), Forwarding of IP packets: Forwarding Based on Destination Address, Forwarding Based on Label, Routers as Packet Switches

Unit IV: Unit Title: Network Layer Protocol (Hours: 7)

Network Layer Protocols: Internet Protocol (IP),Datagram Format, Fragmentation, Security of IPv4 Datagrams,ICMPV4: Messages, Debugging Tools, ICMP Checksum, Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP, Routing algorithms: Distance Vector routing, Link State Routing, IPV6 Addressing: Representation, Address Space, Address Space Allocation, Auto configuration, Renumbering, Transition from IPV4 to IPV6: Strategies, Use of IP Addresses

Unit V: Unit Title: Transport Layer (Hours: 6)

Introduction to Transport layer: Introduction, Transport-Layer Services, Connectionless and Connection-Oriented Protocols, Transport-Layer Protocols: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol (GBN), Selective-Repeat Protocol, Bidirectional Protocols: Piggybacking,User Datagram Protocols: User Datagram, UDP Services, UDP Applications,Transmission Control Protocol: TCP Services, TCP Features , Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers, Options, SCTP: SCTP Services, SCTP Features

Unit VI: Unit Title: Application layer (Hours: 7)

Introduction to Application layer:Providing Services, Application-Layer Paradigms, Client-Server Programming: Application Programming Interface, Using Services of the Transport Layer, Iterative Communication Using UDP, Iterative Communication Using TCP, Concurrent Communication, World wide web and HTTP: World Wide Web, Hyper-Text Transfer Protocol (HTTP) FTP: Two Connections, Control Connection, Data Connection, Security for FTP, Electronic Mail: Architecture, Web-Based Mail, E-Mail Security, Domain Name System (DNS):Name Space, DNS in the Internet, Resolution, Caching, Resource Records, DNS Messages, Registrars, Security of DNS, Network Management: Introduction. Configuration Management, Fault Management, Performance Management, Security Management, Accounting Management, SNMP: Managers and Agents, Management Components, ASN.1: Language Basics, Data Types, Encoding.

Text Book: Behrouz A. Forouzan: Data Communication and Networking, (5/e) (TMH

Reference Books:

1. William Stallings: Data & Computer Communications, 6/e, Pearson Education
2. William L. Schweber : Data Communication, McGraw Hill
3. J.Freey : Computer Communication & Networks, AEW Press
4. D. Corner: Computer Networks & Internet, Pearson Education.

4KE03 OPERATING SYSTEM

Course Pre-requisite: Discrete Structures, Data Structure, Any programming Language

Course Objectives:

1. To make students aware of the kernel and shell structure of the operating systems.
2. To make students aware of the purpose, structure and functions of operating systems
3. To equip students with understanding of the various scheduling algorithms in OS.
4. To make students aware of understanding of memory management in different OS.

Course Outcomes : On completion of the course, the students will be able to

1. Explain memory management issues like external fragmentation, internal fragmentation.
2. Illustrate multithreading and its significance.
3. List various protection and security mechanisms of OS.
4. Analyze and solve the scheduling algorithms.
5. Analyze the deadlock situation and resolve it.
6. Compare various types of operating systems

Unit I: Introduction to OS : (Hours: 7)

Introduction: Operating System definition, OS Evolution, Components and Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Threads Overview, Multithreading Models, Threading Issues, Java Threads

Unit II: Process Scheduling (Hours: 7)

Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue Scheduling

Unit III: Process Synchronization (Hours: 6)

Process Synchronization Basics: The Critical-Section Problem, Synchronization Hardware, Semaphores, Monitors, Deadlocks: Definition & Characterization, Deadlocks Prevention, Avoidance, Detection and Recovery from Deadlock

Unit IV: Memory Management (Hours: 7)

Memory Management Background, Swapping, Contiguous Memory Allocation Schemes, Paging, Segmentation, Virtual Memory Management: Background, Demand paging scheme, Process Creation, Page Replacement Policies, Allocation of Frames, Thrashing

Unit V: Unit Title: File System (Hours: 7)

File-System Interface; Directory Structure, File-System Mounting, File Sharing &Protection, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management. File Recovery

Unit VI: Unit Title: I/O System (Hours : 6)

I/O Systems : Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations , Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure.

Text Book : Avi Silberschatz, P.B.Galvin, G.Gagne: “Operating System Concepts” (9/e) John-Wiley & Sons.

Reference Books:

1. A.S.Tanenbaum “Modern Operating Systems” Pearson Education.
2. William Stallings “Operating Systems” Prentice-Hall.
3. D. M. Dhamdhere “Operating Systems” Tata McGraw-Hill.
4. P. Balkrishna Prasad: “Operating Systems” Scitech Publications (I) Pvt.

4KE04 MICROPROCESSOR & INTERFACING

Course Pre-requisite: Computer Programming and Number System

Course Objectives:

1. To explore 8086 microprocessor and its architecture.
2. To introduce interfacing techniques of 8086 microprocessor.
3. To introduce basics of Internet of Things

Course Outcomes : On completion of the course, the students will be able to

1. Describe 8086 microprocessor and its architecture; also understand instruction processing during the fetch-decode-execute cycle.
2. Design and Test assembly language programs using 8086 microprocessor instruction set.
3. Demonstrate the implementation of standard programming constructs, including control structures and functions, in assembly language.
4. Illustrate and realize the Interfacing of memory & various I/O devices with 8086 microprocessor.
5. Explain the basic concepts of Internet of Things

Unit I: 8086 Architecture (Hours: 7)

8086 architecture and pin configuration, Software model of 8086 microprocessor. Memory addresses space and data organization. Data types. Segment registers, memory segmentation. IP & Data registers, Pointer, Index registers. Memory addresses generation.

Unit II: 8086 Instruction Set (Hours: 7)

8086 Instruction set overview, addressing modes. 8086 instruction formats. 8086 programming: Integer instructions and computations: Data transfer instructions, Arithmetic instructions and their use in 8086 programming.

Unit III: 8086 Instruction Set (Hours: 6)

8086 programming: logical instructions. Shift and rotate instructions and their use in 8086 programming. 8086 flag register and Flag control instructions, compare instruction, control flow and jump instructions, Loops & loop handling instructions. 8086 programming using these instructions.

Unit IV: Subroutines& Macros (Hours: 7)

The 8086 stack segment and stack related instructions. 8086 I/O Address space.Subroutines and related instructions, Parameter passing, Concept of Macros, Status saving on stack.Concept of recursion at assembly program level.8086 Programming using subroutines, recursion and macros.

Unit V: 8086 Interrupt (Hours: 7)

8086 Interrupts types, priority and instructions. Interrupt vector table, External hardware-interrupt interface signals & interrupts sequence. Software interrupts. Non-maskable interrupts. 8086 microprocessor interrupt programming.

Unit VI: Internet of Things (IoT) (Hours: 6)

Internet of things: An overview, IoT conceptual framework, IoT Architectural View, Technology behind IoT, Sources of IoT, M2M communication, Examples of IoT.

Text Books:

1. A. K. Ray & K. M. Bhurchandi: Advanced Microprocessors & Peripherals, Third Edition (TMH).
2. Raj Kamal: Internet of Things, Architecture and Design Principals, McGraw Hill Education (India) Pvt Ltd

Reference Books:

1. W. A. Triebel& Avatar Singh: The 8088/8086 Microprocessors (4e) (PHI /Pearson Education)
2. Liu & Gibson: The 8088/8086 Microprocessor Architecture Programming and Interface (6/e) (PHI)

4KE05 THEORY OF COMPUTATION

Course Pre-requisite: Discrete Mathematics, Data Structures

Course Objectives:

1. To understand different automata theory and its operation.
2. To understand mathematical expressions for the formal languages
3. To study computing machines and comparing different types of computational models
4. To understand the fundamentals of problem decidability and Un-Decidability

Course Outcomes : On completion of the course, the students will be able to

1. To construct finite state machines to solve problems in computing.
2. To write regular expressions for the formal languages.
3. To construct and apply well defined rules for parsing techniques in compiler
4. To construct and analyze Push Down, Turing Machine for formal languages
5. To express the understanding of the Chomsky Hierarchy.
6. To express the understanding of the decidability and un-decidability problems.

Unit I: Finite State Machines (Hours: 8)

Alphabet, String, Formal and Natural Language, Operations, Definition and Design DFA (Deterministic Finite Automata), NFA (Non Deterministic Finite Automata), Equivalence of NFA and DFA: Conversion of NFA into DFA, Conversion of NFA with epsilon moves to NFA, Minimization Of DFA, Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines. Minimization of Finite Automata. (Construction of Minimum Automaton)

Unit II: Regular Expression and Regular Grammar (Hours: 8)

Definition and Identities of Regular Expressions, Construction of Regular Expression of the given Language, Construction of Language from the RE, Conversion of FA to RE using Arden's Theorem, Inter-conversion RE to FA, Pumping Lemma for RL, Closure properties of RLs(proofs not required), Regular grammar, Equivalence of RG (RLG and LLG) and FA.

Unit III: Context Free Grammar and Languages (Hours: 8)

Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, Derivation Trees, Construction of Context-Free Grammars and Languages, Pumping Lemma for CFL, Simplification of CFG, Normal Forms (CNF and GNF), Chomsky Hierarchy.

Unit IV: Pushdown Automata (Hours: 8)

Introduction and Definition of PDA, Construction of PDA, Acceptance of CFL, Equivalence of CFL and PDA: Inter-conversion , Introduction of DCFL and DPDA, Enumeration of properties of CFL, Context Sensitive Language, Linear Bounded Automata.

Unit V: Turing Machines (Hours: 8)

Formal definition of a Turing Machine, Design of TM, Computable Functions, Church's hypothesis, Counter machine, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine.

Unit VI: Decidability and Un-Decidability (Hours: 8)

Decidability of Problems, Halting Problem of TM, Un-Decidability: Recursive enumerable language, Properties of recursive & non-recursive enumerable languages, Post Correspondence Problem, Introduction to Recursive Function Theory.

Text Books:

1. Hopcraft H.E. & Ullman J: Introduction to Automata Theory, Languages and Computation.
2. Peter Linz: An Introduction to Formal Languages and Automata.

Reference Books:

1. Rajesh K. Shukla: Theory of Computation, CENGAGE Learning, 2009.
2. K V N Sunitha and N Kalyani: Formal Languages and Automata Theory, McGraw Hill,2010
3. Lewis H.P. and Papadimition C.H.: Elements of Theory of Computation
4. Mishra &Chandrashekharan: Theory of Computation
5. C.K.Nagpal: Formal Languages and Automata Theory, Oxford University Press, 2011.
6. VivekKulkarni : Theory of Computation, OUP India, 2013

4KE06 COMPUTER NETWORK - LAB

Course Pre-requisite: Computer and Data Communication Requirements

Course Objectives:

1. To understand the working principle of various communication protocols
2. To understand and analyze the signal flow in a digital communication system.
3. To analyze error performance of a digital communication system in presence of noise and other interferences.
4. To evaluate the errors using various error detection & correction techniques.
5. To understand network based protocols in data communication and networking.

Course Outcomes : On completion of the course, the students will be able to

1. Analyze performance of various communication protocols
2. Implement Configure various network protocols.
3. Compare IP Address classes of networks.

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. To study various LAN topologies and their creation using network devices, cables and computers. .
2. To connect the computers in Local Area Network.
3. Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, Routers etc.
4. Write a program of bit stuffing used by Data Link Layer
5. Write a program to implement CRC(Cyclic Redundancy Check)
6. Write a program to implement Checksum
7. Write a program to implement Sliding window
8. Configure Internet connection and use IP-Config, PING / Tracer and Net stat utilities to debug the network issues.
9. Configuration of TCP/IP Protocols in Windows and Linux.
10. Transfer files between systems in LAN using FTP Configuration, install Print server in a LAN and share the printer in a network.
11. Write a C Program to determine if the IP Address is in Class A, B, C, D, or E
12. Write a C Program to translate Dotted Decimal IP Address into 32 Bit Address.
13. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN(TCP/IP Configuration)

4KE07 OPERATING SYSTEM - LAB

Course Pre-requisite: Basic computer programming

Course Objectives:

1. To make students aware of the kernel and shell structure of the operating systems.
2. To make students aware of the purpose, structure and functions of operating systems
3. To equip students with understanding of the various scheduling algorithms in OS.
4. To make students aware of understanding of memory management in different OS.

Course Outcomes : On completion of the course, the students will be able to

1. Explain memory management issues like external fragmentation, internal fragmentation.
2. Illustrate multithreading and its significance.
3. List various protection and security mechanisms of OS.
4. Analyze and solve the scheduling algorithms.
5. Analyze the deadlock situation and resolve it.
6. Compare various types of operating systems

List of Experiments:

This is a sample list of Experiments, **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

4KE08 MICROPROCESSOR & INTERFACING - LAB

Course Pre-requisite: Computer Programming, Number System

Course Objectives: In this lab student will learn about' Microprocessor and Interfacing' in regards to digital computer, microprocessor architecture, programming with 8086 microprocessor and different peripherals**.**

Course Outcomes : On completion of the course, the students will be able to

1. Analyze the internal workings of the microprocessor
2. Design and develop programs in Assembly Language Programming
3. Describe 8086 microprocessor and its architecture; also understand instruction processing during the fetch-decode-execute cycle.
4. Design and Test assembly language programs using 8086 microprocessor instruction set.
5. Demonstrate the implementation of standard programming constructs, including control structures and functions, in assembly language
6. Illustrate and realize the Interfacing of memory & various I/O devices with 8086 microprocessor

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Installation and Introduction of TASM Assembler.
2. Write a program for addition of two 8-bits numbers and two 16-bits numbers.
3. Write a program for subtraction of two 8-bits numbers and two 16-bits numbers.
4. Write a program for multiplication of two 8-bits numbers.
5. Write a program for division of two 8-bits numbers
6. Write a program to check whether a given number is even or odd.
7. Write a program to demonstrate Logical Group and Shift Rotate Instructions.
8. Write a program to check whether a given number is positive or negative.
9. Write a program to find greatest of two 8-bits signed &unsigned numbers.
10. Block Transfer Program
11. Write a program to find Factorial of a number using loop instruction.
12. Write a program to find cube of a given number using Subroutine.
13. Write a program to find square of a given number using Subroutine.
14. Write a program to find square of a given number using Macro.
15. Write a program to find whether the string is palindrome or not.
16. To convert BCD Number Program
17. Write a program to perform Reverse of the String
18. Write a program to transfer 10-bytes from one memory bank to another memory bank.
19. Program for sorting an array for 8086 microprocessor.
20. To write an assembly language program to arrange the given numbers in descending order.
21. Program for searching for a number/character in a string for 8086 microprocessor.

4KE09 C-SKILL-LAB II

Course Pre-requisite: Basic knowledge of scripting language, Programming language, Basic understanding of Electronic concepts.

Course Objectives: To develop an ability to design and implement static and dynamic website and to develop embedded systems with the help of Raspberry Pi/Ardino.

Course Outcomes : On completion of the course, a student will be able to

1. Develop client server program and web applications
2. Make use of project-based experience for web application development.
3. Create embedded systems using Raspberry Pi/Ardino

List of Experiments:

This is a sample list of Experiments, **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Introduction to PHP and configure it to work with Apache Web Server.
2. Design web pages for your college containing a description of the courses, departments, faculties, library etc, use href, list tags.
3. Create your class timetable using table tag.
4. Create user Student feedback form (use textbox, text area , checkbox, radio button, select box etc.)
5. Create your resume using HTML tags also experiment with colors, text , link , size and also other tags you studied.
6. Design a web page of your home town with an attractive background color, text color, an Image, font etc. (use internal CSS).
7. Develop a JavaScript to display today's date.
8. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
9. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).
10. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
11. Write a PHP program to display a digital clock which displays the current time of the server.
12. Write the PHP programs to do the following: a. Implement simple calculator operations. b. Find the transpose of a matrix.
13. Write a PHP program to sort the student records which are stored in the database using selection sort.
14. Study and Install IDE of Arduino and different types of Arduino.
15. Write program using Arduino IDE for Blink LED.
16. Write Program for RGB LED using Arduino.
17. Study the Temperature sensor and write a Program for monitor temperature using Arduino.
18. Study and Implement RFID, NFC using Arduino. • Study and implement MQTT protocol using Arduino.
19. Study and Configure Raspberry Pi.
20. WAP for LED blink using Raspberry Pi.
21. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
22. Create Smart Plugs with Arduino and Raspberry Pi.
23. Interfacing digital sensors with raspberry pi.
24. Creating a webpage to control I-O devices, Reading data from sensor and passing to web page.
25. Implement a program to access Analog sensor via wifi with HTML Web server.

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SYLLABUS OF B.E. SEM. III & IV (I.T.) [C.B.C.S.]

Semester-III

3IT01/3KS01/3KE01 ENGINEERING MATHEMATICS-III

Course Objectives:-

- Find general solutions of linear differential equations with constant coefficients using the roots of the auxiliary equation.
- Calculate the Laplace Transform of basic functions using the definition.
- Apply Laplace transform to find solution of linear differential equations. And solve problems related to Fourier Transform
- Compute and interpret the correlation coefficient.
- Compute the Analytic function and Complex Analysis.
- Perform vector differentiation and integration to analyze the vector fields and apply to compute line, surface and volume integrals.

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Demonstrate the knowledge of differential equations and linear differential equations .
2. Apply Laplace transform to solve differential equations.
3. Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.
4. Demonstrate the basic concepts of probability and statistics.
5. Apply the knowledge of Complex Analysis.
6. Apply the knowledge of vector calculus to solve physical problems.

SECTION-A

UNIT-I: **Ordinary differential equations**:- Complete solution, Operator D, Rules for finding commplementary function, the inverse operator, Rules for finding the particular integral, Method of variation of parameters, Cauchy's and Legendre's linear differential equations. (7)

UNIT-II: **Laplace Transform:-** Definition, standard forms, properties of Laplace transform, inverse Laplace transform, Initial and final value theorem, Convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function . (7)

UNIT-III: **a) Applications of Laplace Transform:-** Solution of Linear differential equations, Simultaneous differential equation by Laplace transform method

b) Fourier Transform:- Definition, standard forms, Fourier transforms, properties of Fourier transforms, Convolution theorem, Fourier sine and Fourier cosine transforms and integrals, inverse Fourier transforms.(7)

SECTION-B

UNIT-IV: **a) Partial differential equation** of first order of following form:- (i)f (p,q) = 0; (ii) f (p,q,z) = 0; (iii) f (x, p) = g (y,q); (iv) P p + Qq = R (Lagranges Form); (v) z = px + qy + f(p,q) (Clairauts form)

b) Statistics Curve fitting: Least Square Method, Coefficient of Correlations, Lines of Regression. (7)

UNIT-V: Complex Analysis: - Functions of complex variables, Analytic function, Cauchy- conditions, Harmonic function, Harmonic conjugate functions, Milne's Method, conformal mappings (translation, rotation, magnification and bilinear transformation), Expansion of function in Taylor's and Laurent's series. (7)

UNIT–VI: Vector calculus:- Scalar and vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, expansion Formulae (without proof), line, surface, volume integrals, irrotational Solenoidal Vector fields. (7)

Text Books:

1. Elements of Applied Mathematics Vol. II by P. N. Wartikar and J.N. Wartikar,
2. Higher Engg. Mathematics by B.S. Grewal.

Reference Books:

1. Advancing Engg. Mathematics by E.K.Kreyzig.
2. A text book of Differential Calculus by Gorakh Prasad.
3. A Text Book of Applied Mathematics by P.N.Wartikar and J.N.Wartikar.
4. Engineering Mathematics by Ravish R Singh, Mukul Bhatt.

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3IT02 Discrete Structure & Graph Theory

Course Objectives:

- Increase Critical thinking and analytical problem-solving skills and awareness of computer related ethics to discrete Mathematical Logic.
- Apply appropriate discrete mathematical concepts and operations to interpret data and to solve problems.
- Identify problem and analyze it in terms of its significant parts and the information needed to solve problems based on sets, relation, function and recursion.
- Formulate and evaluate possible solutions to problem and select the chosen solution based on Boolean algebra.
- Construct graphs and trees, interpret them, and draw appropriate conclusion.

Course Outcomes:

After successfully completing the course, the students will be able to:

- Identify basic terminology of Mathematical Logic, Theory of inference & Predicate calculus.
- Identify, illustrate, and solve engineering problems on the basis of set theory.
- Identify and Design an Algebraic Structures and groups
- Examine and formulate the concept of Lattices & Boolean Algebra to solve engineering problems.
- Design and interpret data using graphs, trees and related algorithms.

UNIT I : Mathematical Logic : Statements & Notation , Connectives , Normal forms , The Theory of Inference for the Statement Calculus , Predicate Calculus , The Inference Theory of the Predicate Calculus.

UNIT II: Set Theory : Basic concepts of Set Theory , Representation of Discrete Structure, Relation and ordering, Functions , Recursion.

UNIT III : Algebraic Structures : Algebraic Systems , Semi groups and Monoids , Grammars and Languages, Polish expression & their compilation , Groups , Semi groups, Application of Residue Arithmetic to Computers.

UNIT IV: Lattice & Boolean Algebra: Lattices as Partially Ordered Sets, Boolean Algebra, Boolean Functions, Representation of Boolean Functions , Minimization of Boolean Functions.

UNIT V: Graph Theory: Basic concepts of Graph Theory , Paths, Reachability & Connectedness, Matrix representation of graphs , Storage Representation and Manipulation of Graphs, Coloring Graphs.

UNIT VI: Trees, Tree Searching, Minimal spanning trees, Simple Precedence Grammars, , rooted tree, expression tree, B tree, Distance between spanning trees of a graph. PERT and Related Techniques.

Text Book : J.P.Trembley, R.Manohar :"Discrete Mathematical Structures with Application to Computer Science" 1988 (Tata McGraw Hill)

REFERENCE BOOKS:

1 G Shankar Rao, "Discrete Mathematical Structures", New Age International, 2002 ISBN:81-224-1424-9.
2 Kenneth H. Rosen, " Discrete Mathematics and its Applications", 7th Edition, McGraw Hill Edition.
3. S.K. Chakraborty & B.K.Sarkar ;"Discrete Mathematics" OXFORD.
4. Bernard Kolman,Robert C.Busby, Sharon Ross: "Discrete Mathematical Structures" Third Edition PHI.

3IT03 OBJECT ORIENTED PROGRAMMING

Course Objectives:

- Study of the basic concepts of Java such as operators, classes, objects, inheritance, packages and exception handling.
- Study of concepts like enumerations, generics, logging, API, assertions, Applets, AWT.
- Preparing the students to learn Object Oriented Programming Methodology.

Course Outcomes:

- Apply Object Oriented approach to design software.
- Implement programs using classes and objects.
- Specify the forms of inheritance and use them in programs.
- Analyze polymorphic behavior of objects.
- Design and develop GUI programs.
- Develop Applets for web applications

Unit I: Introduction to Object Oriented Programming: Introduction, Need of OOP, Principles of Object-Oriented Languages, Procedural Language Vs OOP, Application of OOP, Java Virtual Machine, Java features, Program Structures. **Java Programming Constructs:** Variables, Primitive data types, Identifier, Literals, Operators, Expressions, Precedence Rules and Associativity, Primitive Type Conversion and Casting, Flow of Control.

Unit II: Classes and Objects: Classes, Objects, Creating Objects, Methods, Constructors, Cleaning up Unused Objects, Class Variable and Methods, this keyword, Arrays, Command Line Arguments.

Unit III: Inheritance: Inheritance vs. Aggregation, Polymorphism, Method Overloading Method Overriding, super keyword, final keyword, Abstract class. **Interfaces, Packages and Enumeration:** Interface, Packages, java.lang package, Enum type.

Unit IV: Exception: Introduction, Exception handling Techniques, User-defined exception, Exception Encapsulation and Enrichment. **Input/ Output:** The java.io.file Class, Reading and Writing data, Randomly Accessing a file, Reading and Writing Files using I/O Package.

Unit V: Applets: Introduction, Applet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint (), update () and repaint (), More about applet tag, get Document Base () and get Code Base() methods.

Unit VI: Event Handling: Introduction, Event delegation Model, java.awt.event Description, Sources of events, Event Listeners, Adapter classes, Inner Classes. **Abstract Window Toolkit:** Introduction, Components and Containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Text field and Textarea, Container Class, Layouts, Menu, Scrollbar.

Text Book: Sachin Malhotra and Saurabh Choudhary: Programming in Java, Oxford University Press 2010.

Reference Books:

1. Herbert Schildt: Java Complete References (McGraw Hill)
2. E. Balagurusamy: Programming with Java (McGraw Hill)
3. Khalid Mughal: A Programmer's Guide to Java Certification, 3rd Edition (Pearson)
4. Liang: A text Book of Java Programming, (PHI).

3IT04 ASSEMBLY LANGUAGE PROGRAMMING

Course Objectives :

1. Able to understand the architecture and organization of microprocessor 8086/8088 .
2. Able to understand different addressing modes & instruction format of 8086 & apply in 8086 programming.
3. Able to understand instruction set, control flow instruction and apply the fundamentals of assembly level programming of microprocessor through use of any Open Source Software.(TASM,NASM etc.)
4. Able to understand stack, subroutine. Recursion & apply in 8086 programming.

Course Outcomes ;

After successful completion of this course the student will be able to

1. To draw and explain internal architecture of 8086 with its register organization.
2. Able apply instruction format 7 addressing modes in 8086 programming.
3. Able to apply control flow instruction in 8086 programming through use of any Open Source Software.(TASM,NASM etc.)
4. Able to apply stack & subroutine concept in 8086 programming.

Unit I: Microprocessor 8086 architecture-BIU and EU, pin configuration, Software model of 8086 microprocessor. Memory addresses space and data organization. Data types. Segment registers, memory segmentation. IP & Data registers, Pointer, Index registers. Memory addresses generation.

Unit II: 8086 Instruction set overview, addressing modes. 8086 instruction formats. 8086 programming: Integer instructions and computations: Data transfer instructions, Arithmetic instructions and their use in 8086 programming.

Unit III: 8086 instructions: logical instructions, Shift and rotate instructions 8086 programming: 8086 flag register and Flag control instructions control flow and jump instructions, Loops & loop handling instructions. 8086 programming using these instructions.

Unit IV: Stack and Subroutines,8086 stack segment and stack related instructions. 8086 I/O Address space, Subroutines and related instructions, parameter passing, Concept of Macros, Status saving on stack. Concept of recursion at assembly Program level. 8086 programming using subroutines, recursion and macros.

Unit V: 8086 I/O: Types of input output, isolated I/O interface, input output data transfers, I/O instructions and bus cycles. Programmable Peripheral Interface 8255 PPI: pin diagram, internal organization, modes of operation.

Unit VI: 8086 Interrupt Mechanism, types and priority , Interrupt vector table, Interrupt Instructions, External hardware-interrupt interface signals & interrupts sequence. Programmable Interrupt Controller 8259: Block & pin diagram, internal architecture, Software interrupts, Nonmaskable interrupt, Internal Interrupt functions.

Text Book: Avtar Singh & Walter A. Triebel: The 8088 and 8086 Microprocessors, Programming, Interfacing, Software, Hardware, and Applications, PHI, 2003.

References:

1. Barry B. Brey : The Intel Microprocessor Architecture, Programming & Interfacing (6/e)(PHI)
2. John P Uffenbeck, "8086/8088 Families: Designing, Programming and Interfacing". Prentice Hall
3. D. V. Hall: Microprocessors and Interfacing, TMH.

3IT05 ANALOG AND DIGITAL ELECTRONICS

Course Objectives :

- To understand the basic operation and applications of analog devices such as BJT and JFET
- To introduce analog ICs like Op-Amp and Timer
- To study and develop skills to design basic combinational and Sequential logic circuits
- To lay foundation for understanding computer architecture and organization

Course Outcomes :

On completion of the course learner will be able to-

- Understand the basic applications of BJT.
- Get acquainted with analog ICs like Op-Amp IC-741 and Timer IC-555
- Discriminate the working of sinusoidal and non-sinusoidal waveform generators.
- Apply the concept of K-map to simplify logic expressions.
- Design and implement Combinational circuits
- Explore the applications of Sequential circuits

UNIT I:

Introduction to Analog Circuits: Transistor as an amplifier. Need of biasing, Potential divider bias circuit, Faithful amplification of CE amplifier, Transistor as an electronic switch, Construction and working of JFET.

UNIT II:

Operational Amplifier: Block diagram of Op-Amp, ideal Op-Amp parameters. Applications of op-amp: Inverting & Non-Inverting Amplifier, Voltage follower, Summing Amplifier, Subtractor, Comparator.

UNIT III:

Wave Generators:

Transistorized Oscillators: Barkhausen Criterion, R-C Phase Shift Oscillator, Transistor crystal oscillator Timer IC 555: Block diagram**,** working, Astable multivibrator, Monostable multivibrator.

UNIT IV: Introduction to Digital Circuits: Logic gates, Standard logic expression forms, SOP, POS, Logic expression realization & minimization using K-map (upto 4 variables only). Half Adder, Full Adder, Half subtractor, Full subtractor.

UNIT V: Logic Circuits: Difference between Combinational and Sequential circuits, Code convertors (BCD, Excess-3 and Gray), Multiplexers, De-multiplexers and Decoders.

Flip Flops: SR flip-flop, JK flip-flop, D flip-flop and T flip-flop.

UNIT VI: Sequential Circuits: Difference between Asynchronous & Synchronous sequential circuits, Asynchronous counters, Mod counter, Up-Counter, Down-Counter. Working of shift Registers, SISO, SIPO, PISO and PIPO. Application of Shift Register as a Ring Counter.

Text Books:

1. V.K.Mehta, Rohit Mehta: Principles of Electronics (S.CHAND)
2. Gayakwad R.A.: Op-Amps & Linear Integrated circuits (PHI)
3. Jain R.P. Modern Digital Electronics (TMH)

Reference Books:

1. N.N.Bhargava, D.C.Kulshreshtha, S.C.Gupta: Basic Electronics & Linear circuits, (TTTI)
2. S. Salivahanan: Electronics Devices & circuits, Third Edition
3. John P. Hayes: Introduction to Digital Logic Design{Pearson)
4. Anand Kumar: Fundamentals of Digital Circuits (PHI)

3IT06 OBJECT ORIENTED PROGRAMMING - LAB

Practical based on the syllabus of Object Oriented Programming (3IT03)

Following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on the syllabus of Object Oriented Programming (3IT03)

1. Write a program to demonstrate various data-types used in java and also perform the type casting.
2. Demonstrate the use of this keyword in java.

3. Write a program in java to demonstrate various OOP'S (Inheritance, Polymorphism, and Abstraction) concepts in java.
4. Create User defined Packages in Java
5. Write a program in java to set the priority of thread in order.
6. Demonstrate the strings are immutable in java and create mutable strings in java.
7. Write a program in java which demonstrates the exception caught because of invalid input.
8. Write java program to create a registration form using AWT.
9. Write a Java program to demonstrate the use of AWT components namely buttons, labels, text boxes, menus with event handling.
10. Write a program in java to copy certain text of one file to another newly created file in java using java I/O operations.
11. Write a program in java to connect java to oracle or MySql Database using JDBC drivers
12. Demonstrate the various List interfaces in java.
13. Write a program in java to show use of generic classes and methods

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

3IT07 ASSEMBLY LANGUAGE PROGRAMMING - LAB

Practical based on the syllabus of Assembly Language Programming (3IT04)

Following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on the syllabus of Assembly Language Programming (3IT04). Study experiments are highly discouraged.

1. Executing various debugging commands.
2. Write a program to manipulate the two given operands with general arithmetic operators +, -, *, /
3. Write a program in TASM to store given a number XY i.e. 0X in BX register and 0Y in CX register
4. Program for block transfer from one segment to another segment
5. Write a program in TASM to find out no. of positive and negative numbers from a given series of a signed no.
6. Program to sort the given array in ascending and descending order.
7. Program for Addition/Subtraction of 2 numbers using FAR/NEAR procedure
8. Program to find out Factorial of any given number using recursive procedure.
9. Program to add two BCD numbers.
10. Program for BCD to HEX conversion.
11. Program for HEX to BCD conversion.
12. Program to display System Date/Time.
13. Program to find whether no. is Prime or not.
14. Execute various commands on 8086 Microprocessor Trainer kit.

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

3IT08 ANALOG & DIGITAL ELECTRONICS - LAB

Practical based on the syllabus of Analog & Digital Electronics (3IT05)

Following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on the syllabus of Analog & Digital Circuits (3IT05)

1) To study the input and output characteristics of transistor connected in Common Emitter (CE) configuration.
2) Implementation of Op-amp as an inverting amplifier.
3) Implementation of Op-amp as a non-inverting amplifier.
4) Study of Astable Multivibrator using IC 555 and find the frequency of output square wave.
5) To study and verify the Truth Table of different Logic gates using TTL ICs (7400, 7402, 7404, 7408, 7427, 7432, 7486 etc.).
6) Study and verify the truth table of Half adder and Full adder using logic gates.
7) Study and verify the truth table of Half Subtractor and Full Subtractor using logic gates
8) Implementation of 4bit parallel adder using IC-7483 .

9) Study the working of Multiplexer using one of the ICs like 74151A, 74152, 74153, 74157.
10) Study the working of De-Multiplexer and Decoder using one of the ICs like74138,74154,74156
11) Study the working and Verification of truth table of SR, JK, T and D Flip Flops.
12) Implementation of 3 bit asynchronous counter using JK Flip Flop.
13) Implementation of 3 bit Shift Register using D Flip Flop.

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

3IT09 COMPUTER SKILL LAB - I

This practical lab must cover the following aspects for Python:

1. Basics for python programming that consists of the study of various data types in Python, implementation of control structures and loops, functions (pre-defined and user defined), file handling commands and functions.
2. The lab must also cover the concepts related to networking using python.
3. OOP concepts study and its programming using python libraries.
4. The lab must cover the part of UI deigning using python (Django, Flask, etc.).
5. The plotting of graphs using various libraries such as (matplotlib, seaborn, etc.).
6. The lab must also give a brief introduction regarding the a concept of machine learning or a learning algorithm implementation.
7. An introduction to the data science track can be given by conducting and including an experiment on data manipulation using (Numpy, Pandas, etc.)

The following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on Python, R etc.

1. To study the various data types in Python.
2. To study dictionaries, data frames and tuples in Python
3. To study the control structures and loops in Python.
4. To study the various Functions (pre-defined and User Defined) in Python.
5. To study the various File handling and i/o in Python.
6. To study the concepts related to Networking in Python.
7. To study various OOP concepts using Python.
8. To study UI design using various libraries in Python.
9. To Study Plotting of Graphs using the various libraries in Python.
10. To study basic data manipulation using Python Libraries.
11. To study a learning algorithm using Python.
12. Mini Project (based on all the above mentioned concepts)

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

SEMESTER - IV

4IT01 COMPUTER ORGANIZATION & ARCHITECTURE

Course Objectives :

- How Computer Systems work & the basic principles.
- Instruction Level Architecture and Instruction Execution.
- The current state of art in memory system design.
- How I/O devices are accessed and its principles.
- To provide the knowledge on Instruction Level Parallelism.
- To impart the knowledge on micro programming.
- Concepts of advanced pipelining techniques.

Course outcomes :

- Ability to understand the basic structure of computer including functional units, addressing modes, stacks, queues, subroutines, etc.
- Ability to understand the basic processing unit of computer, execution of a complete instruction.
- Ability to understand about input/output organization of computer including interrupt, DMA, buses, interfaces, etc.
- Ability to understand the concepts of RAM, ROM, cache memory, virtual memory.
- Ability to understand number representation, Booth's algorithm, different peripheral devices.

Unit-I Basic structure of computer: hardware & software, program sequencing. concept of memory locations & address. Main memory operation. instructions & instruction sequencing. Addressing modes. basic I/O operations. Stacks. queues & subroutines.

Unit-II Processing Unit: fundamental concepts. execution of a complete instruction. hardwired control, performance consideration. Micro-programmed control; microinstructions.

Unit-III I/O organization: accessing I/O devices, interrupts, direct memory access, bus arbitration: centralized and distributed. I/O hardware: processor bus (Synchronous & Asynchronous).

Unit-IV Memory Unit: basic concepts, semiconductor RAM memories, internal organization, static & dynamic RAMs, ROMs. speed, size & cost considerations.

Unit-V Cache memories: performance considerations. Virtual memories, address translation. Multiprocessor: The Use of Multiprocessors, Symmetric Multiprocessor and Clusters.

Unit-VI Arithmetic; number representation. Design of fast adders, signed addition and subtraction. Multiplication of positive numbers, sequential multiplication, fast multiplication, Booths' algorithm for multiplication, integer division, restoring and non-restoring division.

Text-Books:

1. "Computer Organization" 5th Edition by V.Carl Hamacher & S.Zaky, McGraw-Hill (ISE).
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.

References:

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill.
3. Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.
4. "Structured Computer Organization", 5th Edition by Tenanbaum A.S., Pearson Education.

4IT02 DATA COMMUNICATION & NETWORKING

Course Objectives :

- To understand the fundamental concepts of computer networking.
- To familiarize the students with basic taxonomy and terminology of data communication.
- To introduce the students to advanced networking concept and network reference models.
- To lay foundation for understanding the students to network design, simulation, modeling and analysis.

Course Outcomes :

- On completion of the course learner will be able to-
- Understand the principles and fundamental concept of computer networks.
- Understand and explain data communication system with its techniques and applications.
- Identify various error detection and correction techniques in data transmission.
- Evaluating the network addresses and learning routing mechanism protocols.
- Design TCP connection and analyze upper OSI layer functions and services.
- Explore the network design and its applications to digital world.

UNIT-I: Introduction (Hours: 06)

Types of Network; Network Topologies; OSI Vs TCP\IP Model; Network Devices: Bridge, Switch, Router; Transmission Medium: Guided media, Unguided media; Time and Frequency Domain, Types of Signals: Analog, Digital, Composite, Periodic, Aperiodic Signal.

UNIT-II: Data Encoding and Multiplexing (Hours: 06)

Data conversions: Digital-to-Digital, Analog-to-Digital, Digital-to-Analog; Configuring DTE-DCE Interface, Manchester and Differential Manchester encoding; Shannon Capacity; Multiplexing: FDM, WDM, TDM; Multiplexing Application: Mobile Telephone System.

UNIT-III: Data Link Layer (Hours: 06)

Design Issues: Services to Network Layer, Framing, Flow control; Error Control: Parity Bits, Hamming Code, Cyclic Redundancy Check (CRC); Data Link Protocols: Synchronous and Asynchronous Protocols, CSMA/CD, WAN Connectivity Protocols: PPP and HDLC.

UNIT-IV: Addressing and Routing (Hours: 06)

Switching Techniques, IPv4 Addressing Scheme, IPv6 addressing Overview, Subnetting, Evaluating Network Address by router, Routing Protocols: Distance Vector, Link State; Ethernet Networks: Token Ring, FDDI.

UNIT-V: Networking and Services (Hours: 06)

Transport Layer Services, TCP/UDP Protocols, TCP Segment, TCP Connection, Upper OSI Layers: Session Layer, Presentation Layer, Application Layer functions and services.

UNIT-VI: Network Design and Applications (Hours: 06)

Network Layout, Network Design Metrics, Network design traceability, WWW, DNS, Voice over IP; Introduction and Comparison of mobile network system and its applications: 2G, 3G, 4G.

Text Books:

1. Fourauzan B., "Data Communications and Networking", 5th Edition, Tata McGraw-Hill, Publications.
2. Andrew S. Tenenbaum, “Computer Networks”, PHI, ISBN 81-203-2175-8.

Reference Books:

1. William Stallings, “Data & Computer Communications”, (6/e) Pearson Education.
2. Wehrle, Klaus, Gunes, Mesut, Gross, James, "Modeling and Tools for Network Simulation", Springer, ISBN: 978-3-642-12330-6
3. J.Freey, “Computer Communication & Networks”, AEW Press.
4. Bhushan Trivedi, “Computer Networks” OXFORD.

4IT03 OPERATING SYSTEM

Course Objectives :

- To introduce basic concepts and different types of operating systems, concept of process and thread.
- To understand the scheduling of processes and concurrency control with synchronization
- To understand the concept deadlock and basic Memory Management
- To understand Virtual Memory management concepts.
- To understand the concept of File System management.
- To understand the concept of Disk Management, Scheduling and Protection and Security.

Course Outcomes :

- Fundamental understanding of the role of Operating Systems, concept of a process and thread.
- To apply the concept of process scheduling and concurrency control to different scenarios.
- To understand and apply the concept deadlock and basic Memory Management
- To realize virtual memory management schemes.
- To realize the concept of File system management.
- To understand and apply the concept of Disk Management, Scheduling and Protection and Security.

Unit I :

Introduction: Operating System (OS definition),OS Evolution, OS Services, Process Concept ,Process Scheduling ,Operations on Processes, Cooperating & Inter-process Communication, Threads: Multithreading Models, Threading Issues ,Java Threads. (6 Hrs)

Unit II : CPU Scheduling: Concepts, Scheduling Criteria, Scheduling Algorithms, Process Synch.: The Critical Section Problem ,Synchronization Hardware, Semaphores, Monitors. (6 Hrs)

Unit III : Deadlocks: Definition& Characterization. Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock. Memory Management: Background, Swapping, Contiguous Memory Allocation schemes ,Paging, Segmentation. (6 Hrs)

Unit IV : Virtual Memory: Background, Demand Paging, Process Creation, Page Replacement policies, Allocation of Frames, Thrashing. (6 Hrs)

Unit V : File-System Interface: Directory Structure, File-System Mounting, File Sharing, Protection, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods Free-Space Management, File Recovery. (6 Hrs)

Unit VI: I/O Systems: Overview, I/O Hardware, Application I/O Interface , Kernel I/O Subsystem, Transforming I/O to Hardware Operations. Disk Scheduling ,Disk Management ,Swap-Space Management ,RAID Structure. (6 Hrs)

Text Book:

Avi Silberschatz, P.B.Galvin, G.Gagne: "Operating System Concepts" (6th Edn) John Wiley & Sons Publication.

Reference Books:

1. A.S Tanenbaum "Modern Operating Systems" Pearson Education.
2. William Stallings "Operating Systems" Prentice-Hall.
3. D M Dhamdhere "Operating Systems" Tata McGraw-Hill.

4IT04 DATA STRUCTURE

Course Objectives :

- To understand the role of Data Structure in memory management
- To acquire knowledge of different types of data structures like: array, types of array, linked list, stacks, queues, trees, and their memory representation
- To learn the fundamental concept of data structure and emphasize the importance of it in developing and implementing efficient algorithms
- To analyze complexity of algorithms in terms of time and memory space
- To Understand data structure, types of data structure and their common applications
- To study the use of algorithms to perform the operations on data structure such as traversing, insertion, deletion, searching, sorting and merging
- To understand importance and applications of linear and non-linear data structure
- To obtained knowledge and skill of Sorting Methods such as: Bubble Sort, Quick Sort, Merge Sort, Selection Sort and Bucket Sort
- To Learn and acquire knowledge about the use of Tree and Graph in applications

Course Outcomes :

- Define fundamental features of array, linked-list, stack, queue, tree and graph
- Write the algorithms to perform various operations such as: Search, Insertion, Deletion, Sort etc
- Implement algorithms for various operations on linear and non-linear data structure
- Classify the linear data structures such as Array, Linked-List, Stack, Queue and non-linear data Structures such as Tree and Graph with their applications
- Implement linear data structures: Array, Linked-list, Stack, Queue using suitable language C,C++
- Implement non-linear data structure: Tree, Graph using C or C++
- know different types of sorting methods and their algorithms
- Choose appropriate algorithm for Searching 9: Perform operations of traverse, insertion, deletion.

UNIT I :

Algorithms and Linear Data Structure: Array Introduction: Data, Data Structure and their types. Algorithm and their Complexity, String processing operations, Pattern matching algorithms: fast and slow. Array: Types of array, memory representation of array, Algorithm and operations on Array: traversing, searching, insertion, deletion. Applications (7 Hrs)

UNIT II:

Algorithms and Linear Data Structure: Linked List (LL) Linked List: Features, Representation of Linked List in memory using array, Types of LL, Algorithms and operations onto LL: traversing, insertion, deletion, searching & their implementation, Applications (5 Hrs)

UNIT III

Linear Data Structure: Stack and Queue Stack: Definition, Memory representation of Stacks using array and Linked List. Operations on to Stack: Push and Pop. Stack Applications: Recursion, Solve arithmetic expressions, tower of Hanoi etc. Queue: Definition, Memory representation of Queue using array and Linked List, Types of queue, Operations on queues: Traversing, Insertion, Deletion, Searching. Applications (6 Hrs)

UNIT IV

Sorting, Sorting Methods and its Algorithms Simple Sorting Algorithms, Bubble Sort, Quick Sort, Insertion Sort, Selection Sort, Heap Sort, Merge Sort, Bucket Sort and their Applications. (6 Hrs)

UNIT V :

Non-Linear Data Structure: Tree Trees: Terminology, Types, Binary trees and their representation in memory, traversing in binary trees using stacks. Binary Search Trees, searching, inserting and deleting nodes in binary trees, Heap tree, Path length & Huffman's algorithm, Spanning Trees, Basic concepts of Kruskal's and Prim's Algorithm, B+ tree. (6 Hrs)

UNIT VI :

Non-Linear Data Structure: Graph Graph: Definitions, Sequential and Linked-list representation of Graphs, Warshalls' algorithm, Bridges in graph, Johnsons algorithm. Graph Traversals: Breadth First Search, Depth First Search, Topological Sort, Shortest Path Algorithms: Unweighted Shortest Paths, Basic concepts of Dijkstra's Algorithm. (6 Hrs)

Text Books:

1. Mark Allen Weiss, 'Data Structures and Algorithm Analysis in C++', 3/e, Florida International University, ISBN 0-321-37531-9
2. Seymour Lipschutz, 'Theory & Problems of Data Structures', Schaum's Outline Series (Mc Graw-Hill) International Editions.

Reference Books:

1. John Hubbard: 'Schaum's Outline DataStructure with C++', ISBN-13: 978-0071353458
2. Jean-Paul Tremblay, Paul G. Sorenson, P. G. Sorenson, 'An Introduction to Data Structures With Applications', (McGraw-Hill Computer Science Series), ISBN-13: 978-0070651579
3. Ellis Horowitz, Sartaj Sahni, Rajasekaran , 'Computer Algorithms/C++', 2nd edition, 2019.

4 IT 05 SOCIAL SCIENCES & ENGINEERING ECONOMICS

SECTION - A

Unit I : Study of Social Science : Importance to Engineer, salient features of Indian constitution. Fundamental Rights and Duties. Directive Principles of State Policy. (8)

Unit II : Indian Parliament : Composition and powers, President of India : Election and Powers. Council of Ministers and Prime Minister (8)

Unit III : Impact of Science and Technology on culture and Civilization. Human Society: Community Groups. Marriage and Family: Functions, Types and problems. (8)

SECTION - B

Unit IV: Production : Factors of production, Laws of return, Forms of Business Organisation. (8)

Unit V : Banking : Functions of Central and Commercial Banks. Introduction to GST, Market : Forms, perfect, imperfect competition and monopoly. (8)

Unit VI: Nature and scope of Economics : Special significance of Economics to Engineers. Economics of Development : Meaning, Characteristics of under development, obstacles to Economic growth and vicious circle of poverty. (8)

Books Recommended :

1. Pylee M.V. : Constitutional Govt. in India, S.Chand and Co.
2. C N Shankar Rao: Sociology, S.Chand and Co.
3. Dewett and Varma J.D. : Elementary Economic Theory, S.Chand and Co.
4. A.N.Agrawal : Indian Economy, Problem of Development and Planning (Wiley Eastern Ltd), New Delhi.
5. S.K.Mishra : Indian Economy, Its Development Experience. Himalaya Pub.House, Bombay.
6. E.Kuper : Economics of W.R. Development, McGraw Hill Co.,
7. Brij Kishore Sharma. : The Constitution of India, PHI.
8. Mahajan : The Constitution of India, S.Chand, New Delhi.
9. Maclaver and Page : Principle of Sociology.
10. Davis K. : Human Society
11. Datt R.K. : Indian Economy, S.Chand and Comp. New Delhi P.M.Sundharam
12. Dhingra I.C. : Indian Economy
13. Jemes L.E., R.R.Lee : Economics of W.R.Planning, McGraw Hill Co.

4IT06 DATA COMMUNICATION & NETWORKING - LAB

Practical based on the syllabus of Data Communication & Networking (4IT02)

Following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on the syllabus of Data Communication & Networking Lab (4IT02)

1. To study computer Networks and Its topology.
2. To study and implement digital –to- digital conversion, analog-to-digital conversion, digital to analog conversion
3. To implement and check flow control in DLL
4. To Study and Implement Asynchronous Protocols
5. To Study and Implement synchronous Protocols
6. To implement packet switching in network
7. To implement Circuit switching in network
8. To Demonstrate and study working of various networking devices like switch,router etc

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

IT07 OPERATING SYSTEM - LAB

Practical based on the syllabus of Operating System (4IT03)

Following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on the syllabus of Operating System (4IT03)

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

1. To study basics of shell programming.
2. To study the creation of process using fork system call.
3. To implement FCFS scheduling algorithm.
4. To implement SJF scheduling algorithm.
5. To implement Priority scheduling algorithm.
6. To implement Round Robin scheduling algorithm.
7. To implement Best Fit algorithm of memory management.
8. To implement First Fit algorithm of memory management.
9. To implement FCFS disk scheduling algorithm.
10. To implement SCAN disk scheduling algorithm.
11. To implement the process synchronization using semaphore concept.

4IT08 DATA STRUCTURE - LAB

Practical based on the syllabus of Data Structure (4IT04)

Following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on the syllabus of Data Structure (4IT04)

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

1. Program to implement Bubble Sort.
2. Program to implement Linear Search & Binary Search
3. Program to perform various operations on Linked List.
4. Program to perform various operations on Stack.
5. Program to reverse the elements in the stack using recursion.
6. Program to perform various operations on Queue.
7. Program to convert a given infix expression into its postfix Equivalent.
8. Program to create a binary search tree of characters.
9. Programs for implementing the following sorting methods to arrange a list of integers in ascending order:
    a. Insertion Sort
    b. Selection Sort
10. Program to implement graph traversal algorithms:
    a) Depth first traversal b) Breadth first traversal

4IT09 COMPUTER SKILL LAB - II

The following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on Raspberry Pi with Adrino etc.

1 Familiarization with Raspberry Pi and perform necessary software installation.
2 To interface LED with Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3 To interface Push button/Digital sensor (IR/LDR) with Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4 To interface DHT11 sensor with Raspberry Pi and write a program to print temperature and humidity readings.
5 To interface OLED with Raspberry Pi and write a program to print temperature and humidity readings on it.
6 To interface Bluetooth with Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
7 To interface Bluetooth with Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
8 Write a program on Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
9 Write a program on Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
10 To install MariaDB database on Raspberry Pi and perform basic SQL queries.
11 Connect to MariaDB through Python 3 program
12 Explore Scientific Python 3 ecosystem and perform image processing with NumPy and Matplotlib

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

REFERENCE BOOKS:

1) "Raspberry Pi by Example"by Ashwin Pajankar: PACKT PUBLICATIONS
2) "Raspberry Pi Amazing Projects " by Ashwin Pajankar: PACKT PUBLICATIONS
3) "20 Easy Raspberry Pi Projects: Toys, Tools, Gadgets, and More!" By : Rui Santos , Sara Santos No Starch Press
4) " IoT Fundamental" by Devid Hanes Publishers: CISCO
5) "Raspberry Pi Cookbook for Python Programmers" by Tim Cox Publishers: PACKT

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SYLLABUS FOR BE ELECTRICAL ENGINEERING / (ELECTRICAL &ELECTRONICS ENGINEERING) / ELECTRICAL ENGINEERING (ELECTRONICS & POWER) SEMESTER PATTERN CHOICE BASED CREDIT GRADE SYSTEM

3EE01 /3 EP01 /3EX01 ENGINEERING MATHEMATICS - III

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Demonstrate the knowledge of differential equations and partial differential equations, applied to electrical engineering systems.
2. Apply Laplace transform to solve differential equations.
3. Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.
4. Apply Z Transform to solve of various Linear Difference equations with constant coefficients.
5. Apply the knowledge of vector calculus to solve physical problems.
6. Demonstrate the basic concepts of probability and statistics.

SECTION-A

UNIT-I:

Ordinary Differential Equations: - Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. Applications to electrical circuits. (7)

UNIT-II:

Laplace Transforms: definition, standard forms, properties of Laplace transform, inverse Laplace transform, Laplace transform of some basic functions, initial and final value theorem, convolution theorem, Laplace transform of Periodic Function, Impulse Function, Unit Step Function. Solution of linear differential equation using Laplace transform. (7)

UNIT-III:

a) Partial differential equation of first order and first degree of following type-

(i) f (p, q) = 0; (ii) f (p, q, z)=0; (iii) f (p, q, x, y) = 0; (iv) Pp + Qq =R (Lagrange's Form); (v) Clairaut form Z = px + qy + f(p, q)

b) Fourier transforms- Definition, standard forms, inverse Fourier transform Fourier sine and Fourier cosine transforms and integrals. (7)

SECTION-B

UNIT-IV:

a) Difference Equation:- solution of difference equations of first order, solution of difference equations of higher order with constant coefficient.

b) Z-transform: Definition, standard forms, Z-transform of impulse function, Unit step functions, Properties of Z- transforms (Linearity, shifting, multiplication by k, change of scale), initial and final values, inverse Z-transforms (by direct division and partial fraction), Solution of difference equation by Z-transforms. (7)

UNIT-V:

Vector Calculus: - Scalar and Vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, expansion formulae (without proof), Irrotational and Solenoidal vector fields, Line Integral, Stokes and Divergence Theorem. (7)

UNIT-VI:

Statistics & Probability: Axioms, conditional probability, Bay's theorem, mathematical expectations, probability distributions: Binomial, Poisson and Normal. (7)

Books Recommended:

1. Elements of Applied Mathematics by P. N. Wartikar and J. N. Wartikar
2. Advancing Engineering Mathematics by E. K. Kreyzig.
3. Advance Engineering Mathematics by B. S. Grewal
4. Integral Transforms by Goyal & Gupta.
5. Statistical Methods by S.G. Gupta

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3EE02/3 EP02/3EX02 ELECTRICAL CIRCUIT ANALYSIS

Course Outcomes:

After completing this course studentwill be able to:

1. Analyze electric and magnetic circuits using basic circuital laws
2. Analyze the circuit using Network simplification theorems.
3. Solve circuit problems using concepts of electric network topology.
4. Evaluate transient response of different circuits using Laplace transform
5. Evaluate two-port network parameters and network functions

Unit I:

a] Terminal Element Relationships: V-I relationship for Dependent &Independent , Voltage and Current Sources., Source Transformations. Source Functions: unit impulse, unit step, unit ramp and interrelationship, sinusoidal input, generalized exponential input.

Magnetic Circuits: concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit, Analysis of series and parallel magnetic circuits.

b] Basic Nodal and mesh Analysis: Introduction, Nodal analysis, super node analysis, mesh analysis, super mesh analysis.

Unit II:

Network Theorems: Superposition theorem, Thevenin'stheorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Substitution theorem, Compensation theorem, Tellegen's theorem

Unit III :

Graph Theory and Network Equation:-Graph of a network, Trees and loops, Tie-set and cut set matrix of a network, Network equilibrium equations, duality-network transformation.

Unit IV:

a] **Transformation of a Circuit into s-domain:** LaplaceTransformed equivalent of inductance, capacitance and mutual inductance, Impedance and admittance in the transform domain, Node Analysis and Mesh Analysis of the transformed circuit. Complete Solution ofLinear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits-for step Inputs. Natural Response, Transient Response, Determination of initial conditions.

Unit V :

Two Port Networks: Two port networks: Open circuit impedance parameters, Short circuit admittance parameters, Transmission parameters, Hybrid parameters, Condition for reciprocity and symmetry of a two port network, Interrelationship between parameters, Interconnection of two port networks , Input impedance in terms of two port network parameters, Output impedance, Image impedance.

Unit VI :

Network functions: Ports and terminal pairs, Network functions, poles and zeros, Necessary conditions for driving point function, Necessary conditions for transfer function. Applications of network analysis in driving network functions, positive real functions, driving point and transfer impedance function.

Text Book: Network Analysis, M.E. Van Valkenburg, PHI, 2005.

Reference Books:

1. Circuits & Networks – Analysis, Design & Synthesis by M.S.Sukhija, T.K.Nagasarkar, OxfordUniversity Press, 2010.
2. Circuit and Network Analysis, SudhakarShyammohan, Tata Mc Graw Hill, 2005.
3. Network Analysis, P. Ramesh babu, SciTech Publications, Chennai, 2009.

3EE03/3 EP03/3EX03 ELECTRICAL MACHINE - I

Course Outcomes:

After Completing this course, students will be able to:

1. Explain the construction and working of DC Machines.
2. Illustrate the different Characteristics, types, their applications and parallel Operation of D.C. Generators.
3. Demonstrate the various characteristics, starting, speed control and braking operation on DC motors
4. Analyze the performance of DC machines by conducting the various tests on it.
5. Determine the parameters of equivalent circuits, performance parameters of single phase transformer and merits & demerits of autotransformer
6. Explain the construction, working, different connections, applications and testing of three phase transformer.

Unit I :

D.C. Machines: Construction, Principle of Operation, EMF Equation, Torque Equation. Armature winding – Lap, wave, single layer, double layer. Armature Reaction and commutation, method of improving commutation.

Unit II :

D.C. Generators: Types, Characteristics and Applications of D. C. Generators, Parallel Operation of D.C. Generators, Introduction to testing of D. C. Generators as per Indian standard.

Unit III :

D.C. Motors: Types, Characteristics & Modified Characteristics, Applications of D.C. Motors. Starting, Electric Braking, Speed Control of DC Motors. Losses, efficiency and testing of DC Motors.

Unit IV :

Single phase Transformer: Working Operation, EMF Equation, and separation of core losses in to its component. Equivalent Circuit, Parallel Operation. Open Circuit, Short Circuit & Sumpner's test on transformer as per Indian standard. Single phase Autotransformer: - construction, working, merits, demerits and its application.

Unit V :

Three Phase Transformer: Construction, Working, Types, connections, vector group connections, open delta Connection, OC, SC, Heat run test, load test, magnetic balance, vector group test on three phase transformer.

Unit VI :

Three Phase Transformer: Three-winding transformer, On load & Off load tap changers, Scott Connection, Power transformer and Distribution transformer. Waveforms of no load current & inrush current phenomenon.

Text Book:

Electrical Machines by D P Kothari & I J Nagrath Published by Tata McGraw-Hill Book Comp. New Delhi.

Reference Books:

1) C. Dawes: Electrical Engineering, Vol.I: Direct current (IV Edition), (McGraw Hill Book Company)
2) H. Cotton: Advance Electrical Technology, (Wheeler publication)
3) Indian Standard Guide for testing DC Machine. IS: 9320-1979, (Indian Standards Institution, New Delhi.)
4) Indian Standard Specification for safety transformer. IS: 1416-1972, (Indian Standards Institution, New Delhi.)

3EE04/3 EP04 – ENERGY RESOURCES AND GENERATION

Course Outcomes:

A student, on completion of this course, will be able to:

1. Explain the operation of Thermal, Hydro, Nuclear and Diesel power plants.
2. Summarize solar energy conversion, solar radiation measuring instruments, wind energy conversion and their applications.
3. Outline the principle and operation of fuel cells, ocean & tidal energy conversion, and other non-conventional energy resources.
4. Determine the various factorsand curves related to electrical load & generating plant.

Unit I:

Conventional and non conventional energy sources, Indian Energy Scenario.

Thermal and hydro power plant: Layout of Thermal power plant, Selection of site, working of various parts: Economizer, air preheater, condenser, cooling tower, ash &coal handling plant, advantages & disadvantages

Layout of Hydro power plant, classification of hydro power plant according to available head, nature of load, functions of different components and their working, mini and micro hydro-electric power generation, advantages & disadvantages.

Unit II :

Nuclear and Diesel power plant: nuclear fission and fusion, Layout of Nuclear power plant, Selection of site, Functions of different components of nuclear plant, types of nuclear reactors , advantages & disadvantages of different nuclear reactors, nuclear waste disposal., safety measures.
Layout of Diesel power plant, functions of different components of diesel plant, advantages & disadvantages.

Unit III :

Solar Energy and its measurement: Solar cell, array & module, Solar constants, solar radiation at earth's surface, Solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surface, principle of solar energy conversion in to heat, types of solar collectors, energy balance equation and collector efficiency.

Unit IV:

a]Fuel cells: Chemistry applied to fuel cells, principle and operation ,classification and types of fuel cells, performance characteristics of fuel cells, classification of fuel cell system.

b]Wind energy :Basic principle of wind energy conversion, wind data and energy estimation, selection of site ,basic components of wind energy conversion system ,classification of WEC systems ,generating system, applications of wind energy.

Unit V :

Ocean, Tidal & Other non-conventional energy resources: Ocean energy resources, ocean energy routes, ocean thermal energy conversion, basic principle of tidal power, components of tidal power plants, operation methods of utilization of tidal energy, estimation of power and energy in single and double basin tidal system,. Operating principles of energy from biomass, energy from biogas, geothermal energy, MHD power generation, energy from urban and rural waste.

Unit VI :

Load-Generation factors: connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor, types of loads, load curve, chronological load curve, load duration curve, energy load curve, energy duration curve, load survey, base load and peak load station.

Text Book: Generation of electrical energy by B.R.Gupta, Eurasia Publishing House, New Delhi.

Reference Books:

1. Non conventional energy resources. By G.D.Rai, Khanna Publishers New Delhi
2. Solar energy by S.P.Sukhatme Tata McGraw Hill Publication
3. Principles of Power System by V.K.Mehta, S.Chand publication.
4. Conventional energy technology by S.B.Pandya, Tata McGraw Hill Publication.

3EE05/3 EP05ELECTRONIC DEVICES AND CIRCUITS

Course Outcomes:

After successfully completing the course, the students will be able to :

1. Demonstrate the knowledge of semiconductor physics and PN Junction Diode
2. Analyze the rectifier and regulator circuits.
3. Analyze the operational parameters of BJT
4. Analyze various multistage amplifier circuits
5. Demonstrate the knowledge of JFET, MOSFET, UJT and their operational parameters

UNIT-I:

P-N Junction diode theory, Energy bands in intrinsic and extrinsic silicon, carrier transport, diffusion current , drift current, mobility and resistivity, generation and recombination of carriers, PN junction diode , zener diode, zener diode as voltage regulator, Numericals based on voltage regulator (line and load regulation, Numericals based on resistivity, conductivity, mass action law)

UNIT-II:

Half wave, full wave center tapped full wave and bridge rectifier. Filters-C, LC and their analysis, clipping and clamping, Numericals based on clipping and clamping

UNIT-III:

Theory and Analysis of Bipolar Junction transistor, 'H' Parameter, methods of biasing, their needs, 'Q' and stability factors, compensation techniques.

UNIT-IV

Study of typical transistor amplifier circuits i) Emitter follower, ii) Darlington emitter follower. iii) Bootstrap emitter follower, iv) RC coupled amplifier, v) Transformer coupled amplifier, vi) Cascaded amplifier, vii) Direct coupled amplifier, viii) Cascade stage.

UNIT-V :

FETs (JFET & MOSFET): Types, Characteristics and parameters (u, gm &Rds), Applications of FET amplifiers, UJT: Characteristics, working, UJT as relaxation oscillator.

UNIT-VI :

Theory, construction and applications of Schottky diode, Tunnel diode, Varactor diode, Selenium diode, LED, Photo diode, PIN diode, photo-transistor.

Text Book: Millman's Electronic Devices & Circuits by J.Millman, C.Halkias, Satyabrata Jit TMH 3rd ed, 2nd reprint 2011.

Reference Books:

1. Electronic Devices and Circuits 5/e – David Bell Oxford University Press
2. Microelectronic Circuits 5/3 – Sedranad Smith Oxford University Press
3. Boylestad R. and "Electronics Devices & Circuits", Prentice Hall of India Private Limited, New Delhi (Fifth Edition), 1993.

3EE06/3 EP06/3EX06 ELECTRICAL CIRCUIT ANALYSIS LAB

Minimum eight experiments based on the syllabus content of 3EP02 Electrical Circuit Analysis. The intensive list of experiment is given below.

1. Verification of output response of series R-C circuit for step input
2. Study of dot convention and determination of
   A) Mutual inductance
   B) Coupling coefficient of b transformer
3. Verification of Mesh and Node analysis.
4. Verification of Superposition theorem.
5. Verification of Thevenin's theorem.
6. Verification of Maximum Power Transfer theorem.
7. Verification of reciprocity theorem.
8. Study of Milliman's theorem& verification.
9. Verification of Norton's theorem.
10. Determination of ABCD parametersT-network &Π-network.
11. Study of Tie set and Cut set schedule for a given network.
12. MATLAB simulation for o/p verification of any theorem.
13. Determination of Z and Y parameter.
14. Determination of hybrid parameter.

3EE07/3 EP07/3EX07 ELECTRICAL MACHINES - I LAB.

Minimum eight experiments based on the syllabus content of 3EP03Electrical Machines – I.

The indicative list of experiments is given below.

1. Plot the OCC of DC generator and find its critical resistance and critical speed.
2. To study the build-up of DC shunt generator, calculate critical resistance at different speeds.
3. Plot/Compare: External, Internal Characteristics of DC Shunt/series/compound generator.
4. Calculate the efficiency and voltage regulation of DC generator by the direct load test.
5. Speed Control of DC Shunt motor by armature control & Field Control method.
6. Perform the direct load test on DC series/shunt/compound motor to plot its performance characteristics, and determine its efficiency and speed regulation.
7. Conduct the Swinburn's test on DC machine to estimate its performance at any desired load condition.
8. Conduct the Hopkinson's test on DC Machine to analyze its performance.
9. Perform Electric Braking Operation on DC shunt Motor.
10. Conduct the Polarity test and Ratio test on transformer
11. Calculate the Equivalent circuit parameters of single-phase transformer by performing OC & SC test on itand determine its efficiency and voltage regulation.

12. Perform the direct load test on single phase/three phase transformer and determine its efficiency and voltage regulation.
13. Conduct back to back test (Sumpner's test)on two single phase transformers and determine the temperature rise.
14. Conduct the magnetic balance test on three phase transformer.
15. Conduct the vector group test on three phase transformer.
16. Conversion of three phase to two phase supply system using Scott Connection
17. Capture the waveform of inrush current of single phase/three phase transformer using DSO.

Reference:

S.G.Tarnekar, P.K.Kharbanda, S.B.Bodkhe, S.D.Naik and D.J.Dahigaonkar"Laboratory Courses in Electrical Engineering", S. Chand & Co. New Delhi, 2013.

3EE08/3 EP08/3EX08 ELECTRONIC DEVICES & CIRCUITS LAB

Minimum eight experiments based on the syllabus content of 3EP05Electronic Devices & Circuits. The intensive list of experiment is given below.

1. To study and verify V-I characteristics of semiconductor diode
2. To study and verify V-I characteristics of Zener diode.
3. To verify the performance of half wave rectifier circuit with and without filter.
4. To verify the performance of full wave bridge rectifier circuit and determination of load regulation.
5. To verify the performance of Zener voltage regulator.
6. To verify characteristics of bipolar junction transistor
7. To study and perform C-E amplifier gain with variation of load resistance.
8. To study and verify the characteristics of FET
9. To study UJT as a relaxation oscillator
10. To study phase shift oscillator & determine frequency of oscillation
11. To study characteristics of MOSFT
12. To study clipper circuits using diodes
13. To study clamper circuits using diodes
14. To study and verify operation of cascade amplifiers
15. To verify operation of transistor as a switch

3EE09/3 EP09/3EX09 ELECTRICAL TECHNOLOGY - LAB

Perform minimum Eight practicals / demonstration from the following list and prepare the report as a term work for this laboratory.

1. Introduction to standard symbols used in wiring diagrams
2. Introduction to different wiring accessories.
3. Demonstration of different types of wirings eg. Domestic wiring, commercial wiring, Industrial wiring.
4. Connection of Staircase wiring, Godown wiring, fluorescent lamp. Ceiling fan, air cooler etc
5. Domestic wiring diagrams
6. Connections of switch board, MCB and energy meter
7. Testing and electrical Maintenance of domestic appliances like lamps, electric iron, heater, geyser, air cooler, fan, microwave-oven, induction heater, etc.
8. Insulation resistance and earth resistance measurement
9. Conduct the load survey for domestic/commercial /Industrial consumers
10. Illumination system Design (selection of type and number of lamps required for any location)
11. Calculation of Energy bill for LT & HT consumers.
12. Safety precautions while working with electrical system
13. Demonstration of first aid treatment after getting electric shock.
14. Study of various components of solar power plant.
15. Design calculation of small capacity roof top solar power plant

SEMESTER – IV

4EE01/4EP01/4EX01 ELECTROMAGNETIC FIELDS

Course outcomes :

At the end of the course the student should be able to:

1. Demonstrate the basic mathematical concepts related to electromagnetic vector fields.
2. Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.
3. Apply the principles of magneto statics to the solutions of problems relating to magnetic field.
4. Apply Maxwell's equation in different forms (differential and integral) to diverse engineering problems.

Unit I :
Review of Vector Analysis: Cartesian, cylindrical and spherical co-ordinate systems, vector algebra and vector calculus. Line integral and multiple integrals. Gauss theorem.

Unit II :
Electrostatics: Coulomb's law, electric field, Gauss flux theorem in integral and differential form. Electrostatics potential, Poison and Laplace equations.

Unit III :
Electrostatics fields in dielectrics: electric dipole, polarization. P and D vectors, boundary conditions. Capacitance and electrical energy.

Unit IV :
Magnetic fields: Biot-Savart law, Ampere's law in integral and differential form. Continuity equation, time of relaxation. Vector and Scalar magnetic potential, electric current, J vector..

Unit V
Magnetic fields in materials: magnetic dipole equivalent volume and plane section curve. H vector, magnetization vector M, boundary conditions between magnetic materials, inductance, Electromagnetic Energy.

Unit VI :
Maxwell equations and wave equations: Displacement current, time varying fields and Maxwell's equations, plane uniform magnetic waves. Depth of penetration Poynting vector

Text Book: "Engineering Electromagnetics", by Hayt W.H. Tata Mc-Graw Hill publication

Reference Books:

1. Electromagnetic fields by TVS Arun Murthy S Chand & Co
2. Principles and applications of Electromagnetic fields by Plansycollin , Mc-Graw Hill Books Co.
3. Foundations of electromagnetic theory by John Reitz, Addison Wesley Pub Co.
4. Basic electromagnetic field by Herbert Neelf, Harber International education
5. Introduction to electromagnetic, Derucy and Johnson, Mc-Graw Hill Books Co.

4EE02/4EP02/4EX02 ELECTRICAL MEASUREMENTS & INSTRUMENTATION

Course Outcomes:

A student completing this course, should be able to:

1. Classify the various measuring instruments like PMMC, MI, Electrodynamometer, and Induction type instruments for measurement of current, voltage, power, and energy.
2. Demonstrate the construction & working of Instrument Transformers and special purpose meters.
3. Analyze various methods for measurement of resistance, inductance, and capacitance using AC/DC bridges.
4. Explain the working of various Digital measuring instruments.
5. Explain the generalized Instrumentation system & working of different transducers.

Unit-I: Analog Instruments - Classification of measuring instrument, Different torques in measuring instrument, Analog Ammeter, Voltmeter, Electrodynamic type Construction, ,theory of operation, torque equation, errors, merits and demerits of each type.

Unit II : Wattmeter and Energy meter-Construction, theory of operation, torque equation, errors, merits and demerits of each type.

Analysis of three phase balanced load:- Blondell's theorem, Measurement of active and reactive power in single phase and three phase circuits.

Unit III : Instrument transformers- C.T.and P.T., Importance, theory and construction, phasor diagram, causes of errors, testing, and applications.

Special Instruments- Frequency meter, Power factor meter, Phase sequence indicator, Synchroscope and Stroboscope.

Unit IV: Measurement of circuit parameters- Different methods of measurement of low, medium, high value of resistance, sensitivity and accuracy of different methods. AC and DC bridges, Wheat -stone, Kelvin, Maxwell ,Wein , Hay , De-Sauty ,Schering , Owen , Anderson's bridge.

Unit V:

Digital methods of measurements, Introduction to A/D, D/A techniques , F/V and V/F conversion techniques , Digital voltmeter (DVM), ammeter, wattmeter, multi-meter and Electronic energy meter, Sources of error, Inherent error in digital meters.

Unit VI:

Generalized Instrumentation system- characteristics of measurement and Instrumentation system. Transducers: Definition, classification, Specification, selection, loading effect, Displacement, velocity transducers, Force and torque transducers, Resistive, inductive, Capacitive, strain gauge transducers, Piezoelectric, current and voltage transducers. Elastic-members (Bellows, Bourdon tube, Diaphragm)

Text Book: A.K. Sawhney, 'Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai& Co (P) L

Reference Books:

1. E.W.Golding&F.C.Widdis, 'Electrical Measurements & Measuring Instruments', A.H.Wheeler& Co.
2. Albert D. Helfrick& William D. Cooper, 'Modern Electronic Instrumentation & Measurement Techniques', Prentice Hall of India, .
3. Joseph. J. Carr, 'Elements of Electronic Instrumentation & Measurements', III edition, Pearson Education.
4. Bouwens, A.J., "Digital Instrumentation", McGraw Hill.

4EP03 CONTROL SYSTEMS

Course Outcomes:

After completing this course, student will be able to:

1. Demonstrate the fundamental concepts of automatic Control and mathematical modeling of the Systems.
2. Determine the transfer function of control system components.
3. Analyze the time response of various systems and performance of controllers.
4. Evaluate the stability of linear systems using various methods.

Unit I : Introduction to automatic control

Open loop and closed loop system, servo-mechanisms, mathematical modeling of physical systems, transfer functions, block diagrams and signal flow graphs. Effect of feedback on sensitivity to parameter variation and reduction of the noise.

Unit II : Control System Components

Electrical / Electro-mechanical components such as A.C./D.C. servomotors, stepper motors, synchros, potentiometers, tacho-generators, encoders, their functional analysis and operating characteristics and their application.

Unit III: Time response analysis:

Time response of first and second order systems to standard inputs. Time response specifications, types of system, error analysis, error coefficients, steady state errors, dynamic error series. Approximate methods for higher order system, proportional, derivative and integral control.

Unit IV: Stability

Stability of control systems, characteristics equation, impulse response, Routh-Hurwitz stability criterion, relative stability. Root Locus: construction of root locus, determination of roots from root locus conditions on variable parameter for stability, effect of addition of poles and zeros.

Unit V: Frequency response methods

Frequency response of linear system, specification, Logarithmic frequency response (Bode) plots from transfer function for various systems. Polar plots for various systems. Estimation of approximate transfer functions from the frequency response.

Unit VI: Stability analysis from frequency response : Gain margin and Phase margin; Stability analysis from Bode plots. Nyquist criterion, Nyquist plots and stability analysis.

Books Recommended:

Text Book: Nagrath I.J., Gopal M.: Control System Engineering, Wiley Eastern.

Reference Books:

1. Control Engineering, D.Ganesh Rao, k. Chennavenkatesh, 2010, PEARSON
2. Ogata K.: Modern Control Systems, Prentice Hall of India.
3. Control Systems by K.R.Varmah TMH edition 2010
4. Linear Control Systems, Ashfaq Hussain, Haroon Ashfaq, Dhanpat Rai & co.

4EP04 NUMERICAL METHODS & OPTIMIZATION TECHNIQUES

Course Outcome:

After completing this course students will be able to

1. Solve linear and Simultaneous Equations with the help of Numerical Methods.
2. Apply various Numerical methods to fit the curve.
3. Solve Numerical differentiation, integration, and Differential Equations.
4. Solve linear, non linear and dynamic optimization problem by various methods.
5. Determine the optimum scheduling by using CPM and PERT.

Unit I:

(a) Absolute, relative and percentage errors and analysis, Solution of Algebraic and Transcendental equations: Bisection Method, False Position method, Newton Raphson methods, Successive approximation method

(b) **Solution of Simultaneous Algebraic Equations**: matrix inverse method, Gauss elimination method,Iterative method-Jacobi's Method, Gauss Seidel Method; Eigen values of a matrix.

Unit II:

(a) Curve fitting by Least Square Method, Correlations and Regression.

(b) Newton's forward and backward interpolation method, Newton's Divided Difference Method, Lagrange's Interpolation method, Interpolation with Cubic Splines.

Unit III:

Numerical differentiation by Taylor series method, Maximum and minimum values, Numerical Integration by Trapezoidal, Simpsons one third and three eight rules, Numerical solution to differential equations by Taylor Series, Euler's method, RungeKutta second and fourth order methods

Unit IV:

Basics of Optimization Techniques, Linear programming - standard form, definitions and theorems, graphical method, simplex method, two phase simplex method, balanced and unbalanced transportation problems.

Unit V:

Non linear programming: unimodal function, Fibonancci search method and golden section method, Steepest descent method, conjugate gradient method, unconstraint optimization, direct search method.

Unit VI:

Dynamic programming: multistage decision processes, principle of optimality, sub optimization, calculus and tabular method of solution, conversion of final value problem into initial value problem.

CPM and PERT: introduction, Network representation of project, critical path, Probability of completion of project, optimum scheduling by CPM, crashing of project.

Books Recommended:

Text Books:

1. Introductory Methods of Numerical Analysis; S. S. Sastry (PHI)
2. Engineering Optimization – Theory & Practice; S. S. Rao (New Age International Pvt. Ltd.)

Reference Books:

1. Mathematical Statistics by J. N. Kapoor, Tata McGraw Hill Pub. Co. Ltd
2. Numerical Methods in Engineering and Science; B. S. Grewal (Khanna Publishers)
3. PERT and CPM- Principles & Application; L. S. Srinath (Affiliated East-West press pvt. Ltd)
4. Optimization for Engineering Design - Algorithms and Examples byKalyan Moy Deb, PHI Pub.

4EE04/ 4EP05 /4EX04 ANALOG AND DIGITAL CIRCUITS

Course Outcomes:

After completing the course, students will be able to

1. Explain the principles of operational amplifiers, parameters of op-amp
2. Illustrate the linear and nonlinear applications of op-amp
3. Demonstrate the knowledge of Voltage regulator and Timer ICs
4. Describe the working of Logic families andtheir applications.
5. Demonstrate the knowledge of combinational and sequential circuits and its application

Unit I:

Introduction to IC's: Operation amplifier; Block schematic internal circuits, Level shifting, overload protection, study of IC 741 op-amp, Measurement of op-amp parameter.

Unit II:

Linear and Non-linear Application of Op-amp: Inverting and non inverting amplifiers, voltage follower, integrator, differentiator differential amplifier, op amp as adder subtractor, op amp as a log and antilog amplifier

Sinusoidal RC-phase shift and Wein bridge oscillators, clipping, clamping and comparator circuits using op-amps.

Unit III:

Other linear IC's : Block schematic of regulator IC 723, and its applications, study of 78XX, 79XX and its applications, SMPS, Block schematic of timer IC 555 and its applications as a timer, a stable, mono stable, bistable multivibrator and other applications, Operation of phase lock loop system and IC 565 PLL, its application.

Unit IV: Basic Logic Circuits : Logic gate characteristics, NMOS inverter, propagation delay, NMOS logic gate, CMOS inverter, CMOS logic gates, BJT inverter, TTL, NAND gate, TTL output, state TTL logic families, ECL circuits, composition logic families.

Unit V:

Combinational Digital Circuits: Standard gate assemblies, Binary adder, Arithmetic functions, Digital comparator, Parity check generator, Decoder / demultiplexer, Data selector / multiplexer, Encoder

Unit VI:

Sequential Circuits and Systems: Bistable Latch, Flip-Flop clocked SR,J-K, T, D type shift Registers, counter. Design using filp-flops, Ripple and synchronous types, application of counters

Books Recommended:-

Text Book: Millman, Microelectronics, 2nd Ed., McGraw Hill.

Reference Books:

1. Gayakwad, Op-Amp & LLG, 2nd Ed.
2. Malvino& Leach, Digital Principles & Applications, 4th Ed., McGraw Hill.
3. K.B.Botkar, Integrated Electronics (Khanna Publishers.)

4EE07/ 4EP06 /4EX06 ELECTRICAL MEASUREMENTS & INSTRUMENTATION- LAB

Minimum eight experiments based on the syllabus content of 4EP02 Electrical Measurements & Instrumentation. The intensive list of experiment is given below.

1. Measurements of Low resistance by using Kelvin double Bridge.
2. Measurements of Medium resistance by Ammeter Voltmeter method/Wheatstone Bridge
3. Measurement of High resistance by Loss of Charge method.
4. Measurement of Insulation resistance by using Megger

5. Measurement of unknown Inductance using Maxwell Bridge/Hay Bridge/Anderson Bridge
6. Measurement of Unknown Capacitance by Desauty Bridge/Schering Bridge
7. Measurement of frequency using Wien Bridge
8. Extension of range of ammeter using shunt/CT.
9. Extension of range of voltmeter using multiplier/PT.
10. Calibration of Wattmeter by Phantom loading
11. Calibration of energy meter to detect the error in it.
12. Measurement of active & reactive power measurement in 1 phase / 3 phase circuit.
13. Measurement of rotational speed using stroboscope
14. Conversion of non electrical quantity into its equivalent electrical quantity using proper transducer.
15. Compare the accuracy, preciseness, sensitivity of Analog & Digital Measuring Instruments.

4EP07 CONTROL SYSTEM LAB

Minimum eight experiments based on the syllabus content of 4EP03Control System. The intensive list of experiment is given below.

1. Study of Potentiometer
2. Study of A.C. Synchro and its characteristics
3. Determination of Transfer Function of D.C. Generator
4. Determination Of Transfer Function of D.C.Servomotor and Its Characteristics
5. Performance Characteristics of a D.C. Motor Angular Position Control System
6. Determination Of Frequency Response of Given R-C Network
7. Determination Of Transfer Function of A.C. Tacho-Generator
8. Experimental Study Of The Operating Characteristics of a Small Stepper Motor and Its Controller
9. Study Closed Loop PI Controller System and Its Time Response to Different Input.
10. Experimental Study of Position Control of DC Motor using Ardiuno
11. Experimental Study of Time Domain Analysis of Second Order Control System
12. Study AC Position Control System

4EE09/ 4EP08 /4EX08 ANALOG AND DIGITAL CIRCUIT LAB

Minimum eight experiments based on the syllabus content of 4EP05Analog & Digital Circuit. The intensive list of experiment is given below.

1. To Plot Frequency Response Of Non-Inverting Mode Of Op-Amp Using IC741 and Determine the Bandwidth & Maximum Gain
2. To Plot Frequency Response Of Inverting Mode Of Op-Amp Using IC741 and Determine the Bandwidth & Maximum Gain
3. To Perform Op-Amp as Differentiator Using IC741 .
4. Design The Circuit for Supplying 5V,25mA As A Low Voltage Regulator Using IC 723
5. Verification Of Truth Table Of Various Logic Gates Using ICs
6. To Study and Verify The Operation Of SR and MS ,JK Flip Flop
7. To Verify The Operation Of Multiplexer Using IC74153.
8. To Design And Verify Function Of Decade Counterusing IC 7490
9. To Verify The Truth Table Of 4 Bit Comparator
10. To Perform Op-Amp As Integrator Using IC741
11. A stable Multi-vibrator Using IC 555timer
12. To Study And Verify The Operation Of Half-Adder And Full-Adder.

4EE10/ 4EP09 /4EX09 ELECTRONIC TECHNOLOGY LAB

Perform Minimum Eight experiments / demonstration based on the following contentand prepare the report as a term work for this laboratory.

- **Study of electronic Components:** Identification of components, name, types, symbol, size, rating and application.
- **Handling Electronic Components:** Finding values and testing (using DMM), test working condition, fault detection.
- **Working with breadboards:** understanding the breadboards for component mounting, working with small circuits on breadboard

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- **Soldering:**Soldering skill tips- use of proper soldering Iron, Metal, Flux**,** Cleaning, Tinning etc., mounting components on zero PCB, testing of small circuits mounted on zero PCB. De-soldering of components
- **PCB Layout and design:** Understanding different PCBs, Working on PCB Layout (Software), PCB etching, drilling on PCB, Mounting components on PCB, Working with small circuits on PCB and their testing
- **Electronic circuit Simulation:** Familiarizing with the simulation software, simulation and result validationof simple circuit with software.

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NOTIFICATION

No. 135 /2021 Date : 2/12/2021

Subject :- Implementation of new syllabi of Semester V & VI of B.E. (C.B.C.S.) as per A.I.C.T.E. Model Curriculum from the session 2021-2022 & onwards.

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabi of **V & VI** of various branches of B.E. in Civil, Mechanical, Computer Science & Engg., Computer Engg., Information Technology, Electrical Engg., Electrical (Electronics & Power) and Electrical & Electronics Engg. (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2021-2022 and onwards in phase wise manner as per **Appendix – A** :

Sd/-
(Dr.T.R.Deshmukh)
Registrar
Sant Gadge Baba Amravati University

Appendix – A

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SYLLABUS PRESCRIBED FOR SEMESTER V & VI OF B.E. (MECHANICAL ENGG.)

SEMESTER – V

5ME01 HEAT TRANSFER

Course Learning Objectives (CLOs):

1. To provide details of heat transfer involving conduction, convention and radiation mechanisms.
2. To carry out heat transfer analysis and to demonstrate different techniques used in solving a heat transfer problem.
3. To impart basics of designing heat transfer equipment.

Course Outcome (COs) :

At the end of Heat Transfer course the student will be able to:

1. Solve steady state heat transfer problems of 1-D heat conduction with and without internal heat generation.
2. Design and to analyze the performance of extended surfaces.
3. Apply Lumped heat capacity method for analysis of unsteady state heat transfer.
4. Explain the laws of radiation and its applications.
5. Predict heat transfer coefficients for forced and free convection heat transfer applied to internal and external flow conditions.
6. Design and analyze the performance of heat exchangers using NTU and LMTD methods.

UNIT - I: Introduction, heat transfer in engineering, modes of heat transfer, basic laws of heat transfer and their basic equations. Conduction-thermal conductivity and thermal diffusivity effect of phase &temperature on thermal conductivity, one dimensional steady state heat conduction through slab, cylinder & sphere- simple and composite. Combined conduction- convection, overall heattransfer coefficient. General heat conduction differential equation. One dimensional steady state conduction with internal heat generation for infinite slab, wire & cylinder. **(**8 Hrs**)**

UNIT II : Insulations, critical radius of insulation, Conduction through extended surfaces, analysis of a uniform C.S. fin, fin efficiency, fin effectiveness, Biot number. Introduction to unsteady state heat conduction, Newton's law of cooling, lumped heat capacityanalysis. **(8 Hrs)**

UNIT III : Radiation-general concepts and definitions, black body & greybody concept. Laws of radiation - Kirchoff's Plank's, Stefan- Boltzman's, Wien's law. Concept of shape factor, emissivity factor and radiation heat transfer equation. (No numericals).Radiation errors in temperature, measurement, radiation shield. (7 Hrs)

UNIT IV: Forced convection- heat convection, forced and natural convection, boundary layer theory, hydrodynamic & thermal boundary layers, boundary layer thickness. Laminar & turbulent flow over flat

plate and through pipes & tubes (only concept, no derivation & analytical treatment). Dimensionless number and their physical significance Reynold, Prandtl, Nusselt, Grashoff number, empirical correlations for forced convection for flow over flat plate, through pipes & tubes & their applications in problem solving. **(8 Hrs)**

UNIT V: Free convection- velocity and thermal boundary layers for vertical plate, free convection over vertical cylinder and horizontal plate/cylinder (only concept, no derivation & analytical treatment). Use of empirical correlations in problem solving. Condensation & Boiling - introduction to condensation heat transfer, film & drop condensation. Boiling heat transfer, pool boiling curves. **(7 Hrs)**

UNIT VI : Heat exchanger - applications, classification, overall heat transfercoefficient, fouling. L.M.T.D. & E.N.T.U. methods, temperature profiles, selection of heat exchangers. Introduction to working of heat pipe with and without wick. **(7 Hrs)**

Books Recommended:

Text Books:-

1. Heat and Mass Transfer; R.K Rajput; S. Chand, New Delhi.
2. Heat and Mass Transfer; V.M. Domkundwar; Dhanpat Rai & Co. Delhi.
3. Heat Transfer; A. F.Mills, V. Ganesan, Pearson Publication.

Reference Books:-

1. Heat Transfer; J.P. Holman; McGraw Hill
2. Heat Transfer; P.K. Nag; TMH.
3. Heat and Mass Transfer Data book, V.M. Domkundwar, Dhanpat Rai & Co.
4. Heat and Mass Transfer Data book; C.P. Kothandaraman; New age International.

5ME02 METROLOGY & QUALITY CONTROL

Course Learning Objectives:

1. To study generalized production technology, applications, general configuration and functional elements of inspection instruments.
2. To study about quality in production and services and quality management.
3. To study application of non destructive test for increasing productivity and efficiency of the work.
4. To study design and applications of various gauges and comparators used in inspection.
5. To study various techniques for the inspection of gears and threads.
6. To study various techniques for angular measurement, surface texture measurement, and geometric features measurement.
7. To study advance inspection techniques CMM, profile projector etc.

Course Outcomes:

1. Create & apply the concept of inspection, quality control and its importance to industry.
2. Demonstrate the skills of controlling various out of control processes using statistical quality control tools.
3. Understand the importance of improving production and productivity using work study approach.
4. Apply the knowledge of various measurement standards and techniques in the industry to measure various parameters related to metrology.

UNIT I : Concept of quality and quality control, quality of design and quality of conformance, Quality characteristics, Cost of quality & Value of quality, Specification of quality, quality control & inspection.
Concept of TQM & Quality assurance, Concept of variation, variable and attribute data, Frequency distribution, Measures of Central tendency - Mean, mode & median, Measures of dispersion. -Range, std.deviation & variance. (8 **Hrs**)

UNIT II : Concept of universe and population, Normal distribution curve; Control charts for variables, process capability, Control charts for attributes; comparison between variable charts and attribute charts; precision & accuracy, Sampling plans,Operating Characteristic curve, Quality circle (7 **Hrs**)

UNIT III : Introduction to Non-Destructive testing, Ultrasonic testing, X-ray or Radiography Testing, Liquid Penetrant testing, Magnetic Particle Testing, Eddy current testing, it's applications, Advantages & Disadvantages. (7 **Hrs**)

UNIT IV : Standards of measurements: line standards, end standard, wave length standard. Limits, fits and gauges: terminology of limits, Fits and gauges, concept of interchangeability, allowance tolerance, Indian Standard Specification for limits, fits and gauges, B.S. System. Limit gauging - design of Go, No Go gauges. (8 **Hrs**)

UNIT V : Linear measurement: various comparators such as mechanical, electrical, optical, pneumatic comparators, their principle, operations and applications.
Angular measurements: vernier, optical, bevel protractor universal bevel protector, Sine bar level clinometers, taper gauges. Thread measurement: screw thread limit and fit limits gauging of screw threads (8 **Hrs**)

UNIT VI : Gear measurement : alignment error, master gear, Parkinson tester. Study and use of optical dividing head, auto collimator, tool makers microscope. Interferometry, flatness testing, squareness testing. Surface texture testing. Coordinate measuring machine- types, role and application. **(7 Hrs**)

Books Recommended:

Text Books:

1. Engineering Metrology – R.K.Jain - Khanna Publishers.
2. Statistical Quality Control- M. Mahajan – Dhanpatrai & Co. Pvt.Ltd.
3. Non Destructive Testing techniques by Ravi Prakash, New Age Publications.

Reference Books:

1. Quality Control - By Juran - Mc. Graw Hill Pub. Company.

2. Statistical Quality Control- By Grant E.L. – R.S.L.Leavgen Worth-.Mc. Graw Hill Pub. Company
3. Statistical Quality Control- By Gupta - Dhanpatrai & Com. Pvt. Ltd

5ME03 KINEMATICSOF MACHINES

Course Learning Objectives:

1. To get the basic Knowledge about the mechanism used in automobiles, industrial machines etc.
2. To study about the synthesis and analysis of the mechanism used in machines.
3. To get the operational knowledge about the power transmitting devices used in automobiles.
4. To study the designing and importance of cams in machines.
5. To study the most effective power transmission device used in automobiles, industrial equipment, toys, etc.

Course Outcomes:

Students will be able to-

1. Understand & apply the concept and its applications of link, mechanisms and machines.
2. Demonstrate the ability to analyze the mechanisms and machines on the basis of velocity and acceleration and they will show the ability to solve analytical methods.
3. Show the ability to use graphical and analytical methods for synthesis of mechanisms to develop mini projects in the course duration.
4. Understand the practical for study of brake, clutch, dynamometer, gear train etc.

Unit I: 1. Introduction to study of mechanisms, machines, different types of links, kinematic pairs. Grashof's law-class-I and class –II mechanisms. Grubler's criterion, Kutzbach's criterion for planer mechanism. Inversions of four bar, single slider, double slider mechanisms.

2. Transmission angle, Mechanical Advantage, Transmission angle and Mechanical Advantage of 4-bar mechanism. **(7 Hrs)**

Unit II: 1**. Velocity analysis**: - Relative velocity method, method of equivalent mechanisms, Instantaneous centre of rotation method for 4-bar mechanism, body and space centroids.

2**. Acceleration analysis**:- Relative acceleration method and analytical method. **(8 Hrs)**

Unit III: Synthesis of Mechanisms:- Introduction to type, number and dimensional synthesis, graphical method of two position, three position and four position synthesis for input output coordination, Freudenstien's equation, Bloch's method. **(7 Hrs)**

Unit IV: Frictional torque in pivot and collar bearing. Clutches and Dynamometers: types, constructional details, operation. **(7 Hrs)**

Unit V: Special purpose mechanisms:- Steering mechanisms, Geneva wheel mechanism. **Cams**:- Introduction, types of cam & follower, different motions of followers, graphical layout of cam profiles, cam with specified contours. (8 Hrs)

Unit VI: 1. **Gear**: Introduction, terminology, gear tooth profiles, law of gearing, involumetry, interference of spur gears, minimum number of teeth to avoid interference.

2. **Gear Trains**:- Types of gear trains and its speed ratio applications. **(7 Hrs)**

Books Recommended:

Text Books:

1) Theory of Machines, P.L.Ballaney, Published by Dhanpat Rai and sons-N Delhi.
2) Theory of Machines, S.S.Ratan, Published by Tata Mc Graw Hill.
3) Theory of Machine, R.S.Khurmi and Gupta J.K., Published by EurasiaPublishing house-N Delhi.

Reference Books:

1) Theory of Machines and Mechanisms, J.E.Shigley, Uicker andGordon, Published by Oxford University press-New York.
2) Theory of Machines, V.P.Singh, Published by Dhanpat Rai-N Delhi.
3) Theory of Machines and Mechanisms, Ghosh and Amitabh, PublishedAffiliated East West Press, N-Delhi.

5ME04 MEASUREMENT SYSTEMS

Course Learning Objectives:

1. To study the generalized measurement system and the general performance characteristics of measuring instruments, applications, general configuration and functional elements of measuring instruments.
2. To study the strain gauges, their types, strain gauge circuits for strain measurement and to study the pressure measurement methods and devices
3. To study the types, constructional details and working of force, torque and flow measuring devices.
4. To study the different types of temperature measuring devices, standards, construction details and their working and to study the different types of liquid level measuring devices.
5. To study the mechanical and electrical types of speed measuring devices, contact and contactless speed measuring devices and their applications.
6. To study the methods of vibrations measurement and methods of linear and angular displacements.

Course Outcomes:

At the end of Measurement System course, the student will be able to:

1. Analyze different measurement systems.
2. Calculate different types of errors in the measurement system.
3. Use strain gauges and pressure measurement devices for several applications.
4. Compare different methods of force, Power and flow measurement using different methods.
5. Select appropriate liquid level and temperature measurement devices for given applications.
6. Measure speed of motors and rotating shafts by using tachometers, stroboscope.

UNIT I : 1. Generalized Measurement system: Significance of measurement, generalized systems. application of measuring instruments. Types of measuring instruments.

2. General configuration and functional elements of measuring instruments, types of inputs, various methods of correctionfor interfering and modifying inputs. (6 Hrs)

UNIT II : General performance Characteristics:-

1. Static characteristics, different types of errors, combination of component errors in overall systems.
2. Dynamic characteristics: General mathematical model of zero order, first order and second order instruments, response of first and second order instruments to following inputs step, ramp, impulse and frequency. (8 Hrs)

UNIT III : Strain Measurement :

1. Types of strain gauges, strain gauge circuits, calibration, Temperature compensation, use of strain gauges on rotating shafts, selection and installation of strain gauges.
2. Pressure Measurements:- Basic methods of pressure measurement: strain gauge pressure cell, High pressure measurement Bridgeman type, low pressure Measurement - Mcleod, Knudsen, ionisation, Thermal conductivity gauges. **(8 Hrs)**

UNIT IV : 1. Force Measurement: Various mechanical. Hydraulic, pneumatic and electrical methods.

2. Torque and Power Measurements: Various mechanical, hydraulic & electric methods.
3. Flow Measurements: Construction- orifice, Rota meter. Pressure probes- Pitot static tube, turbine meter, electro-magnetic flow meter. **(6 Hrs)**

UNIT V : 1. Temperature Measurements : Standards, Various temperature measuring devices, Bimetallic strip, pressure thermometers, thermo couples, electrical resistance thermometers, Thermistors, radiation Thermometers.

2. Liquid Level Measurements : Various methods such as- single float, displacement or force transducers. Pressure sensitivity, bubbler or Page system, capacitance variation type (for both conducting and non conducting type liquids) Resistance variation type. **(8 Hrs)**

UNIT VI: 1. Speed Measurements: Various mechanical type tachometers, electrical types tachometers, stroboscope etc.

2. Vibration Measurements : Seismic, Strain gauge and piezoelectric accelerometers.
3. Displacement measurements : Linear and angular displacement measurements, LVDT, LDR, Capacitive & inductive pick ups. **(8** Hrs)

BOOKS RECOMMENDED:

Text Books:-

1. Measurement Systems : - By Erenest O. Doebelins - MC Graw Hill.
2. Mechanical Measurement & Control: By D.S.Kumar.

References Books:-

1. Mechanical Measurements :- By T.G.Beckwith & N.L.Bulk - AddisonWerllv.
2. Instrumental Measurement & Analysis : By Nakra Choudhari TataMc Graw Hill.
3. Mechanical Measurement & Instrumentation : By R.K.Rajput,KatsonsBooks Publications.

5ME05 OPEN ELECTIVE - I (1) PRODUCTION MANAGEMENT

Course Learning Objectives:

1. To study the new product design & manufacturing process technology.
2. To study the objectives of forecasting, factors affecting forecasting.
3. To study method study, work measurement.
4. To study objectives and functions of Production Planning and Control.
5. To study inventory control & inventory control application
6. To study quality management, quality related costs, quality function deployment & total quality management.

Course Outcomes:

1. Apply the knowledge of operations management and its applications in industrial environment.
2. Demonstrate the knowledge of advanced manufacturing technologies and philosophies.
3. Students will demonstrate the importance of inventory control, JIT in manufacturing.
4. Apply the basic concept of quality management, TQM etc.

UNIT I: Designing products, services and processes; Historical evolution of productions and operations management, newproduct designs, manufacturing process technology.
Flexible manufacturing systems (FMS) and computer integrated manufacturing (CIM). **(9 Hrs.)**

UNIT II: Sales Forecasting: Objectives, types of forecasting, factors affecting forecasting, process of sales forecasting, methods of sales forecasting. **(7 Hrs.)**

UNIT III : Work study: method study, recording techniques of method study, principles of motion economy. Work measurement techniques. **(7 Hrs.)**

UNIT IV: Production planning and control: Objectives and functions of PPC, types of production systems, principles of sound production control system. **(7 Hrs.)**

UNIT V: Inventory Control: Demand and control system characteristics, inventory concepts, costs Modeling, Deterministic inventory models, stochastic inventory models, inventory control application, just-in-time manufacturing. **(7 Hrs.)**

UNIT VI: Quality Management: Quality and quality related costs, quality function deployment(QFD), Taguchi's off-line quality control methods, managerial responsibility in managing for quality products & services. TQM. Failure analysis, bath tub curve, Reliability of system. **(8 Hrs.)**

Books Recommended:

Text Books:

1. Production and operations management- concepts models and Behaviour by Everett E. Adam,Jr., & Ronald J. Ebert (Prentice- Hallof India)
2. Industrial engineering & production Management by M. Mahajan(Dhanpat Rai & Co.)

References Books:

1. Production and operations management – Total Quality and responsiveness by Hamid Noori & Russell Radfort (Mc Graw Hill, Inc.)
2. Industrial engineering & management by O. P. Khanna (Dhanpat Rai& Co.)
3. Production and Operations Management; J.P. Saxena; McGraw Hill.

5ME05 OPEN ELECTIVE-I

(2) MANUFACTURING TECHNIQUES

Course Learning Objectives:

1. To study the fundamentals of different manufacturing processes and various activities in manufacturing.
2. To study the fundamentals of metals & alloys, properties of engineering materials like ferrous, non- ferrous metals and their alloys
3. To study different machine tools. cutting tools used in machine shop , various operations performed with working principles of these machine tools
4. To study the activities related to mechanical working of metals, various hot working & cold working operations fundamentals of metal forming ; sheet metal working processes with different tools and equipment
5. To study the necessary details regarding pattern making, moulding, core making and casting with foundry tools & equipment, also melting practice by cupola furnace.
6. To study different Joining processes, basic terms of welding processes tike arc welding, gas welding, resistance welding. friction welding , soldering ; brazing processes with tools & processes.
7. To study the methods of producing metal powders
8. To study plastic part manufacturing by different processes like extrusion. Injection, blow, compression, and transfer moulding processes.

Course Outcomes:

1. Apply the knowledge of various manufacturing techniques and its applications in engineering.
2. Understand the knowledge of machining operations, sheet metal working and processes.
3. Students will show the ability to apply various joining methods in practice.
4. Students will exhibit the knowledge of powder metallurgy.

Unit I : Overview of manufacturing: Classification of manufacturing processes, selection of manufacturing processes, types & properties of materials, selection of materials, Introduction to conventional and non-conventional machining processes. (6Hrs)

Unit II : Introduction to cutting type shaping processes, Basic concept of metal cutting, Types of cutting tools, Orthogonal & oblique cutting, General purpose machines Vs Special purpose machines. (8Hrs)

Unit III: Introduction & application of various metal cutting operations – Turning, drilling, boring, milling, shaping, planning and grinding process. (8Hrs)

Unit IV: Introduction to metal forming and sheet metal process: Forming process- Forging, rolling, extrusion, wire drawing. Sheet metal processes- Forming, bending, drawing, coining, embossing. Cutting process: Punching, blanking, shearing, lancing. (7Hrs)

Unit V : Metal casting: Steps involved in casting, advantages of casting, pattern, difference between pattern and casting, pattern allowances, material used for patterns, molding sand, sand mould making core, types of cores, defects of castings, melting furnace(Cupola), casting process and its applications. (6Hrs)

Unit VI: Joining process with its types, advantages and disadvantages of riveting, soldering, brazing. Arc welding, gas welding, resistance welding, friction welding. (6Hrs)

Books Recommended:

Text Books:

1. Manufacturing processes –Workshop practice, R.A. Khan, Ali Hassan, Scitech Pub.
2. Workshop Technology - Hajra Chaudhary, Dhanpat Rai and Sons.

Reference Books :

1. Processes and materials of manufacture E.P. Degarmo, Prentice Hall of India (PHI)
2. Material and processes in manufacturing Lindberg, Tata McGraw Hill Pub.

5ME06 HEATTRANSFER - LAB.

Course learning objective: The lab work should clear the vision about all the modes of heat transfer. The practical knowledge should enhance the approach of student towards real life applications of the subject.

Course Outcomes:

Upon successful completion of lab Course, student will be able to:

i) Understand various modes of heat transfer
ii) evaluate various parameters of the heat transfer process

List of Practicals (Any six of the following):-

1. Determination of thermal conductivity of a metal bar.
2. Determination of thermal conductivity of insulating powder.
3. Study of heat transfer through composite wall.
4. Study of heat transfer through composite cylinders.
5. Determination of fin efficiency.
6. Verification of Stefan-Boltzman's law.
7. Determination of emissivity of grey body.
8. Determination of heat transfer coefficient for forced convection.
9. Determination of heat transfer coefficient for natural convection.
10. Study of pool & nucleate boiling.
11. Trial on double pipe heat exchanger.
12. Determination of efficiency of cross flow heat exchanger.
13. To write a computer program for conduction heat transfer problem.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

5ME07 METROLOGY & QUALITY CONTROL - LAB.

Course learning objective:

The course aims at understanding the principles of metrology for precision measurement of various mechanical components using various measuring tools. Students shall also learn to use standard practices and standard data, learn to use statistical concept, control chart for variables, control chart for attributes.

Course Outcomes:

Upon successful completion of lab Course, students will be able to:

i) Explain the principles involved in measurement and inspection.
ii) Select and use appropriate measurement instrument for a given application
iii) Apply the basics of sampling in the context of manufacturing

Practicals : At least six from the below list.

1. Determination of Linear dimensions of a given specimen/part using Precision/Non-Precision Measuring instruments.
2. Determination of Angular Measurement using Precision/Non-Precision Measuring instruments.
3. Measurement of Gear Tooth Thickness by Gear Tooth VernierCaliper/Constant Chord/Span Micrometer.
4. Measurement of Circularity/Roundness of a given specimen.
5. Measurement of Screw Thread Element by Floating Carriage Micrometer.
6. Testing of Surfaces by using Optical Flat.
7. Measurements of various angles of single point cutting tool by usingProfile Projector and Tool Maker's Microscope.
8. Preparation of Variable Control Charts for the given lot of sample.
9. Preparation of Attribute Control Charts for the given lot of sample.

Practical Examination:- The practical examination shall consist of oral on term work.

5ME08 KINEMNATICS OF MACHINES - LAB.

Course Learning Objectives: Objectives of this lab are to impart practical knowledge on design and analysis of mechanisms for the specified type of motion in a machine. With the study of rigid bodies motions and forces for the transmission systems, machine kinematics can be well understood.

Course Outcome: On successful completion of the course students will be able to:

Design linkage, cam and gear mechanisms for a given motion or a given input/output motion or force relationship, identify the basic relations between velocity & acceleration and use graphical and analytic methods to study the motions of various mechanisms

Practicals: - *At least eight practicals from the below list shall beperformed.*

1. To Study, Analyse and drawing of inversions of four bar mechanism to identify the types and number of links, types of motion and its mode of fixing arrangement for the required application.
2. To Study and analyse of inversions of slider crank mechanism using working models and graphical representations to find type & number kinematic pair , type of joint and Degree of freedom.
3. To Study and analyse of inversions of double slider crank mechanism using working models and graphical representations to find type & number kinematic pair , type of joint and Degree of freedom.
4. To determine Velocity and acceleration of links in mechanism by relative velocity method. (2 Problem)
5. To determine Velocity and acceleration of Piston of a reciprocating engine by clein's construction method. (2 Problem)
6. To find braking force, braking toque of internal expanding and external expanding brake .

7. To study, understand and observe the actual working and function of each part of single plate clutch by dismantling and assembling.
8. To study, understand and observe the actual working and function of each part of centrifugal clutch by dismantling and assembling.
9. Study of dynamometers.
10. To draw Cam profile for a given follower type and follower motion. (2 Problem.)
11. To Study and find train value and speed ratio of various types of gear trains
12. To study and drawing of Simple four bar Mechanism using position synthesis.
13. To Study and drawing of four bar mechanism by input-output coordination methods using Bloch's Synthesis and Freudenstein's equation.
14. To study interference and undercutting of spur gear pair using graphical layout.
15. To study and drawing of Generation of Involute and Cycloidal Spur Gear Tooth Profile.

The practical examination shall consist of viva-voce on the above syllabus& practical work.

5ME09 MEASUREMENTSYSTEMS -LAB.

Course Learning Objectives :

i) To study various sensers and measuring instruments required to measure various properties and quantities occurring in a typical engineering system.

ii) To understand general performance characteristics of measuring instruments, applications and general configuration of the measuring instruments.

Course Outcomes: Upon completion of this course students will be able to:

i) Choose appropriate measuring device for measurement of various quantities
ii) Analyse the performance of various
iii) Analyse and execute the calibration process for measuring instruments

List of Practicals :

At least eight practicals from the following list:

1. Measurement of strain using strain gauges.
2. Calibration of pressure gauge with pressure gauge tester.
3. Measurement of linear displacement by LDR and inductive pick-uptransducers.
4. Performance of capacitance transducer as an angular displacementmeasuring device.
5. Performance of inductive Transducers.
6. Measurement of flow using optical flow meter and R otameter.
7. Speed measurement by a stroboscope.
8. Speed measurement by magnetic pick up or photo electric pick up tachometer.
9. Pressure measurement by strains gauge type transducer.
10. Vibration measurement by using Seismic Transducer.
11. Measurement of Liquid level by using capacitive pickup transducer.
12. Temperature measurement using contact and non contact type instruments or various types of sensors.

*The practical examination shall consist of viva-voce on the above syllabus & practical work.

SEMESTER: SIXTH

6ME01 DESIGN OF MACHINE ELEMENTS

Course Learning Objectives (CLOs):

1. To study the concept of stresses and understand the design procedure of riveted and welded joints.
2. To study design procedure of knuckle joint, springs and power screw.
3. To analyze & select types of shafts, keys, couplings for various machines and industrial applications.

COURSE OUTCOMES (COs):

1. Understand the concept of various stresses and apply the design procedure to riveted joints and welded joints.
2. Understand design procedure of knuckle joint, springs and power screw.
3. Analyze & select types of shafts, keys, couplings for various machines and industrial applications.
4. Analyze the various types of bearings and understand the design procedure of IC Engine parts.

Unit I : (A) Meaning of design, Phases of design, Simple stresses, Thermal stresses, Impact Stress, Torsional stress, bending stresses in straight & curved beams, it's applications, Hooks, C-clamps.
(B) Rivetted Joints- Design, failures, strength & efficiency of riveted joint.
(C) Welded Joint- Strength, of transverse & parallel fillet welded section. **(11 hrs)**

Unit II : (A) Design of knuckle joint.
(B) Design of spiral & leaf spring.
(C) Design of power screw- Torque required to raise loads, efficiency & helix angle, overhauling & self locking of screw, ACME threads, stresses in power screws. **(11 hrs)**

Unit III : (A) Design of Shaft – Subjected to twisting, bending & combined twisting & bending loads, based on rigidity.
(B) Design of coupling, rigid coupling, sleeve, muff coupling, flange coupling & flexible coupling. **(**11 hrs**)**

Unit IV : (A) Antifriction bearing: Types of bearing, construction, life of bearings, selection of bearings.
(B) Journal bearing: Lubrication, selection of lubrication, design procedure & numerical.
(C) Design of IC Engine parts: Connecting rod, design of flywheel based on TM diagram. **(11 hrs)**

Books Recommended
:-Text Books:

1. Machine Design by Dr. P.C. Sharma & dr. D. K. Agrawal, Katsons Publications Ltd.
2. Machine Design by R.K.Jain ,Khanna Publisher's
3. Machine Design, R.S. Khurmi, J.K. gupta, Eurasia Publications, New Delhi.
4. Machine Design Data book by PSG, Coimbtore
5. Machine Design data book by Mahadevan.

Reference Books:-

1. Design of Machine Element by V.B. Bhandari, Tata McGraw Hill Publuication.
2. Machine Design – Jindal, Pearson Publication.
3. Design of Machine Element – C. S. Sharma & Kamlesh Purohit, PHI Publication.

6ME02 DYNAMICS OF MACHINES

Course Learning Objectives:

1. To study Static force analysis and Dynamic force analysis of plane mechanisms.
2. To demonstrate the use of gyroscopic effect on ship, aeroplane, four wheeler and two wheeler
3. To determine natural frequency vibrations.
4. To seek the knowledge of static and dynamic balancing.

Course Outcomes:

Students will be able to:

1. Apply basic concept of static force analysis and lubrication mechanism.
2. Understand the knowledge of dynamic force analysis analytically and graphically.
3. Apply the knowledge of space mechanism and vehicle dynamics.
4. Understand concept of free vibration and force vibration, concept of Torsional vibration.
5. Analyze the concept of balancing of machinery.

Unit I: 1. Static equilibrium, superstition principle, Static force analysis applied to plane motion mechanisms, virtual work method, static force analysis without and with friction.

2. Theory of hydrodynamic lubrication, boundary lubrication, film lubrication, rolling friction, performance of bearing. (8 Hrs)

Unit II: 1. D'Alemberts Principle. Engine force analysis-piston effort, thrust along connecting rod, side of cylinder, on the bearings, crank effort and turning moment on the crank shaft.

2. Dynamic equivalent system of connecting rod.

3.Turning moment diagrams for two stroke, four stroke and multi cylinder engines, fluctuations of speed & energy, Flywheel requirements. **(7 Hrs)**

Unit III: 1**. Space mechanism**:- Gyroscope, gyroscopic effect as applied to ship, aeroplane, four wheeler, two wheeler, universal joint.

2**. Vehicle dynamics**: - Coefficient of adhesion, resistance to vehicle motion, relative drive effectiveness, braking of vehicles. **(7 Hrs)**

Unit IV: Types of vibrations, elements of mechanical vibrating systems, degree of freedom in mechanical vibratory system.

1. **Longitudinal vibrations**- Natural frequency of free longitudinal vibrations by equilibrium, energy and Rayleigh method. Effect of inertia constraint in longitudinal vibrations. Damped vibrations with mass, spring and dash pot. Definitions of logarithmic decrement, magnification factor, transmissibility, vibration isolation.

2. **Torsional vibration**-single rotor systems, Two Rotor system, three rotor system, geared systems. **(**8 Hrs**)**

Unit V: 1.**Transverse vibrations**- Natural frequency of free transverse vibrations. Effect of inertia constraints in transverse vibrations. Natural frequency of free transverse vibrations due to point load and uniform distributed load acting over a simply supported shaft. Frequency of free transverse vibrations of a shaft subject to a number of point loads by energy and Dunkerley's method.

2.**Whirling or critical speed shaft**. (6 Hrs)

Unit VI: Balancing :- Balancing of rotating masses in same and different transverse planes, Partial balancing of reciprocating masses & Study of its effect. **(**8 Hrs**)**

Books Recommended:

Text Books:

1) Theory of Machines, P.L.Ballaney, Published by Dhanpat Rai andsons-N Delhi.
2) Theory of Machines, S.S.Ratan, Published by Tata Mc Graw Hill.
3) Theory of Machines, V.P.Singh, Published by Dhanpat Rai-N Delhi.
4) Theory of Machine, R.S.Khurmi and Gupta J.K., Published by EurasiaPublishing house-N Delhi.

Reference Books:

1) Theory of Machines and Mechanisms, J.E.Shigley, Uicker andGordon, Published by Oxford University press-New York.
2) Theory of Machines and Mechanisms, Ghosh and Amitabh, published affiliated East West Press N-Delhi.

6ME03 CONTROL SYSTEM ENGINEERING

Course Learning Objectives:

1. To study the basics of control systems and their mathematical modeling along with reduction methods.
2. Study the basic control actions and Industrial controllers.
3. To study the analysis of control systems with respect to transient time response and their errors.
4. To study the different pneumatic controllers and prime movers and their actions.
5. To understand stability analysis, frequency analysis by using bode plot for analytical problems.
6. Study of important automatic speed control systems.

Course Outcomes:

1. Understand the basic system concept and study different types of systems.
2. Understand the concept Transient- Response analysis and will apply in numerical methods, the knowledge of basic control action and industrial controllers.
3. Understand the concept of Stability and exhibit the knowledge of root locus concept.
4. Understand the concept of Frequency Response method and use bode diagram in solving analytical problems.

Unit I: Introduction system concept, open & closed loop systems, Mathematical models of physical systems, transfer functions. Block diagrams reduction and signal flow graphs. (8 Hrs)

Unit II : Basic control actions and Industrial controllers :-Classification of industrial automatic controllers, control actions, proportional controllers, obtaining derivative and integral control action, effects of integral and derivative control action on systems performance. (7 Hrs)

Unit III : Transient Response Analysis :- Introduction Std. Test signals, steady state response of first and second order systems for stop, ramp and impulse input, transient response specifications, steady state error & error constants. (7 Hrs)

Unit IV: Concept stability, necessary condition for stability, Rauths stability criterion, Root locus concept, construction of Root loci, systems with transporation lag. (8 Hrs)

Unit V : Frequency Response methods :-Introduction, concept of Bode diagrams. (7 Hrs)

Unit VI : Study of important automatic speed control systems in machine tools, Prime movers, system generators, etc. Analysis of performance characteristics. (7 Hrs)

BOOKS RECOMMENDED:-

TEXT BOOKS :

1. Automatic Control Engineering by F. H. Ravan Mc-Graw-Hill.
2. Modern Control Engg. - by Katsuhiko Ogata, PHI, .
3. Control System Engg. - by Nagrath & Gopal.

REFERENCE BOOKS:

1) Automatic Control Engg. - by Kuo B.C. & F. Golnaraghi,
2) Modern Control System by Richard C. Dorf, Robert H. Bishop,

6ME04 PROFESSIONAL ELECTIVE-I (1) TOOL ENGINEERING

Course Learning Objectives (CLOs):

1) To study the basic geometries of different cutting tools, chip formation mechanism, tool force analysis etc. in metal cutting.
2) To understand the steps in designing and drawing of single and multipoint cutting tools and form tools.
3) To study the basic principles of workpiece positioning and clamping. To get acquainted with designs of locators, clamps, drill bushes and methods of location.
4) To understand the design and operation of various types of Jigs and Fixtures.
5) To develop a graphical design of a jig or fixture suitable to the requirements of a workpiece.
6)To understand the theory of metal cutting and how to estimate the required force and clearance amount in sheet metal cutting and forming operations.
7)To study construction and working of various types of dies used for different press working operations.
8) To study the steps in designing and drawing of different cutting, drawing and forming dies in press working.

Course Outcomes:

1. Create the design of single and multi-point cutting tools.
2. Apply the knowledge related to machining in order to estimate tool life and selection of cutting fluids.
3. Create the design of multipoint tools like twist drills, reamers, broach and milling cutters & press working dies like punching, blanking and drawing.
4. Analyze the real time problems of work holding by designing jigs and fixtures.

Unit I: Single Point cutting Tool: Shear angle, shear strain, velocity relations, un-deformed chip thickness, Merchant's circle, energy relations, nomenclature, single point cutting tool design, recommended speed, feed and depth of cut Form tools. Graphical approach of circular form tool design. (08 Hours)

Unit II: Jig & Fixture Design: Economics, principles of locations, types of locations, prevention of jamming, problems of chip & dust in location, use of dowels. Redundant location, Principles of clamping, types of clamps, power clamping, Tool guiding & tool setting, types of drill Jigs & fixtures, (07 Hours)

Unit III: Jig & Fixture Design: Design of Plate, Channel, Box, Turnover and Post type Drill Jigs. Design of Turning, Milling, Fixture, Broaching, Assembly & Welding Fixtures. (07 Hours)

Unit IV: Multi-point Cutting Tools: Types, Geometric elements and forces in various tools like Twist drills & Reamers, Circular Broaches, Milling Cutters, Taps and Dies, Gear shaper cutter & Gear Hobs. (07 Hours)

Unit V: Press tools: Classification of presses, Theory of sheet metal cutting, clearance, cutting force calculations, Methods of reducing cutting forces, Centre of pressure & its significance, Classification of press working operations, Theory of bending, spring back action in metals, drawing fundamentals, calculation of drawing & bending forces, planning for cupping operation, Stock layout. (07 Hours)

Unit VI : Design of Press working Tools: Types of die construction, function & nomenclature of die components, Cutting Dies- Blanking & Punching, Forming Dies-Forming, Drawing and Bending etc. Design of Compound, Combination and progressive dies miscellaneous dies- Horn die, Cam-action die, Rubber & Building die, Suppress die. (08 Hours)

Text Books:

1. Tool Design - Cyril Donaldson (Tata Mc-graw Hill)
2. Jigs & Fixtures - P.H.Joshi (Tata Mc-graw Hill)
3. Fundamentals of Metal Cutting & M/c Tools - Juneja (New Age International).
4. Fundamentals of Tool Design - A.Kumar (Dhanpatrai & Sons).
5. A Text book of Production Engineering- P.C.sharma (S.Chand Publication).

Reference Books :

1. Metal Cutting Theory & Cutting Tool Design- Arshinov (Mir Publications)
2. Tool Design - ASTME (ASTME)
3. Jigs and Fixture- Grantt.

6ME04 Professional Elective – I (2) NON-CONVENTIONAL ENERGY SOURCES

Course Learning Objectives (CLOs):

1. To study the introduction to renewable and non-renewable resources of energy.
2. To study the radiation transmission through covers & Solar Energycollections.
3. To study the solar energy utilisation and solar energy storage.
4. To study energy from ocean and energy from wind.
5. To study biomass energy resources like biomass and biodiesel.
6. To study photo voltaic cell, fuel cell and geothermal energy.

Course Outcomes (COs):

1. Able to study the concept of renewable and non-renewable sources.
2. Apply the basic concept of solar energy utilization and storage.
3. Apply the concept of energy from ocean and wind.
4. Study the concept of bio-mass energy resources.

UNIT I :

1. Introduction:- Global and Indian energy scenario, Need of Renewable energy, need, Renewable and non renewable energy sources, energy and environment,

2. Solar Radiation: Solar constant, Definitions of basic earth-sun angles. T ypes of Sol ar radiation, Measurement of solar radiation using Pyrheliometer, Pyranometer and Sunshine Recorder, estimation of solar radiation intensity. (7 hrs)

UNIT II :

1.Solar thermal systems : Low temperature applications: solar water heating, space heating, drying. High temperature applications, dish and parabolic collectors. Central tower solar thermal power plants. Solar energy storage and utilization: Methods of storage- mechanical, thermal, electrical storage systems.

2. Solar Photovoltaic Systems: Basic principle of power generation in a PV cell ; Types of photovoltaic cell, Application of PV; Brief outline of solar PV stand-alone system; Storage battery and Balance of system.(8 Hrs)

Unit III :

Wind Energy Systems: Potential of wind electricity generation in India and current scenario. Wind pattern and wind speed data, Types of turbines, Coefficient of Power, Betz limit. Wind electric generators, Power curve; wind characteristics and site selection; Windfarms for bulk power supply to grid. Application for pumping (7 Hrs.)

Unit IV :

Biomass Energy: Biomass: Sources and Characteristics; Wet biogas plants; Biomass gasifiers: Classification and Operating characteristics; Updraft and Downdraft gasifiers; Gasifier based electricity generating systems.

Biogas-Types of bio gas plants, factors affecting production rates. Introduction to biodiesel and ethanol as alternative fuels, (7 Hrs.)

Unit V : **Energy from Ocean:** Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy.

Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Wave energy and power from wave, wave energy conversion devices, advantages and dis-advantages of wave energy (7 Hrs.)

UNIT VI : Fuel Cells: Introduction, working principle of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells.

Hydrogen Energy: Hydrogen as alternative fuel, Production methods, Hydrogen storage, **Geothermal Energy Resources:** Hot Dry Rock system, Vapor dominated, liquid dominated, flash steam, binary fluid and total flow concept of power generation. **(8Hrs)**

Books Recommended:

TEXT BOOKS:-

1. Solar Energy, S.P.Sukhatme, TMH.
2. Non-Conventional Energy Sources, G.D.Rai, Khanna Publications.
3. Non-Conventional Energy Sources, B. H. Khan

REFERENCE BOOKS:-

1. Treatise on Solar Energy : H.P. Garg; John Wiley & Sons.
2. Renewable Energy Conversion, Transmission and Storage, Bent Sorenson; Elsevier Publication
3. Renewalle Energy; GodfreyBoyle, Oxford University Press, Mumbai.

6ME04 PROFESSIONAL ELECTIVE-I

(3) COMPUTER AIDED DESIGN & SIMULATION

Course Learning Objectives (CLOs):

1. To study product cycle & fundamentals of CAD/CAM.
2. To understand the concept of representations of curves and surfaces.
3. To study the solid modeling techniques.
4. To study the geometric transformation techniques.
5. To study basic probability & statistics and physical modeling.
6. To study Simulation of Mechanical Systems & Simulation of manufacturing systems.

Course Outcomes (COs):

1. Understand the concept of CAD/ CAM and CIM .
2. Apply knowledge using CAD modeling for component design
3. Apply the knowledge of geometric transformation.
4. Understand the Mechanical & Manufacturing simulation systems.

Unit I: Fundamentals of CAD/CAM:

Product cycle and scope of CAD/CAM/CIM in product cycle, CAD/CAM, Hardware and software, selection of software, CAD workstation configurations. (6 Hrs)

Unit II: Representations of curves and surfaces:

Introduction to analytical curves, synthetic curves: Hermite cubic Spline, Bezier Curve, B- Spline curve. Surface Representation : Synthetic Surfaces, Applications of surface modeling. (6 Hrs)

Unit III: Solid Modeling :

2D Vs 3D modeling, Comparison of Wireframe, surface and solid modeling techniques, Geometry Vs Topology, Requirements of Solid Modeling Methods: Constructive Solid Geometry (CSG), Boundary Representation (B-rep), etc. (6 Hrs)

Unit IV: Geometric transformation

2D geometric transformations, Homogeneous co-ordinate representation, Composite Transformations, 3D transformations, Inverse transformations, geometric mapping. (8 Hrs)

Unit V: Introduction to statistics and physical modeling: A review of basic probability and statistics, random variables and their properties , Estimation of means variances and correlation. Physical Modeling- Concept of System and environment, Principles of modeling, types of models. (8Hrs)

Unit VI: Simulation of Mechanical Systems: Basic Simulation modeling, Role of simulation in model evaluation and studies, advantages of simulation Simulation of manufacturing Systems: Introduction to Flexible manufacturing systems, Simulation software for manufacturing. (8 Hrs)

Books Recommended :

Text Books:

1) P. N. Rao; CAD/CAM Principles and Applications; McGraw Hills Publications.
2) Mikel P. Groover and Emory W. Zimmers: Computer Aided Design and Manufacturing, Prentice hall.
3) Ibrahim Zeid: Mastering in CAD- CAM, Tata McGraw Hill Publication.
4) Geoffrey Gordon, System Simulation; Prentice Hall

Reference Books:

1) Mikell P. Groover: Automation, Production systems & Computer Integraded manufacturing, Prentice Hall.
2) Robert E. Shannon; System Simulation: The Art and Science ; Prentice Hall
3) J. Schwarzenbach and K.F. Gill Edward Arnold; System Modelling and Control
4) P. Radhakrishnan and Subramaniam: CAD/CAM/CIM, wiley Eastern Ltd.

6ME05 OPEN ELECTIVE -II

(1) NON-CONVENTIONALENERGYSOURCES

Course Learning Objectives(CLOs):

1. To study the introduction to renewable and non-renewable resources of energy.
2. To study the radiation transmission through covers & Solar Energycollections.
3. To study the solar energy utilisation and solar energy storage.
4. To study energy from ocean and energy from wind.
5. To study biomass energy resources like biomass and biodiesel.
6. To study photo voltaic cell, fuel cell and geothermal energy.

Course Outcomes (COs):

1. Understand concept of renewable and non-renewable sources.
2. Understand the basic concept of radiation transmission through covers and solar energy collections, the basic concept of Solar energy utilization and storage.
3. Demonstrate, concept of energy from ocean and wind.
4. Understand the concept of bio-mass energy resources, concept of direct energy conversion and fuel cell.

UNIT I :

1. **Introduction:-** Global and Indian energy scenario, Need of Renewable energy, need, Renewable and non renewable energy sources, energy and environment,
2. **Solar Radiation:** Solar constant, Definitions of basic earth-sun angles. T ypes of Sol ar radiation, Measurement of solar radiation using Pyrheliometer, Pyranometer and Sunshine Recorder, estimation of solar radiation intensity. (7 hrs)

UNIT II: Solar thermal systems. Low temperature applications: solar water heating, space heating, drying. High temperature applications, dish and parabolic collectors. Central tower solar thermal power plants.

Solar Photovoltaic Systems: Basic principle of power generation in a PV cell ; Types of photovoltaic cell, Application of PV ; Brief outline of solar PV stand-alone system ; Storage battery and Balance of system. (8 Hrs)

Unit III : Wind Energy Systems: Potential of wind electricity generation in India and current scenario. Types of turbines, Coefficient of Power, Wind electric generators, Power curve; wind characteristics and site selection; Windfarms for bulk power supply to grid. (7 Hrs.)

Unit IV : Biomass Energy: Biomass: Sources and Characteristics; Wet biogas plants ; Biomass gasifiers: Classification and Operating characteristics; Updraft and Downdraft gasifiers; Gasifier based electricity generating systems. Introduction to biodiesel and ethanol as alternative fuels, (7 Hrs.)

Unit V : **Energy from Ocean:** Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. **Ocean Thermal Electric Conversion** (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India.

Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy. (7 Hrs.)

UNIT VI:

1. **Fuel Cells :** working principle, types of fuel cells, applications.
2. **Geothermal Energy Resources:** Hot Dry Rock system, Vapor dominated, liquid dominated, flash steam, binary fluid and total flow concept of power generation. (8Hrs)

BOOKS RECOMMENDED:

Text Books:

1. Solar Energy; S.P. Sukhatme; TMH
2. Non-Conventional Energy Sources; G.D. Rai; Khanna Publications
3. Non-Conventional Energy Sources; B. H. Khan.

Reference Books:

1. Treatise on Solar Energy; H.P. Garg; John Wiley & Sons.
2. Renewable Energy Conversion, Transmission and Storage; BentSorensen; Elsevier Publication
3. Renewable Energy; Godfrey Boyle; Oxford University Press, Mumbai
4. Renewable Energy Sources and Emerging Technology; D.P. Kothari, K.C. Singal, Rakesh Ranjan; PHI

6ME05 OPEN ELECTIVE-II (2) AUTOMOBILE ENGINEERING

Course Learning Objectives:

1. To study the Introduction of automobiles, engine types and working of SI and CI engines.
2. To study the fuel feed systems, their types and to understand the basics of cooling system.
3. To study the electrical system, Battery capacity and its ratings, starter motor drive and to understand the basics of Ignition system.
4. To study the basics of transmission system, clutches, gear boxes and to understand the principle of differential.
5. To study the braking system, steering system, wheel balancing and alignment and to study the introduction of power steering.
6. To study the basics of suspension system, shock absorbers and to study the types of lubricants and lubrication system, crankcase ventilation.

Course Outcomes (COs):

1. Understand the basics of automobile engineering and its components.
2. Analyze &develop about the cooling system and its function.
3. Understand basic concept of transmission system and types of gears box, basic concept of electrical system and ignition system.
4. Apply the knowledge of suspension and lubrication.

UNIT I : Introduction, Classification of automobiles, chassis layout, basic working of SI and CI engines, engine parts, engine types, Multiple cylinder engines. (7 Hrs)

UNIT II : Fuel feed systems- fuel feed systems for petrol and diesel engines, Basic principles of Multipoint Fuel Injection Systems(MPFI) and Common Rail Diesel Injection Systems(CRDI). Cooling system: purpose, Air cooling and liquid cooling system, radiator, by pass recirculation system, antifreeze mixtures. (7 Hrs)

UNIT III : The electrical system. Battery Capacity, standard capacity ratings, starter motor drive-Bendix drive. Ignition system:- Battery coil ignition system, Electronic ignition system. (7 Hrs)

UNIT IV: Transmission system:- Layout, Working principle of clutch, single plate friction clutch and multiplate clutch, Gear Boxes:- Sliding mesh, constant mesh gear box, Propeller shaft, Hotchkiss drive, torque tube drive, differential. (8 Hrs)

UNIT V: Braking system: Mechanical, hydraulic brakes, power brakes and vacuum brakes. Steering system:- Function, types of linkages, steering gears, wheel balancing, wheel alignment, camber, castor, king pin inclination, toe-in& toe-out & their effects, Introduction to power steering. (7 Hrs)

UNIT VI: Suspensions : shock absorbers, Rigid axle and independent suspension system, Auto lubrication :- Types of lubricants, their ratings, multi viscosity oils. Engine lubrication:- types of lubricating systems, full pressure system, dry sump system, crankcase ventilation. (6Hrs)

BOOKS RECOMMENDED:

Text Books:

1. Automobile Engineering- Vol. I & II; Kirpal Singh; Standard Publishers Distributors
2. Automobile Engineering; R.K. Rajput; Laxmi Publications, New Delhi

Reference Books:

1. Automotive Mechanics; Crouse & Anglin; TMH.
2. Automotive Mechanics; J. Heitner; East West Press
3. Automotive Mechanics; S. Srinivasan; TMH.

6ME06 DESIGN OF MACHINE ELEMENTS - LAB.

Course learning objectives:

1. To study the basic design principles
2. To familiarize with use of design data books & various codes of practice
3. To make conversant with preparation of working drawings based on designs

Course Outcomes: After successfully completion of this course students will be able to:

1. Design various machine elements like joints, springs, couplings etc, under various conditions
2. Convert design dimensions into working/manufacturing drawing
3. Use design data book/standard codes to standardize the designed dimensions

Practical Term Work: At least Six exercises based on the following:

1. Design of Cotter or Knuckle joint.
2. Design & drawing of screw jack.
3. Design & drawing of Riveted joints.
4. Design & drawing of leaf spring.
5. Design of shaft on the basis of various loading.
6. Design and drawing of Coupling (any one type).
7. Design and drawing of Journal Bearing Plumber Block Type).
8. Design and drawing of connecting rod in IC Engine.
9. Design and drawing of Flywheel.
10. Determine Hydrodynamic lubrication profile using Journal Bearing Apparatus.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME07 DYNAMICS OFMACHINES- LAB.

Course Learning Objectives:

1. To understand Static force analysis and Dynamic force analysis of plane mechanisms.
2. To demonstrate the use of gyroscopic couple and its effect.
3. To understand the phenomenon of vibrations.
4. To demonstrate the effect of static and dynamic balancing.

Course Outcomes:

Students will be able to :

1. Apply basic concept of force analysis and lubrication mechanism.
2. Understand the knowledge of dynamic force analysis analytically and graphically.
3. Apply the knowledge of space mechanism and vehicle dynamics.
4. Understand concept of vibrations.
5. Analyze the concept of balancing of machinery.

Practicals:- At least eight practical from the following list:

1. Study of static force analysis of mechanism. (any 2 problem)
2. Determining the inertia forces of connecting rod
3. Determination of gyroscopic couple using motorized gyroscope .
4. Study of vehicle dynamics.
5. To study the longitudinal vibration of helical spring and to determine the frequency and time period of oscillation theoretically and experimentally.
6. Experiment on free and damped vibration of systems with one degree of freedom.
7. Experiment on forced damped vibration of systems with one degree of freedom.
8. Experiment on free damped torsional vibration.
9. To verify the Dunkerley's rule.
10. To determine the natural frequency of free torsional vibration of single rotor system.
11. To determine the natural frequency of free torsional vibration of two rotor system.
12. Experiment on whirling speed of shaft.
13. Experiment on static balancing of rotating masses.
14. Experiment on dynamic balancing of rotating masses.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME08 PROFESSIONAL ELECTIVE -I - LAB (i) TOOL ENGINEERING –LAB.

Course learning objectives:

1. To study the basic geometries of different cutting tools
2. To study cutting forces involved in machining operation using tool dynamometer.
3. To understand the steps involved in designing and drawing of various tools.
4. To understand the design and operation of various types of Jigs and Fixtures.

Course Outcomes: On completion of this course students will be able to :

1. Create the design of single and multi-point cutting tools.
2. Create the design of multipoint tools like twist drills, reamers, broach and milling cutters & press working dies like punching, blanking and drawing.
3. Analyze the real time problems of work holding by designing jigs and fixtures.

TERM WORK: (Any Six of the following)

1. Design & Drawing of single point cutting tool.
2. Design & Drawing of Form Tools (Using Graphical Method).
3. Measurement of forces in Orthogonal cutting by Lathe Tool Dynamometer.
4. Measurement of forces & Torque in Drilling by Drill Tool Dynamometer.
5. Study of geometric Elements & Forces in Multi-Point Cutting Tool. 6. Design & drawing of Post Drill Jig.
7. Design & Drawing of Turnover Drill Jig.
8. Design & Drawing of Milling Fixture.
9. Design & Drawing of Turning Fixture.
10. Design & Drawing of Compound Die.
11. Design & Drawing of Progressive Die.
12. Design & Drawing of Drawing die.

Practical Examination : Practical exam shall consist of viva-voce based on the term work and theory syllabus.

6ME08 PROFESSIONAL ELECTIVE -I – LAB
(2) NON-CONVENTIONAL ENERGY SOURCES–LAB.

Course Learning Objectives (CLOs):

1. To study the introduction to renewable and non-renewable resources of energy.
2. To study the radiation transmission through covers & Solar Energycollections.
3. To study the solar energy utilisation and solar energy storage.
4. To study energy from ocean and energy from wind.
5. To study biomass energy resources like biomass and biodiesel.
6. To study photo voltaic cell, fuel cell and geothermal energy.

Course Outcomes (COs):

1. Understand concept of renewable and non-renewable sources.
2. Understand the basic concept of radiation transmission through covers and solar energy collections, the basic concept of solar energy utilization and storage.
3. Demonstrate, concept of energy from ocean and wind.
4. Understand the concept of bio-mass energy resources, concept of direct energy conversion and fuel cell.

List of practicals : Any six practicals will be based on the following topics :-

1. Study of Pyrheliometer and measurement of direct radiation.
2. Study of pyranometer and measurement of global and diffuse radiation.
3. Study of sunshine recorder and measurement of sunshine hours.
4. Study and testing of a flat plate recorder.
5. Study of biogas plant.
6. Study of photovoltaic system,
7. Study of various types of Wind mill.
8. Study of various solar equipment.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME08 PROFESSIONAL ELECTIVE -I – LAB
(1) COMPUTER AIDED DESIGN & SIMULATION

Course Learning Objectives (CLOs):

1. To understand fundamentals of CAD.
2. To study the solid modeling techniques.
3. To study the geometric transformation techniques.
4. To demonstrate Simulation of Mechanical Systems.

Course Outcomes (COs):

1. Understand the concept of CAD.
2. Apply knowledge using CAD modeling for component design
3. Apply the knowledge of geometric transformation.
4. Understand the Mechanical & Manufacturing simulation systems.

Practicals:- Any six practicals from the list should be performed.

1. Creation of 2D drawing (Sketching Module) of any mechanical machine component using any modeling/drawing software.
2. Creation of isometric view from given orthographic view of any mechanical machine part using any modeling software.
3. Creation of 3D drawing of any mechanical machine part using any modeling software.
4. Creation of assembly of Knuckle joint/ Cotter joint using any modeling software.
5. Creation of sheet metal component using any modeling software.
6. Simulation of Four bar chain mechanism using any modeling software.
7. Simulation of Slider crank chain mechanism using any modeling software.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME09 RESEARCH SKILLS – LAB

Course learning objectives:

1. Apply fundamental and disciplinary concepts and methods in ways appropriate to their principal areas of study.
2. Demonstrate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
3. Use effectively oral, written and visual communication.
4. Identify, analyze, and solve problems creatively through sustained critical investigation.
5. Integrate information from multiple sources.
6. Demonstrate an awareness and application of appropriate personal, societal, and professional ethical standards.
7. Practice the skills, diligence, and commitment to excellence needed to engage in lifelong learning.

Course Outcomes:

1. Demonstrate a sound technical knowledge of their selected research topic.
2. Undertake problem identification, formulation and solution.
3. Design engineering solutions to complex problems utilizing a systems approach.
4. Conduct an engineering research.
5. Demonstrate the knowledge, skills and attitudes of a professional engineer.

Students will have to perform any one task and prepare a report on it; from the following list:

1. A mini project involving mechanisms/ electromechanical systems/
2. CAD modeling/ simulation of any thermal, hydraulic or mechanical system.
3. IoT based system for any domestic/ rural/ agricultural/ industrial application
4. A system using non- conventional energy source
5. Market research for launching a new product.
6. Study of any Small Scale Industry.
7. Any other innovative concept for promoting research and innovation among students.

***Practical Examination:-** The practical examination shall consist of oral basedon the task and the report.

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SYLLABUS BE SEM. V ELECTRICAL ENGG. (ELECTRONICS & POWER)

5EP01 POWER SYSTEM- I

Course Outcomes:

After completing this course, the students will be able to:

1. Determine the parameters of transmission lines.
2. Evaluate the performance of transmission line
3. Describe transmission lines voltage control and power factor improvement methods.
4. Explain representation of power system, Ferranti effect and corona phenomenon.
5. Demonstrate various Insulators , its string efficiency & underground cables.

Syllabus:

Unit I: Transmission line parameters: calculation of resistance, inductance and capacitance of single phase and three phase transmission lines, skin effect and proximity effect, transposition, G.M.D. & G.M.R. methods, double circuit lines, bundled conductors, effect of earth on inductance and capacitance, interference with communication lines.

Unit II: Electrical characteristics of transmission line: V-I characteristics of short, medium and long lines, A, B, C, D constants, nominal T and equivalent π representations.

Unit III: Voltage control and power factor improvement: methods of voltage control and power factor improvement, use of static VAR generators and synchron ous condenser, automatic voltage control. Receiving end and Sending end power circle diagrams.

Unit IV: Representation of power systems: single line diagrams, per unit system and one-line impedance and reactance diagrams. Ferranti effect, corona phenomenon, Introduction to Travelling waves.

Unit V: Insulators: materials used, types, comparison of pin type and suspension type insulators, voltage distribution and string efficiency, methods of increasing string efficiency, grading rings and arcing horns. Introduction to insulator testing, line supports for LV, HV, EHV and UHV.

Unit VI: Underground cables: material used for conductor & insulation, different types of cables and their construction, parameters of underground cable, grading of cable, losses, break down and rating, selection of cables.

Text Books:

1. Modern Power System Analysis by D. P. Kothari, I. J. Nagrath TMH Publishing
2. Elements of power system analysis by William D. Stevenson, Jr, McGraw-Hill International edition

Reference Books:

1. Power System Engineering by D. P. Kothari, I. J. Nagrath TMH company ltd., New Delhi
2. Narain G. Hingorani and Lazlo Gyugyi "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems.
3. Principles of power system by V. K. Mehta, S. Chand & company ltd., New Delhi.
4. Electrical Power Systems by C. L. Wadhwa, New Age International Publishers, New Delhi
5. Electrical Power Systems by Ashfaq Husain, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
6. Electrical Power system design by M. V. Deshpande, TATA McGraw-Hill Publishing Company Limited, New Delhi.

5 EP02 MICROPROCESSORS & MICROCONTROLLER

Course Outcomes:

After completing the course the students will be able to

1. Recite Fundamentals and Architecture of Microprocessor 8085, Microcontroller 8051
2. Interpret Assembly Language Programming of Microprocessor 8085, Microcontroller 8051
3. Illustrate interfacing with Microprocessor 8085, Microcontroller 8051
4. Apply knowledge of Microprocessor 8085 for measurement of Electrical quantities
5. Discusss Fundamentals and Architecture of Microprocessor 8086
6. Explain Fundamentals and Architecture of Microprocessor 8051

Unit I: 8085-architecture and Pin Diagram, Microprocessor Operations (Initiated, Internal and External) BUS organization and register structure, instruction set of 8085, addressing modes, Machine Cycles & Bus Timings.

Unit II: Assembly Language Programming of 8085, counters and time delays, stack and subroutines, Memory mapped I/O and I/O mapped I/O, address decoding techniques. Interrupt system of 8085 (software and hardware interrupts), Data transfer schemes, serial data transfer through SOD and SID line.

Unit III: Programmable Interfacing devices: Internal architecture, programming and interfacing of Programmable Peripheral Interface PPI (8255), Programmable Interrupt Controller PIC (8259), and Universal Synchronous Asynchronous Receiver Transmitter USART (8251) and Programmable Interval Timer PIT (8253)

Unit IV: Introduction to microcontroller: 8051 pin configuration and architecture, 8051 Internal resources, pin diagram, I/O pins, ports and their internal logic circuits, counters, serial ports, interrupt structure, SFRs and their addressing, watch-dog timer, internal code memory, data memory, stack pointer, flags, bit addressable memory.

Unit V: Instruction set of 8051.Addressing modes. Various groups of instructions: data transfer. Arithmetic-logical group. Interrupt, timer counter related instructions. Interfacing of 8051with external memories. Programming 8051 with interfacing examples.

Unit VI: 8085 Microprocessors / 8051 Microcontroller Applications: hardware & software developments: signal conditioning & data acquisition system components. Measurement of Pulse width and Magnitude using 8085. Measurement of fundamental quantities -voltage, current, frequency, speed using 8051 Microcontroller.

Text Book: Microprocessor Architecture, Programming, and Applications with the 8085, Romesh Gaonkar PHI Publication - 2006

Reference Books:

1. An Introduction to Microcomputers Volume 1 Basic Concepts, Adam Osborne Osborne-McGraw Hill, Berkely California, 1980
2. Introduction to Microprocessor L. Gibson, Prentice-Hall, 2003
3. Advance Microprocessor and Peripherals, K. M. Bhurchandi & A. K. Ray, 2nd Edition, Tata McGraw Hill, 2006.
4. Microprocessor 8086 ,Sunil Mathur PHI 2010
5. The 8051 Family of Microcontrollers Richard Barnett Prentice-Hall, Inc -2000
6. The 8051 Microcontroller and Embedded Systems: Using Assembly and C,M A Mazidi,J.GMazidi and Mckinlay, 2nd Edition, Pearson.

5EP03 ELECTRICA L MACHINES – II

Course Outcomes:

After completing this course students will be able to

1. Describe the construction, working operation & performance characteristics of three phase Induction Motor
2. Analyze the starting, braking and speed control of three phase induction motors by various methods.
3. Describe the construction, working operation & performance characteristics of single-phaseInduction Motor
4. Demonstrate the construction, working operation & performance characteristics of synchronous machine.
5. Explain the construction & working of special motors like Universal, Reluctance, PMSM & BLDC Motor

Unit I: Three phase induction motor – I:
Construction, Types (squirrel cage and slip-ring), Rotating Magnetic Fields, principles of operation, Working, Torque Slip Characteristics, Starting and Maximum Torque. Effect of parameter variation on torque slip characteristics (variation of rotor and stator resistances, stator voltage, frequency).Equivalent circuit. Phasor Diagram, Performance evaluation by direct & indirect testing, circle diagram.

Unit II: Three phase induction motor – II :
Starters for squirrel cage &slip-ring type IM, Methods of speed control, electric braking, High Torque IM, single phasing, cogging and crawling, Generator operation Self-excitation, Doubly-Fed Induction Machines.

Unit III: Single phase Induction Motor : Double revolving field theory, Constructional features, equivalent circuit, working, Split-phase starting methods and applications of single-phase Induction motors.

Unit IV: Synchronous Generator:
Constructional details, working principle, operation, armature reaction, circuit model, determinations of parameters of the circuit model and phasor diagram, methods of determining the regulations and efficiency, Parallel operation of alternators - synchronization and load division.

Unit V: Synchronous Motor:
Construction, principle of operation, working, starting methods, torque equation - V-curve, Inverted V curve & power angle characteristics, hunting & damping, applications. Transient, sub transient & steady state reactance of synchronous machines.

Unit VI: Special Motors:

Construction, working principle, operation, characteristics and applications of Universal motor, Reluctance Motor, Permanent Magnet Synchronous Motor & BLDC Motor.

Text Books:

1. D.P.Kothari & I.J. Nagrath, "Electrical Machines"- 5thEdition, TMH Publication.
2. S. Langsdorf, "Alternating Current Machines", McGraw Hill Publication

Reference Books:

1. Stephen D. Umans, "Fitzgerald and Kingsley's Electric Machinery", 7th Edition, McGraw Hill Publication, 2020.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
4. C L Dawes, "A Course in Electrical Engineering (Volume -2)", McGraw Hill Publication.

5EP04 Professional Elective-I SIGNALS AND SYSTEMS

Course Outcomes :

After completing this course student will be able to

1. Demonstrate knowledge of continuous-time and discrete-time signals and systems.
2. Analyze the continuous-time systems using continuous Time Fourier transform.
3. Explain the concept of sampling, Sampling Theorem, aliasing and the Nyquist rate.
4. Analyze DT systems & their realization using Z-transforms.
5. Analyze the discrete time systems using DTFT and DFT

Unit I: Introduction to Signals and Systems: Classification of Signals Classification of Systems, Systems Modeling Some Ideal Signals, Energy and Power Signals Frequency Response, Discrimination of Continuous-Time Signals Topological Models, Analysis of Continuous-Time Systems Properties of Elementary Signals Linear Convolution Integral, Response of Continuous-Time Systems

Unit II: Fourier Transform Properties of Fourier Transform, Tables of Fourier Transform Pairs Fourier Transform of Periodic Signals, Ideal Low-Pass Filter Frequency-Domain Analysis of Systems Fourier analysis of Sampled Signals

Unit III: Analysis of LTI Discrete-Time Systems: Time Domain and Frequency Domain, Properties of Discrete-Time Sequences Linear Convolution, Discrete-Time System Response.

Unit IV: Sampling: Representation of continuous time signals by its samples, reconstruction of a signal from its samples, aliasing, discrete time processing of continuous time signals, sampling of discrete time signals

Unit V: Z- Transform: Z- transform, the region of convergence for the z-transform, Inverse z- transform, properties of Z transform, analysis and characterization of LTI systems using z transforms, System function algebra and block diagram representations, the unilateral z –transform.

Unit VI: Discrete Fourier Transform and Fast Fourier Transform Representation of Discrete-Time aperiodic signals and the Discrete-Time Fourier Transform; Fourier Transform for Periodic Signals; Properties of the Discrete-Time Fourier Transform; Discrete-Time LTI Systems and Discrete-Time Fourier Transform. Fast Fourier Transform (FFT)

Text Books:

1. Alan Oppenheim &Alan Willsky ,"Signals and Systems" Prentice Hall India Learning Private Limited; 2nd edition
2. P. Ramesh Babu R. Ananda Natarajan "Signals and Systems**."** Scitech Publications

Reference Books:

1. Fred Taylor,Principles of Signals and Systems "Tata McGraw-Hill, 1998, New Delhi
2. Nagrath, Sharan, Ranjan Rakesh and Kumar Sukhbinder" Signals and Systems" Tata McGraw-Hill, 1998, New Delhi.
3. S Haykin and B Van Veen, "Signals and Systems "John wiley & sons

5EP04 Professional Elective - I

2. NETWORK ANALYSIS AND SYNTHESIS

Course Outcomes :

After completing this course student will be able to

1. Analyze the transient response of series and parallel A.C. circuits
2. Demonstrate the properties of network functions.
3. Demonstrate the properties of positive Real Functions
4. Synthesize driving point functions of RL, RC and RLC
5. Synthesize two port network functions
6. Design passive filters to meet desired specifications

Unit I: Transient Analysis:

Transient response of RC, RL and RLC circuit to various excitation signals such as step, ramp, impulse and sinusoidal signals.Network solution with Laplace transformation, initial and final value theorem and convolution integral.

Unit II: Network Functions:

Network Functionsfor one port & two-port networks, poles and zeroes of network functions. Restrictions on poles and zeroes locations for driving point functions and transfer functions. Time domain behavior of electrical network from the pole- zeroes plot.

Unit III: Positive Real function: Driving point function, Brune's positive real function, properties of positive real function, testing of driving point function. An application of Maximum Modulus Theorem, properties of Hurwitz polynomial, computation of residue, even and odd functions

Unit IV: Synthesis of One Port Networks

Properties of LC, RC and RL driving point functions and their synthesis in canonical (Foster and Cauer) forms. Synthesis of RLC driving point functions which can be synthesized by partial fraction or continued fractions

Unit V: Synthesis of Transfer Functions

Properties of transfer functions, Zeros of Transmissions (ZOTs), synthesis of Y21 and Z21 with 1ohm termination. Synthesis of transfer functions using constant resistance single and double terminated lattice and bridge T networks. Synthesis of open circuit transfer function

Unit VI: Filter fundamentals

Classification of filters, Analysis of prototype filter section, Analysis of a prototype Low Pass Filter, High Pass Filter, Band Pass Filter, Band Stop Filter, M–Derived Filter, Low Pass Filter with RC and RL Circuits, High Pass Filter with RC and RL Circuits, Low Pass Filter with RLC Circuit. Introduction of Different Types of Active Filters

Text Books :

1. Van Valkenberg, "Network Analysis",, Prentice Hall of India (PHI)
2. Sudhakar and Shyammohan,"Circuits and Networks: Analysis and Synthesis ,McGraw-Hill Education

Reference Books:

1. Van Valkenburg "Introduction to Network Synthesis", Prentice Hall of India (PHI)
2. Kelkar, Pandit, "Linear Network Theory", Pratibha Publication.
3. Franklin Kuo, "Network Analysis and Synthesis", Wiley international.
4. A.Chakrabarti, "Circuit Theory" Dhanpat Rai & Co.
5. C.L Wadhwa, "Network Analysis and Synthesis" New Age International Publishers, 2007.

5EP04 Professional Elective – I

3. ELECTRONIC COMMUNICATION THEORY

Course Outcomes:

After successfully completing the course, the students will be able to

1. Explain various types of signal & elements of communication system.
2. Analyze the signal using Fourier Transform
3. Apply Amplitude modulation & Frequency modulation on the communication signal
4. Compare Pulse communication & Digital communication
5. Describe microwave communication system.

Unit I: Introduction to Electronics Communication Systems:

Signals: Analog & digital, Deterministic & Non-deterministic, Periodic & non periodic,Elements of Communication Systems, Transmitter, Receiver, Need for Modulation, bandwidth requirements, Noise, External, internal noise, noise calculation, noise figure.

Unit II: Signal Analysis:

Fourier Series, Exponential Fourier Series, Fourier Transform, Properties of Fourier Transform, Dirac Delta Function, Fourier Transform of Periodic functions, Fundamental of Power Spectral Density & Energy Spectral Density.

Unit III: Amplitude Modulation:

Amplitude Modulation Theory, Generation of Amplitude Modulation, Single Side band Communication, suppression of carrier, suppression of unwanted sideband, AM receiver.

Unit IV: Frequency Modulation:

Theory of Frequency Modulation, characteristics of FM, Generation of FM, pre-emphasis, De-emphasis, wide &Narrowband FM Transmission, FM receiver.

Unit V: A. Pulse Communication:

Information Theory, Classification of pulse modulation, Sampling process, pulse amplitude modulation, PWM and PPM modulation pulse code modulation.

B. Digital Communication:

Fundamentals of data communication systems, data sets and interconnection requirements.

Unit VI: Microwave communication system

Analog microwave communication: LOS, OTH microwave system Satellite communication: Satellite orbits, frequencies, attitude, transmission path.

Text Book: Electronic Communication System by Kennedy, Davis, TMH

Reference Books:

1. Electronics Communication by K.Shoenbcle PHI, India.
2. Electronics Communication techniques, Paul Young, Willey Eastern Pub.
3. Principle of C.E TMIL Taub Schilling.
4. Electronics Communication - Robert Shrader McGraw Hill.

5FEEP05 Open Elective – I

1. ELECTRICAL DRIVES

Course Outcomes:

After completing this course, Students will be able to:

1. Explain the basic Concept of electrical drives
2. Describe Power Electronics devices & their Applications
3. Demonstrate various starting, braking and speed control methods of D.C. Motors
4. Demonstrate various starting, braking and speed control methods of three phase Induction Motor.
5. Describe the construction, working principle and applications of single phase Induction Motor& special motors.

Unit I: Concept of electric drives, classification and comparison of electrical drive system, Cooling and heating of electric motors. Types of duties: continuous, intermittent and short time. Selection of an electric drive for particular applications.

Unit II: Theory, principle, Characteristics of Power Transistor, SCR, Power MOSFET and IGBT. Introduction to single phase & three phase fully controlled bridge convertors.

Unit III: D.C. Motors: Types, characteristics, Torque equation, Starting and braking, Speed controland Applications.

Unit IV: Three phase Induction Motors: Types, construction, principle of working, characteristics and applications. Starting and braking. Speed control methods: Thyristorized stator voltage control of three phase induction motor.

Unit V: Single phase Induction Motors: Double revolving field theory, Cross field theory,types, construction, principle of working, starting methods and applications.

Unit VI: Special Motors: Construction, Principle of working, and applications of D.C. servo motors, stepper motors, Brushless D.C. motors and Universal motor.

Text Books :

1. S.K.Pillai : A First Course on Electrical Drives by New Age International Publishing Co. Ltd
2. I.J.Nagrath & D.P.Kothari : Electric Machines by Tata Mc Graw Hill Publishing Co Ltd.

Reference Books :

1. VedamSubrahmanyam: Electric Drives : Concepts & Applications by Tata Mc Graw Hill Publishing Co Ltd.
2. Ion Boldea, Nasar. S A : Electric Drives by CRC Press India
3. Ashfaq Husain: Electric Machines by Dhanpat Rai & Co. Ltd
4. M.D.Singh &K.B.Khanchandani : Power Electronics by Tata Mc Graw Hill Publishing Co Ltd
5. V.K.Mehta: Principles of Electronics by S.Chand and Co Ltd ,New Delhi

5FEEP05 Open Elective-I:

2. POWER SUPPLY SYSTEM

Course Outcomes:

After completing this course student will be able to

- Describe the Structure of Power system
- Explain construction and working of various generation plants
- Describe layout and working of Substations
- Compare various power distribution system
- Explain Electrical wiring required for various Installations

Unit I: Structure of Power System :

Generation, transmission and distribution. Power generating stations – different types. Steam power stations: Main parts and working, Water tube boiler, Fire tube boiler and their characteristics. Main flow circuits of steam power station. Power station auxiliaries,

Unit II: Gas-turbine power stations:

Main parts, plant layout and Bryton cycle operation. Combined cycle generation & Cogeneration. Nuclear power stations- Layout of nuclear power station, types of power reactors, main parts and control of reactors, nuclear waste disposal, radioactivity and hazards.

Unit III: Hydro-electric stations:

Site selection, constituents and schematic arrangement of hydroelectric stations, principles of working, types of turbines, Layout and working of Pumped storage plant.

Unit IV: Substation:

Classification of substations, Major equipment, Selection & location of site for substation, Main Electrical connections, Symbols for various apparatus & circuit elements in substation, 66/11kV and 11kV/400V substation Key diagram, Busbar layouts. Auxillary supply, substation earthing.

Unit V: Power distribution system:

Primary and secondary distribution, types of conductors in Distribution system. Connection Scheme: radial, parallel, ring main, comparison of distribution systems

Unit VI: Electrical wiring and installation:

Domestic, commercial and industrial wiring, main, sub-main and sub-circuit wiring.Types and need of Earthing.Fuse and disconnecting devices. Electrical Safety precautions.

Text Books :

1] Principles of Power System, by V K Metha and RohitMetha, S Chand Publication
2] Generation of Electrical Energy, by B R Gupta, S Chand Publication

Reference Books :

1] A Course in Power System J B Gupta, S Chand Publication
2] Elements of Electrical Power Station Design, by M. V. Deshpande, Wheeler publications
3] Electrical Installation Estimating & Costing by J. B. Gupta
4] Transmission & Distribution by H. Cotton.

5FEEP05 Open Elective – I

3. POWER PLANT ENGINEERING

Course Outcomes: -

1) Describe different Sources of Energy Generation
2) Explain the Working and layout of steam power plant & hydro power plant.
3) Discuss the working principle and basic component of Nuclear, Diesel & gas power plant
4) Illustrate various terms related to power plant economics & tariff.

Unit-I: Introduction:

Energy resources and their availability, types of power plants, selection of the plants, Introduction to basic thermodynamic cycles used in power plants, Conventional and non-conventional energy sources, Indian Energy Scenario.

Unit-II: Hydro Electric Power Plant:

Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, Layout of Hydro power plant, operation of different components of hydro-electric power plant , classification of hydro Electric power plant, Pump Storage Plant, site selection, advantages & disadvantages

Unit-III: Steam Power Plants:

Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, Layout of Thermal power plant , Site selection, coal storage, coal handling systems, ash handling systems, working of various parts: Economizer, air preheater, condenser, cooling tower, Electrostatic Precipitator, advantages & disadvantages

Unit-IV: Nuclear Power Plants:

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium- Uranium reactor (CANDU) fast breeder reactor, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

Unit-V: Diesel & Gas power plant:

Layout of Diesel power plant, functions of different components of diesel plant, advantages & disadvantages, Principle of Operation of Gas Turbine Plants, Open cycle gas turbine plant, closed cycle gas power plant, Combined gas and steam cycle.

Unit-VI: Power Plant Economics:

Load curve, energy load curve, energy duration curve, connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor, types of loads, operating cost, annual plant cost, Generation cost, Depreciation, Objectives of Tariff, Types of Tariff.

Text Books:

1. Generation of electrical energy by B.R.Gupta, Eurasia Publishing House, New Delhi.
2. Power Plant Engineeirng; R. K. Rajput ; Laxmi Publications.

Reference Books:

1. Non conventional energy resources. By G.D.Rai, Khanna Publishers New Delhi
2. Principles of Power System by V.K.Mehta, S.Chand publication.
3. Conventional energy technology by S.B.Pandya, Tata McGraw Hill Publication.
4. Power Plant Engineeirng. P. K. Nag.

5EP06 POWER SYSTEM – I LAB

Student should perform minimum eight practicals based on the syllabus

List of Experiments:

1. To study the performance of a transmission line using a nominal T model.
2. To study the performance of a transmission line using a nominal π model.
3. To calculate A,B,C,D parameters for a transmission line by using nominal T model
4. To calculate A,B,C,D parameters for a transmission line by using nominal π model.
5. To study skin effect, proximity effect and Ferranti effect in transmission line.
6. To study Corona phenomenon and corona loss and its control in transmission line.
7. To study conversion of single line diagram to impedance diagram and reactance diagram for a typical power system.
8. To draw the circle diagram for a typical power system.
9. Study of a tap changing transformer (ON load and OFF load tap changing).
10. Study of static VAR generator and synchronous condenser.
11. To study different types of insulators used in power system & their comparison.
12. To conduct a dry and wet test on a pin type insulator.
13. To conduct a flashover test on an insulator.
14. To study a horn gap.
15. To study different types of power cables.
16. To study testing of cables.
17. To draw different Tower structures

Note: Above experiments may be conducted by using models, simulation, numerical, drawing sheets or experimentation.

5EP07 MICROPROCESSOR & MICROCONTROLLER- LAB

List of Experiments:

Student should perform minimum eight practicals based on the syllabus

1. Write an Assembly Language Program for the Addition of two 8-bit/16-bit numbers
2. Writean Assembly Language Program for the Subtraction of two 8-bit numbers
3. Write a Program for Finding the larger and smaller one among the two 8- bit numbers
4. Write a Program for Finding the largest/smallest number in array of 8-bit numbers
5. Write a Program for Masking and setting of nibbles
6. Write a Program for Block data transfer in same and reverse order
7. Write a Program for Sorting of even and odd numbers from an array of 8-bit numbers
8. Write a Program for Multiplication of two 8-bit numbers
9. Write a Program for Square wave generation using 8255 PPI
10. Write a Program for Stepper motor control using 8255 PPI
11. Write a Program for Interfacing ADC with 8085/8051using 8255 PPI
12. Write a Program for Interfacing DAC with 8085/8051 using 8255 PPI
13. Write a Program for Lamp load control using 8255 PPI
14. Write a Program for measurement of DC Voltage /Current using ADC, 8255 PPI
15. Study of Architectural Differences: Microprocessor 8085, and Microcontroller 8051

5EP08 ELECTRICAL MACHINES-II LAB

Student should perform minimum eight practicals based on the syllabus**.**

List of Experiments:

1. Perform the load test on three phase IM & plot its performance characteristics.
2. Perform the No load test on three phase IM to separate out its no load losses.
3. Estimate the performance parameters of three phase IM from its circle diagram.
4. Plot the equivalent circuit of three phase Induction motor.
5. Study of different types of starters used for three phase IM
6. Speed control of three phase squirrel cage Induction motor by various methods like stator voltage control method, frequency control method, changing number of poles.
7. Speed control of three phase Induction motor.
8. Perform the electric braking of three phase Induction motor.
9. Perform the load test on single phase IM & plot its performance characteristics.
10. Load test on three phase alternator to determine its performance parameters.
11. Synchronize the three-phase alternator with infinite bus-bar
12. Perform the OC & SC test on synchronous generator to estimate its regulation by EMF & MMF methods
13. Estimate the regulation of three phase alternator using ZPF method.
14. Perform the load test on three phase Synchronous motor.
15. Plot the V & inverted V curves of synchronous motor.

5EP09 INFORMATION & COMMUNICATION TECHNOLOGY - LAB

Student needs to complete minimum eight assignments based on the following:

Word Processing with MS-Word:

- Basic operations- Editing and Formatting text, paragraphs and pages, printing the documents.
- Working with tables, figures, images.
- Mail merge. Working with Charts, Equations, symbols.

Working with workbooks /work sheets.

- Data Entry techniques & Defining data set as a Table.
- Setting, Previewing, and Printing under MS-Excel.
- Performing Calculations, using Excel Formulas, Functions and Charts.
- Sorting/ Filtering data in excel sheet.

Working with MS Power Point.

- Presentation Basics. Adding more components to the slides, Printing the slides.
- Formatting Presentations, backgrounds and layout. Applying Themes. Using Slide Master.
- Working with Graphics, Images and Clips.
- Working with Multimedia. Inserting Sound and Narration.
- Delivering Presentations. Animating Objects. Adding Action effects.
- Live Presentation. Using Custom Shows.
- Saving/Protecting the Presentation.

Working with Latex:

- Basic operations- Editing and Formatting text, paragraphs and pages, printing the documents.
- Working with tables, figure & images.

Web Page Development:

- Introduction to HTML, CSS, JAVA Coding.
- Development of Web page.

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6EP01 POWER ELECTRONICS

Course Outcomes:

After completing this course student will be able to

1. Explain the concepts and techniques used in power electronics
2. Apply the knowledge of series and parallel connection of SCRs in power control applications
3. Analyze various single phase and three phase power converter circuits
4. Analyze the single phase and three phase Inverter circuits
5. Explain the operation of DC/DC and AC/AC converter circuits
6. Demonstrate the applications of power electronic circuits.

Unit I: SCR, Triac, Diac – Construction and Applications, two Transistor Analogy of SCR, SCR turn ON mechanism, different methods for turning ON SCR, turn OFF mechanism, Thyristor firing circuits, introduction to Power MOSFET and IGBT their construction and characteristics.

Unit II: Series-Parallel operation of SCRs, firing circuits for series and parallel operations, static and dynamic equalizing circuit, equalization of current in parallel connected SCRs ,string efficiency, de-rating factors, protections of SCRs against di/dt, dv/dt, over-voltage and over-current protection, Gate protections, Electro Magnetic Interference(EMI) and Shielding.

Unit III: Principle of phase control, half wavecontrolled rectifier, half controlled bridge and fully controlled bridge rectifier for R, RL and RLE load, derivation for output voltage and current, effect of freewheeling diode, effect of source inductance.

Three phase half controlled bridge and fully controlled bridge rectifier.

Unit IV: Classification of circuit for forced commutation, series inverter, improved series inverter, parallel inverter, single phase PWM inverters, principle of operation of three phase bridge inverter in 120^0 and 180^0mode,single phase transistorized bridge inverter.

Unit V: Basic principle of Chopper, Time ratio control and current limit controlled technique, Voltage commutated Chopper circuit, Jones Chopper, Step up Chopper, Step down Chopper and AC Chopper.

Unit VI: Basic principle of cycloconverter, single phase to single phase cycloconverter, Introduction, principle of operation of single-phase voltage controllers for R and R-L load

Speed control of DC series motor using chopper, Speed control of DC shunt motor using phase controlled rectifier. Speed control of three phase Induction motor by stator voltage control method, V/f control.

Text Books:

1. M.D. Singh & K.B. Khanchandani, “Power Electronics “Tata Mc-Graw Hill, New Delhi
2. Rashid Muhammad, H., “Power Electronics: Circuits, Devices and Applications”, 2nd Edition. Prentice-Hall, 1998

Reference Books:

1. Mohan Ned, Undeland Tore, M. and Robbins William, P., “Power Electronics: Converter, Applications and Design”, John Wiley & Sons, 1994.
2. LandevCyrill, W., “Power Electronics”, McGraw Hills, London, 1981.
3. Dewan, S.B. and Satrughan A., “Power Semiconductor Circuits”, John Wiley & Sons,
4. Dubey, G.K., Doradlla, S.R., “Thyristerised Power Controllers”, Wiley Eastern, 1987.

6EP02 ELECTRICAL ENERGY DISTRIBUTION & UTILISATION

Course Outcomes:

After completing this course, Students will be able to:

1. Demonstrate the knowledge of distribution substation
2. Compare different power distribution systems
3. Describe elements of distribution Automation system
4. Select proper electrical drive for industrial applications
5. Explain the workingof electric traction system
6. Describe an illumination system & electric heating

Unit I: Substation: Selection & location of site, classification, major equipment ,graphical symbols for various apparatus & circuit elements ,key diagram for 33/11kV substation along with selection & specification of substation equipment, types of bus-bar arrangements, substation earthing. Introduction to Gas Insulated Substation (GIS).

Unit II: Power distribution system -I: Primary and secondary distribution, types of conductors in Distribution system, comparison of distribution systems radial, parallel and ring main, economics of feeder design.

Unit III: Power distribution system - II: Methods for reduction of line losses in distribution system. Introduction to High Voltage Distribution System (HVDS). Distribution Automation: Need for distribution automation, feeder automation, and communication requirements for Distribution automation, Remote terminal unit (RTU). Introduction to SCADA systems.

Unit IV: Electrical Drives: Concept, types, selection criterion for electrical drive. Types of duties, rating calculations for these duties. Heating and cooling. Industrial applications: Textile mill, Cement mill, Sugar mill.

Unit V: Traction System: Requirement, speed- time curves. General features, types, Quadrantal diagram of speed-torque characteristics of traction motors. Control of traction motors: Series-Parallel control. Different accessories for track electrification –overhead wires, conductor rail system, current collector-pantograph

Unit VI: Illumination : Street lighting**:** Principle, illumination level, mounting height of lamps, spacing, types of lamps. Flood lighting: Flood lighting calculations, waste light factor, Depreciation factor, Utilization factor. LED: Working principle, advantages & applications.

b) **Electric Heating**:Resistance& Induction heating & its applications.

Text Books:

1. S.K.Pillai, “A First Course on Electrical Drives”, New Age International Publication
2. J.B.Gupta, “A Course in Power System”, S.Chand Publication

Reference Books:

1. M.V.Deshpande, “Electrical Power System Design”, TMH Publishing Company Ltd
2. S.Sivanagaraju&S.Satyanarayana, “Electric Power Transmission & Distribution” Pearson Publication
3. P. S. Satnam&P.V.Gupta, “Substation design & Equipment” Dhanpat Rai Publication.
4. J.Upadhyay&S.N.Mahendra : Electric Traction by Allied Publishers Ltd
5. J.B.Gupta :Utilization of Electric Power & Electric Traction by S.K.Kataria& Sons, New Delhi.
6. H.Pratap :Art & Science of Utilization of Electrical Energy by Dhanpat Rai & Company Ltd.
7. H Pratap, “Modern Electric Traction” Dhanpat Rai & Sons Ltd
8. Dr.M.K.Khedkar&Dr.G.M.Dhole : A Textbook of Electrical Power Distribution Automation by University Science Press
9. S.L.Uppal: Electrical Wiring, Estimating and Costing by Khanna Publishers.

6EP03 COMPUTER AIDED ELECTRICAL MACHINE DESIGN

Course Outcomes:

After completing this course, student will be able to

1. Explain the Basics of Computer aided machine design & material selection.
2. Derive the design parameters of single & three phase transformer core.
3. Calculate the winding& cooling system parameters of the transformer
4. Develop the armature winding diagram for three phase Induction Motor
5. Determine the stator core dimensions of three phase Induction motor
6. Design the squirrel cage & wound type rotor for three phase Induction motor

Unit I: Introduction :

Review of transformer & Induction motor constructional features, Major considerations in electrical machine design, optimization, electrical engineering materials: Conducting, Insulating & Magnetic Materials,Limitations of traditional design, need for CAD, analysis, synthesis and hybrid methods of CAD, Introduction to FEM based machine design.

Unit II: Transformer Design –I:

Transformer Core Design - Material selection, type of construction, Specific magnetic & electric loadings, output equation, core and yoke cross sections, window dimensions, overall core dimensions calculations, core loss estimation from design data. Optimum core design for Minimum cost, Minimum losses, Minimum weight & Minimum volume.

Unit III:Transformer Design – II:

Transformer Winding - types, and design calculation, Layout, no-load current calculation, primary and secondary winding resistance and leakage reactance from design data, mechanical forces – types & causes.Estimation of efficiency & regulation from design data.

Cooling methods for a transformer, design of transformer tank. Calculation of cooling tubes.

Unit IV: AC winding Design :

Concentrated & distributed winding, Integral slot & fractional slot winding, Full pitch & short pitch windings, Single layer& double layer winding, distribution factor, coil pitch factor and winding factor, EMF equation, Development of winding diagrams.

Unit V: Induction motor stator design:

Specific electric and magnetic loadings selection, output equation, main dimensions (D&L) calculation, stator slot-numbers, shape and dimensions, stator teeth dimension, stator core dimensions.Air gap length calculation.

Unit VI: Induction motor rotor design:

Squirrel cage rotor design –selecting number of rotor slots, design of rotor bars & slots, design of end rings. **Wound type rotor design** - rotor winding design, rotor slots design, and rotor core design. Bearings, shaft design. estimation of no-load current, stator and rotor winding resistances from design data, dispersion coefficient & its effect on performance of IM.

Text Books:

1. A. K. Sawhney, "A Course in Electrical Machine Design" Dhanpat Rai & Co Ltd, 2016
2. R.K.Agrawal, "Principles of Electrical Machine Design", S.K.Kataria and Sons, Delhi

Reference Books:

1. M.G.Say,"The Performance and Design of Alternating Current Machines", C.B.S. Pub., Delhi.
2. K.G.Upadhyay,"Design of Electrical Machines", New Age international Publishers,1st Edition 2008
3. S.K.Sen,"Principles of Electrical Machine Design with Computer Programs", Oxford and I.B.H. Company Pvt. Ltd., New Delhi
4. IndrajitDasgupta, "Design of Transformers", TMH 1st Edition 2002
5. Indian Standards for Transformer & Three phase IM design from BIS websites.

6EP04 Professional Elective - II

1. ADVANCED CONTROL SYSTEMS

Course Outcome

After completing this course students will be able to

1. Design compensator using time domain and frequency domain specifications
2. Represent system using state space model
3. Analyze controllability and observability for systems and design full state feedback controller.
4. Analyze digital systems using Z Transform
5. Develop the describing function for the nonlinearity to assess the stability of the system.
6. Analyzethe Nonlinear system using Phase plane Analysis

Unit I: Compensation Techniques:

Introduction, preliminary consideration of classical design. Lead compensator, Lag Compensator, Lead-Lag compensator, Feedback compensation in frequency domain.

Unit II: State Space Technique I:

State, state space and state variables ,SISO /MIMO linear systems state Variable models- differential equations, transfer functions, block diagrams And state diagrams. Transfer function decomposition –Phase variable Forms, canonical forms and Jordan canonical forms, STM computation, L.T, Canonical transformation, and Cayley Hamilton theorem. Time Response –SISO systems.

Unit III: State Space Technique II:

Concept-controllability and observability , SISO/ MIMO linear Systems Gilbert's method and Kalman's test; SISO controllable Systems design –state feedback.

Unit IV: Sampled Data Control Systems:

Representation, Z transform, Sampler and hold, ZOH, Open loop and closed loop SDCS, Z transfer Function, difference equation, solution, Pulse transfer function, Stability Analysis, S and Z domain relationship, Jury's test, and bilinear Transformation. Root locus method.

Unit V: Non-Linear System Analysis I:

Non linear system behaviour, types and characteristics, Describing function Stability analysis limit cycles, Limitation of Describing function.

Unit VI: Non-Linear System Analysis II:

Linearization, Singular points, Classification and nature, Phase plane method, non linear system analysis, Phase trajectories, construction –analytical and graphical method by isoclines, stability analysis, limit cycles, limitations – phase plane method.

Text Books:

1. Nagrath and Gopal, "Control system Engineering" Wiley Eastern Ltd , New Delhi
2. K.Ogata," Modern Control Theory "Prentice Hall Of India Pvt Ltd , New Delhi.

Reference Books:

1. Naresh Sinha. "Control system Engineering" Wiley Eastern Pvt. Ltd., New Delhi.
2. B.C. Kuo. "Automatic Control system" Prentice Hall Of India Pvt Ltd Delhi
3. D Roy Choudhury, "Modern Control Engineering"Publisher: PHI Learning.

6EP04 Professional Elective – II:

2. PROCESS CONTROL SYSTEMS

Course Outcomes:

After Completing this course student will be able to

1. Explain the various Electronic Instruments for measurement of electrical parameters.
2. Analyse the different signals
3. Demonstrate the signal counting, recording and working of digital readout devices.
4. Demonstrate the Various techniques of A/D and D/A conversions.
5. Apply various signal processing tools as per requirement
6. Develop ladder diagrams &programmes for PLC

Unit I : Electronics Instruments for Measurement of Electrical Parameters Advantages of Electronic Instruments, Electronic Voltmeters Electronic Multi-meter, differential volt meter, Digital voltmeter, Q meter, vector impedance meter, vector voltmeter.

Unit II: Signal Generation and Analysis Signal generators, Function generators. Wave analyzer Harmonic Distortion Analysers, Spectrum Analysis.

Unit III: Signal Counting and Recording Decade counting Assembly, Binary counter, Decimal counter, Decade counter with digital display, universal counter, Digital readout devices, storage type CRO, Servo type X-Y recorder.

Unit IV: Signal conditioning and Conversions. Frequency characteristics of various types of signals, active filters bandpass, low pass and high pass filters using opAmps. Various techniques of A/D and D/A conversions. Modulation and demodulation PCM techniques, phase locked loop.

Unit V: Signal Processing Pulse times, triggered delayed sweeps, discrete pulse delay circuits, pulse sequencing, analog multiplexers and de-multiplexers, digital multiplexing sample and hold circuits, serial and parallel digital data conversion. Signal transmission, Analog and digital telemetry techniques, MODEM and UART, keyboard and character generators, tape recorder,

Unit VI : Introduction to Processor and Processor based Techniques. Introduction to PLC, PLC architecture, programming; ladder diagram and examples, micro controller based instrumentation

Text Books:

1. H.S. Kalsi – Electronic Instrumentation, - Tata Mc-Graw Hill Publishing Company, New Delhi.
2. Cooper, Helfrick – Electronic Instrumentation and Measurement Techniques, A Prentice Hall of India. New Delhi.

Reference Books: -

1. B.R. Gupta-Electronics and Instrumentation – Wheeler Publishing.
2. Rangan, Sharma & Mani – "Instrumentation – devices & Systems." Tata Mc-Graw Hill Publishing Company, New Delhi.
3. R.P. Jain-Digital Electronics, Tata Mc-Graw Hill Publishing Company, New Delhi.
4. Microprocessors and Digital Systems, by:D.V.Hall,TMH Publishing Company, New Delhi.
5. Shoen Beck- Electronic Communication, Prentice Hall of India. Pvt. Ltd. New Delhi.
6. B. Ram- fundamental of Microprocessors, Dhanpat Rai & Sons, New Delhi.
7. A.K. Sawhney – A Course in Electrical & Electronics Instrumentation, Dhanpat Rai & Sons, New Delhi.

6EP04 Professional Elective – II

3. INDUSTRIAL ELECTRICAL SYSTEM

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the electrical wiring systems for residential, commercial and industrial consumers.
2. representing the systems with standard symbols and drawings, SLD.
3. Understand various components of industrial electrical systems.
4. Analyze and select the proper size of various electrical system components.

Unit I: Electrical System Components :
LT system wiring components, selection of cables, wires, switches, distribution box, meteringsystem, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse currentcharacteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator,Relays, MPCB, Electric shock and Electrical safety practices

Unit II: Residential and Commercial Electrical Systems:
Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Unit III: Illumination Systems:
Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

Unit IV: Industrial Electrical Systems – I:
HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC,MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

Unit V: Industrial Electrical Systems – II:
DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing theDG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Unit VI: Industrial Electrical System Automation:
Study of basic PLC, Role of in automation, advantages of process automation, PLC basedcontrol system design, Panel Metering and Introduction to SCADA system for distribution automation.

Text Book: S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008.

Reference Books:

1. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.
2. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co.,
3. Web site for IS Standards.
4. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

6FEEP05 Open Elective – II

(1) ENERGY AUDIT AND MANAGEMENT

Course Outcomes:

After completing this course student will be able to:

1. Discuss energy scenario and its management.
2. Conduct the energy audit of different systems.
3. Determine the economics of energy conservation
4. Discuss various energy Conservation methods & their case studies
5. Explain fundamentals of Harmonics.

Unit I : Energy Scenario & Management:

Indian energy scenario, Energy needs of growing economy, Energy pricing in India Energy sector reforms, various forms of energy, Primary and secondary energy, commercial and non-commercial energy, Global primary energy reserves, Energy and environment, Necessity of conserving energy, Energy strategy for the future, Electrical energy management, Concept of supply side management and demand side management, Methods of implementing Demand side management and advantages to consumer, utility and society.

Unit II: Energy Audit:

Definition, Need of energy audit, Preliminary and detailed energy audit. Procedure for carrying out energy audit, Instruments used for energy audit, Data Analysis-Energy— production relationship, specific energy consumption, Sankey diagram, CUSUM Technique, Bench marking energy performance, Recommendations for energy conservation, Action plan, Executive Summary.

Unit III: Economics of energy conservation:

Cost factors, Budgeting, Standard costing and Sources of capital, Cash flow diagram and activity chart, Simple Payback period analysis, Time value of money, Net present value method, internal rate of return method, Profitability index for benefit cost ratio

Unit IV: Energy Conservation:

Energy conservation in motive power, Illumination, Heating & cooling systems, Pumping systems, thermal power stations and Transmission & Distribution Sector. Cogeneration &Waste heat recovery systems.

Unit V: Energy Audit Case Studies:

Energy Intensive Industries, Commercial, Industrial, Municipal and Agriculture Sector, IT industries, Hospitals.

Unit VI: Fundamentals of Harmonics:

Harmonic distortion, voltage versus current distortion, Power systems quantities under non sinusoidal conditions- active reactive and apparent power, displacement and true power factor, harmonic phase sequences, triplen harmonics, harmonic indices- Total harmonic distortion (THD), Total demand distortion (TDD) , Harmonic sources from commercial and industrial load.

Text Book: Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, Book-2, Book-3, Book-4 (available online BEE website)

Reference Books:

1. S. C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991.
2. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)
3. Energy Conservation and Audit ByThumman, Fairmont Press
4. Energy Audit and Conservation TERI

6FEEP05 Open Elective – II (2) ELECTRICAL ESTIMATING & COSTING

Course Outcomes:

After completion of the course students will be able to

1. Understand methods of installation and estimation of service connection
2. Decide type of wiring, its estimation and costing for residential building
3. Carry out electrification of commercial complex, factory unit installations
4. Design & estimate for feeders & distributors
5. Understand contract, tendering and work execution process.

Unit I: Electrical Installation:

Classification of Electrical Installation, General requirement of Electrical Installation. Important definitions related to Installation.

Service Connection: Concept of service connection, Types of service connection & their features. Methods of Installation of service connection. Estimation of service connection.

Unit II : Residential Building Electrification :

Procedures for designing the circuits and deciding the number of circuits. Selection of type of wiring and rating of wires & cables. Earthing of Residential Installation. Estimate and cost Preparation of Residential Installation.

Unit III: Electrification of commercial Installation:

Concept of commercial Installation. Differentiate between electrification of Residential and commercial Installation Deciding the size of cables, busbar and busbar chambers. Earthing of the electrical Installation Selection of type wire, wiring system.Preparation of detailed estimate and costing of commercial Installation.

Unit IV: Electrification of factory unit Installation:

Concept of Industrial load. concept of Motor wiring circuit.Important guidelines about power wiring and Motor wiring.Selection and rating of wire, cable size. Sequence to be followed to prepare estimate. Preparations of detailed estimate and costing of small factory unit/ workshop.

Unit V: Design & estimate for feeders &distributors:

Different schemes for feeders & distributors, estimates for different feeders & distributors, Distribution transformer, Deciding Size & location, Estimate for outdoor & indoor type distribution substation.

Unit VI: Contracts, Tenders and Execution:

Tender and tender notices. Procedure for submission and opening tenders. Comparative statements, criteria for selecting contractors, General conditions in order form. Principles of Execution of works administrative approval, technical sanctions. Billing of executed work.

Text & Reference Books:

1. Electrical Design; Estimating and costing by K.B. Raina, S.K.Bhattacharya New Age International (p) Limited, New Delhi.
2. Electrical Estimating and costing by Surjit Singh Dhanpat Rai and company, New Delhi
3. Electrical Estimating and costing by N. Alagappan S. Ekambaram, Tata Mc Graw Hill Publication New Delhi

6FEEP05 Open Elective - II
3. ELECTRICAL MATERIALS

Course outcomes:

After completing this course students will be able to

1. understand importance of electrical engineering materials
2. understand how electric conduction takes place in conductors
3. understand importance of semiconductors and magnetic materials in electrical engineering.
4. understand importance of dielectric materials in electrical engineering.
5. Identify the need of special materials in electrical engineering.

Unit-I Introduction to Electrical Engineering Materials:
Importance of materials, Classification of electrical materials, Scope of electrical materials, Requirement of Engineering materials.Types of engineering materials, Levels of material structure.

Unit-II Conducting Materials:
Review of metallic conduction on the basis of free electron theory. variation of conductivity with temperature and composition, materials for electric resistors- General Electric properties; material for brushes of electrical machines, lamp filaments,fuses and solder.

Unit-III Semiconductors:
Semiconductors: Mechanism of conduction in semiconductors, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors.

Unit-IV Magnetic Materials:
Classification of magnetic materials- origin of permanent magnetic dipoles, magneto materials used in electrical machines, instruments and relays.
Magnetic Circuit terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetic, Ferromagnetic, Antiferromagnetic. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss.

Unit-V Dielectrics & Insulating Materials:
Dielectrics, Factors influencing dielectric strength. Capacitor materials. Insulating materials, Insulating Materials: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), resins and varnishes, liquid insulators(transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators.

Unit-VI Materials for Special Applications:
Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, sintered alloys for breaker and switch contacts.

Text & Reference Books:

1. Electrical Engineering Materials by Dekker A.J (PHI)
2. Electrical Engineering Materials by S.P.Seth (Dhanpatrai and Sons)
3. An Introduction to Electrical Engineering Materials by Dr. C. S Indulkar & Dr. S. Thiruvelgadam (S Chand Publication)

6EP06 POWER ELECTRONICS LAB

Perform minimum eight experiments:

List of Experiments:

1. To verify the V-I characteristics of SCR
2. To verify forward and reverse characteristics of DIAC
3. To verify forward and reverse characteristics of TRIAC
4. To study UJT as relaxation oscillator
5. AC voltage control using triac - diac combination
6. To verify the operation of half and full controlled converter
7. To verify the operation of SCR commutation circuits
8. To design & simulate dc-dc buck converter
9. To design & simulate dc-dc boost converter
10. Construct and test the dc chopper control circuit using thyristor
11. Study of PWM based step down dc chopper using MOSFET/IGBT
12. To verify the operation of Single phase single pulse / sinusoidal PWM inverter using MOSFET/IGBT
13. To verify the operation of Single phase parallel inverter using MOSFET/IGBT
14. To verify the operation of Single phase to single phase cycloconverter
15. To verify the operation of Single phase dual converter With R - RL loads
16. To verify the operation of Single phase ac voltage controller

6EP07 ELECTRICAL ENERGY DISTRIBUTION & UTILIZATION LAB

Perform minimum eight experiments

List of Experiments:

1) Study of Distribution substation equipments.
2) Study of various types of busbar arrangements.
3) Study of Power distribution system.
4) Study of Distribution Automation system.
5) Prepare a report on visit to distribution substation.
6) Simulation of various types of Electrical Distribution System (Radial, Parallel, Ring main)
7) Development of single line diagram of of 33/11 kV substation in AutoCAD Electrical
8) Determination of Efficiency by Performing Load Test on Three-Phase Induction Motor.
9) Determination of Efficiency by Performing Load Test on DC Shunt Motor.
10) Electric Braking of DC.Shunt Motor.
11) Electric Braking of Three-Phase Induction Motor.
12) Speed Control of Three-Phase Slip-Ring Induction Motor.
13) Determination of Efficiency by Performing Load Test on Single-Phase Induction Motor.

14) Study of Electric Heating.
15) Design Scheme of Illumination System.
16) Study of Electric Traction System .

6EP08 COMPUTER AIDED ELECTRICAL MACHINE DESIGN LAB

Develop Minimum Eight Computer Programme:

List of Computer Programme:

1. Develop a computer programme for core design of a single-phase core type transformer
2. Develop a computer programme for core design of a single-phase shell type transformer
3. Develop a computer programme for core design of a three-phase core type transformer
4. Develop a computer programme for optimum core design of a three-phase core type transformer for minimum cost or maximum efficiency.
5. Develop a computer programme for Estimation of Iron losses in a three-phase core type transformer.
6. Develop a computer programme for windings design of a single-phase transformer
7. Develop a computer programme for windings design of a three-phase transformer
8. Develop a computer programme for calculating the No load current of a single-phase transformer.
9. Develop a computer programme for calculating the No load current of a three-phase transformer.
10. Develop a computer programme for tank design and calculating the number of cooling tubes required for three phase core type transformer.
11. Develop a computer programme to calculate Main dimensions (D & L) of a three phase Induction motor.
12. Develop a computer programme for stator core design of three phase induction motor.
13. Develop a computer programme for squirrel cage rotor design of three phase induction motor.
14. Develop a computer programme for wound type rotor design of three phase induction motor.
15. Develop a computer programme for estimating magnetizing current of a squirrel cage type three phase induction motor.

6EP09 COMPUTER TECHNOLOGY- LAB

Student needs to complete minimum eight assignments based on the following:

- Computer Network: Basic hardware and terminology in networks, Classifications, The Internet, The Intranet and Extranet.
- Installation of operating systems, application software in Personnel Computer or laptop.
- Develop the simulation models for various tasks in electrical engineering using simulation software.
- Develop the computer programme for various tasks in electrical engineering using software.
- Study of PLCs used for Industrial automation & develop the ladder diagram for given task in automation using PLC.
- Basics of IoT, IoT based Monitoring & Controlling of various Electrical Equipments.

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B.E. COMPUTER SCIENCE & ENGINEERING SEM. V & VI

Syllabus of B.E. Sem. V (Computer Science & Engineering)

5KS01 Database Management Systems (L-4, T-0, C-4)

Course Prerequisite: Discrete Mathematics, Data Structures and Algorithm

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Database Management Systems by being able to do each of the following:

- To understand the fundamental concepts of database management system.
- To learn database query languages.
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
- To understand the query processing and optimization.
- To learn basics of transaction management and concurrency control.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Model, design and normalize databases for real life applications.
2. Discuss data models, conceptualize and depict a database system using ER diagram.
3. Query Database applications using Query Languages like SQL.
4. Design & develop transaction processing approach for relational databases.
5. Understand validation framework like integrity constraints, triggers and assertions.

Unit I: Introduction to DBMS Hours: 8

Database System Applications, Purpose of database systems, View of Data, Database Languages Database Architecture, Database Users and Administrators, Entity- Relationship Model, Constraints, Removing redundant attributes in Entity sets, E-R diagrams, Reduction to Relational Schemas, E-R design issues, Extended E-R Features. (8)

Unit II: Relational Algebra, SQL Hours: 8

Relational Model: Structure of Relational Databases, Database schema, keys, schema diagram, relational query languages, relational operators, The Relational Algebra, Overview of SQL query language, SQL data definition, Basic Structure of SQL queries, Additional basic operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database Operations, Join expressions, Views.

Unit III: Relational Database Design **Hours: 8**

Integrity Constraints, SQL data types and schemas, Authorization, Triggers, Features of good relational designs,atomic domains and First Normal Form, decomposition using functional dependencies, Functional dependency theory, Algorithms for decomposition, Decomposition using multi-valued dependencies, More Normal Forms, Database Design Process.

Unit IV: Query Processing and Query Optimization Hours: 8

Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Query Optimization: Overview, Transformation of Relational Expressions ,Estimating Statistics of Expression Results, , Choice of Evaluation Plans, Materialized Views.

Unit V: Transaction Management Hours: 8

Transaction Concept, Simple transaction model, Storage structure, Transaction Atomicity and Durability, transaction isolation, Serializability, transaction isolation and atomicity, transaction isolation levels, Implementation of Isolation levels, Transactions as SQL statements

Unit VI: Concurrency Control and recovery system Hours: 8

Lock-Based Protocols, Deadlock Handling, Multiple Granularities, Timestamp- Based Protocols, Validation-Based Protocols, Multi-version schemes, Recovery system :Failure classification, Storage , Recovery & Atomicity, Recovery algorithm, buffer management, Failure with loss of nonvolatile storage , early lock release and logical undo operations, , Remote Backup Systems

Text Book: Abraham Silberschatz, Henry F. Korth, S. Sudarshan, DATABASE SYSTEM CONCEPTS, Sixth Edition, McGraw Hill

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill
2. Shamkant B. Navathe, RamezElmasri, Database Systems, Pearson Higher Education
3. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
4. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
5. G.K. Gupta: Database Management Systems, McGraw Hill.
6. Toledo and Cushman: Database Management Systems, (Schaum's Outlines)

5KS02 COMPILER DESIGN (L-3, T-0, C-3)

Course Pre-requisite: Basic knowledge of Discrete Mathematics, Theory of Computation

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:

- To learn concepts of programming language translation and phases of compiler design
- To understand the common forms of parsers.
- To study concept of syntax directed definition and translation scheme for the representation of language
- To illustrate the various optimization techniques for designing various optimizing compilers

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe the fundamentals of compiler and various phases of compilers.
2. Design and implement LL and LR parsers
3. Solve the various parsing techniques like SLR, CLR, LALR.
4. Examine the concept of Syntax-Directed Definition and translation.
5. Assess the concept of Intermediate-Code Generation and run-time environment
6. Explain the concept code generation and code optimization.

Unit I: Introduction to Compiler Hours: 06

Introduction to Compilers: Language Processor, The Structure of a Compiler. Lexical Analysis: The role of lexical analyzer, Input Buffering, Specification of tokens, Recognition of tokens, The lexical analyzer generator Lex, Finite Automata, From Regular Expressions to Finite Automata, State minimization of DFA.

Unit II: Syntax Analysis Hours: 07

Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis: Parse Tree and Derivation, Ambiguity in Grammar, Elimination of left recursion and left factoring. Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, FIRST and FOLLOW, LL (1) Grammars, Construction of predictive parsing tables, Non recursive predictive parsing, Error recovery in predictive parsing.

Unit III: Bottom up parsing Hours: 07

Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing Introduction to LR parsing: Simple LR, Items and the LR(0) Automation, The LR-Parsing algorithm, Construction of SLR parsing table, More powerful LR Parsers: canonical LR(1) Items, Constructing LR(1) sets of items and canonical LR(1) parsing tables, Constructing LALR parsing tables, The parser generator Yacc.

Unit IV: Syntax Directed Translation Hours: 07

Syntax Directed Translation: Syntax directed definitions, Inherited and synthesized attributes, Evaluation orders of SDD's: Dependency Graphs, S-attributed definitions, L-attributed definition. Application of Syntax-Directed Translation: Construction of syntax trees. Syntax-directed Translation Schemes.

Unit V: Intermediate-Code Generation Hours: 07

Intermediate-Code Generation: Variants of Syntax Trees: Directed Acyclic Graphs(DAG), Three Address Code. Run Time Environments: Storage Organization, Static versus Dynamic Storage Organization, Stack Allocation of Space: Activation trees, Activation Records, Calling Sequences, Variable- Length data on stack. Access to Nonlocal Data on the Stack. Heap Manager: The Memory Manager. Introduction to Garbage Collection: Design Goals for Garbage Collectors.

Unit VI: Code Generation Hours: 06

Code Generation: Issues in Design of a Code generator, The Target Language, Address in the target code, Basic blocks and flow graphs. Optimization of Basic Blocks, Peephole Optimization and The Principal sources of Optimization.

Text Book: Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: "Principles, Techniques and Tools", Pearson Education Second Edition.

Reference Books:

1. D. M. Dhamdhere, Compiler Construction—Principles and Practice, (2/e), Macmillan India.
2. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman Compilers: "Principles, Techniques and Tools", Pearson Education (Low Price Edition).
3. Andrew Appel, Modern Compiler Implementation in C, Cambridge University press.
4. K C. Louden "Compiler Construction—Principles and Practice" India Edition, CENGAGE.
5. Bennett J.P., "Introduction to Compiling Techniques", 2/e (TMH).

5KS03 COMPUTER ARCHITECTURE & ORGANIZATION (L-3, T-0, C-3)

Course Pre-requisite: Microprocessor & Assembly Language Programming

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computer Architecture & Organization by being able to do each of the following:

- To discuss the basic concepts and structure of computers.
- To solve concepts of arithmetic operations.
- To understand addressing modes and memory organization.
- To analyze conceptualize multitasking ability of a computer and pipelining
- To explain IO communication

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Discuss basic structure of computer.
2. Understand the basic operation of CPU.
3. Compare and select various Memory and I/O devices as per requirement.
4. Solve the concepts of number representation and their operation.
5. Explain the concept of parallel processing and pipelining.

Unit I: Basic Structure of Computer Hours: 7

Basic Structure of Computer H/W & S/W: Functional Units, Basic Operational Concepts, Bus structures, Addressing Methods and Machine Program Sequencing: Memory Locations, Addresses, Instruction and instruction sequencing, Addressing Modes. Basic I/O Operations.

Unit II: Memory Unit Hours: 7

Basic Concepts, Memory Hierarchy, Semiconductor RAM Memories, Internal Organization of Memory Chips, Static Memories, Dynamic Memories, Read Only Memories, Speed, Size and Cost.

Unit III: Processing Unit Hours: 8

Fundamental Concepts, Execution of a Complete Instruction, Hardwired Control, Performance Consideration, Microprogrammed Control, Microinstructions, Microprogram Sequencing.

Unit IV: I/O Organization Hours:6

Accessing I/O Devices, Interrupts, Enabling and Disabling Inerrupts, Handling Multiple Devices, DMA,I/O Hardware, Standard I/O Interfaces:SCSI

Unit V: Arithmetic Hours: 7

Number Representations, Design of Fast Adders, Signed Addition and Subtraction, Multiplication of Positive Numbers ,Booth Multiplier, Fast Multiplication ,Integer Division, Floating Point Numbers and Operations.

Unit VI: Parallel Organization and Pipelining Hours: 7

Parallel Processing, Array Processors, The Structure of General Purpose Multiple Processors, Symmetric, Multiprocessors, Multithreading and Chip Multiprocessors, Clusters, Multicore Organization, Memory Organization in Multiprocessors. Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Text Book: Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw-Hill.

Reference Books:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance", Eighth Edition, Pearson.
   John P. Hayes, "Computer Architecture and Organization", McGraw Hill Publication.
2. DA Patterson and JL Hennessy, Computer Organization and Design, Morgan Kaufmann Publisher, 2nd edition
3. A.S. Tanenbaum, "Structured Computer Organization", PHI Publication.

5KS04 COGNITIVE TECHNOLOGIES (L-3, T-0, C-3)

Course Prerequisite: Basic knowledge of Artificial Intelligence, Programming and Data Structures.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cognitive Technologies by being able to do each of the following:

- This course intends to introduce concept of cognitive technologies and important approaches of cognitive technologies.
- Student will learn and analyze key concept of cognitive technologies.
- Students will gain an understanding of innovation concepts, terminology, current and future trends in cognitive technologies.
- Introduces students to IBM Watson platform, an artificially intelligent computer system capable of answering questions posed in natural language, developed in IBM's Deep QA project.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe the Cognitive computing and principles of cognitive systems.
2. Identify role of Natural Language Processing in cognitive system.
3. Outline application of advanced analytics in cognitive computing.
4. Justify role of Cloud and Distributed Computing in Cognitive Computing.
5. Assess the process of building a Cognitive Application.
6. Identify the Emerging Areas and Future Applications of Cognitive Computing.

Unit I: Foundation of Cognitive Computing & Design Principle of Cognitive Systems Hours: 07

The Foundation of Cognitive Computing: Cognitive Computing as a New Generation, The Uses of Cognitive Systems, What Makes a System Cognitive, Gaining Insights from Data, Domains Where Cognitive Computing Is Well Suited, Artificial Intelligence as the Foundation of Cognitive Computing, Understanding Cognition, Two Systems of Judgment and Choice, Understanding Complex Relationships Between Systems, The Elements of a Cognitive System, Infrastructure and Deployment Modalities.

Design Principles for Cognitive Systems: Components of a Cognitive System, Building the Corpus, Bringing Data into the Cognitive System, Machine Learning, Hypotheses Generation and Scoring, Presentation and Visualization Services.

Unit II: NLP and Big Data in Cognitive System Hours: 07

Natural Language Processing in Support of a Cognitive Sy stem: The Role of NLP in a Cognitive System, Semantic Web, Applying Natural Language Technologies to Business Problems.

The Relationship Between Big Data and Cognitive Computing**:** Dealing with Human-Generated Data, Defining Big Data, The Architectural Foundation for Big Data, Analytical Data Warehouses, Hadoop, Data in Motion and Streaming Data, Integration of Big Data with Traditional Data.

Unit III: Knowledge Representation and Advance Analytics in Cognitive Computing Hours: 06

Representing Knowledge in Taxonomies and Ontologies: Representing Knowledge, Developing a Cognitive System, Defining Taxonomies and Ontologies, Explaining How to Represent Knowledge, Models for Knowledge Representation. Applying Advanced Analytics to Cognitive Computing: Advanced Analytics Is on a Path to Cognitive Computing, Key Capabilities in Advanced Analytics, Using Advanced Analytics to Create Value, Impact of Open Source Tools on Advanced Analytics.

Unit IV: Role of Cloud and Distributed Computing in Cognitive Computing Hours: 07

The Role of Cloud and Distributed Computing in Cognitive Computing: Leveraging Distributed Computing for Shared Resources, Why Cloud Services Are Fundamental to Cognitive Computing Systems, Characteristics of Cloud Computing, Cloud Computing Models, Delivery Models of the Cloud, Managing Workloads, Security and Governance, Data Integration and Management in the Cloud.

The Business Implications of Cognitive Computing: Preparing for Change, Advantages of New Disruptive Models, What Does Knowledge Mean to the Business?, The Difference with a Cognitive Systems Approach, Meshing Data Together Differently, Using Business Knowledge to Plan for the Future, Answering Business Questions in New Ways, Building Business Specific Solutions, Making Cognitive Computing a Reality, How a Cognitive Application Can Change a Market.

Unit V: IBM Watson and Process of Building a Cognitive Application Hours: 07

IBM's Watson as a Cognitive System: Watson Defined, Advancing Research with a "Grand Challenge", Preparing Watson for Jeopardy, Preparing Watson for Commercial Applications, The Components of DeepQA Architecture.

The Process of Building a Cognitive Application: The Emerging Cognitive Platform, Defining the Objective, Defining the Domain, Understanding the Intended Users and Defining their Attributes, Defining Questions and Exploring Insights, Creating and Refining the Corpora, Training and Testing.

Building a Cognitive Healthcare Application: Foundations of Cognitive Computing for Healthcare, Constituents in the Healthcare Ecosystem, Learning from Patterns in Healthcare Data, Building on a Foundation of Big Data Analytics, Cognitive Applications across the Healthcare Ecosystem, Starting with a Cognitive Application for Healthcare, Using Cognitive Applications to Improve Health and Wellness, to Enhance the Electronic Medical Record and to Improve Clinical Teaching.

Unit VI: Emerging Areas and Future Application Hours: 06

Smarter Cities: Cognitive Computing in Government: How Cities Have Operated, The Characteristics of a Smart City, The Rise of the Open Data Movement Will Fuel Cognitive Cities, The Internet of Everything and Smarter Cities, Understanding the Ownership and Value of Data, Smarter Approaches to Preventative Healthcare, Building a Smarter Transportation Infrastructure, Using Analytics to Close the Workforce Skills Gap, Creating a Cognitive Community Infrastructure, The Next Phase of Cognitive Cities.

Emerging Cognitive Computing Areas: Characteristics of Ideal Markets for Cognitive, Computing Vertical Markets and Industries.

Future Applications for Cognitive Computing: Requirements for the Next Generation, Technical Advancements That Will Change the Future of Cognitive Computing, What the Future Will Look Like, Emerging Innovations.

Text Book:

Judith Hurwitz, Marcia Kaufman and Adrian Bowles, "Cognitive Computing and Big Data Analytics", publication John Wiley & Sons, Inc, 2015.

Reference Books:

1. José Luis Bermúdez, Cognitive Science: An Introduction to the Science of the Mind, publication Cambridge University Press, New York, Second Edition.
2. Jay Friedenberg and Gordon Silverman, Cognitive Science: An Introduction to the Study of Mind, Sage Publications, Inc. London, 2014.
3. Huimin Lu (Editor), Cognitive Internet of Things: Frameworks, Tools and Applications, Springer Nature Switzerland AG 2020.
4. Danish Contractor and Aaditya Telang (Editors), Applications of Cognitive Computing Systems and IBM Watson, 8th IBM Collaborative Academia Research Exchange, publication Springer Nature Singapore Pte Ltd., 2017.
5. S. Bird, E. Klein, E. Loper (2009), Natural Language Processing with Python, O' Reilly Media.

5KS04 DATA SCIENCE AND STATISTICS [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Science and Statistics by being able to do each of the following:

- Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
- Apply principles of Data Science to the analysis of business problems.
- Apply the learned concepts for the skillful data management.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Demonstrate proficiency with statistical analysis of data.
2. Build skills in transformation and merging of data for use in analytic tools.
3. Perform linear and multiple linear regression analysis.
4. Develop the ability to build and assess data-based models.
5. Evaluate outcomes and make decisions based on data.

Unit I: Data Science and Statistical Learning Hours: 6

Introduction: What Is Data Science?, Statistical Inference, Exploratory Data Analysis, and the Data Science Process, Exploratory Data Analysis, Stages of a Data Science Project, The Data Science Process, Why Statistical Learning: f Estimation- Why and How, Tradeoff Between Prediction Accuracy and Model Interpretability, Supervised vs Unsupervised Learning, Regression vs Classification Problems, Accessing Model Accuracy: Measuring the Quality of Fit, The Bias Variance Trade-off, The Classification Setting.

Unit II: Linear Regression Hours: 7

Simple Linear Regression: Estimating the Coefficients, Assessing the Accuracy of the Coefficient Estimates, Assessing the Accuracy of the Model, Multiple Linear Regression: Estimating the Regression Coefficients, Other Considerations in the Regression Model: Qualitative Predictors, Extensions of the Linear Model, Potential Problems, The Marketing Plan, Comparison of Linear Regression with K-Nearest Neighbors.

Unit III: Classification and Cross Validation Hours: 7

Classification: An Overview of Classification, Why not Linear Regression?, Logical Regression: The Logistic Model, Regression Coefficients, Making Predictions, Multiple Logistic Regression, >2 Response Classes, Linear Discriminant Analysis: Using Bayes' Theorem, LDA for $p = 1$ and $p > 1$, Quadratic Discriminant Analysis, Comparison of Classification Methods, Cross Validation: The Validation Set Approach, Leave-One-Out and k-Fold Cross-Validation, Bias-Variance Trade-Off for k-Fold Cross-Validation, Classification Problems, The Bootstrap

Unit IV: Linear Model Selection and Regularization Hours: 6

Subset Selection: Best Subset Selection, Stepwise Selection, Choosing the Optimal Model, Shrinkage Methods: Ridge Regression, The Lasso, Selecting the Tuning Parameter, Dimension Reduction Methods: Principal Components Regression, Partial Least Squares, Considerations in High Dimensions: High-Dimensional Data, What Goes Wrong in High Dimensions?, Regression in High Dimensions, Interpreting Results in High Dimensions

Unit V: Nonlinearity and Tree Based Methods Hours: 7

Moving Beyond Linearity: Polynomial Regression, Step Functions, Basis Functions, Regression Splines: Piecewise Polynomials, Constraints and Splines, Representation, Number and Locations of the Knots, Comparison to Polynomial Regression, Smoothing Splines: An Overview and Smoothing

Parameter λ, Local Regression, Generalized Additive Models: Regression Problems and Classification Problems, Tree-Based Methods: Decision, Regression and Classification Trees, Trees Versus Linear Models, Advantages and Disadvantages, Bagging, Random Forests, Boosting

Unit VI: SVM and Unsupervised Learning Hours: 7

Maximal Margin Classifier: Hyperplane and Classification, The Maximal Margin Classifier, Construction, The Non-separable Case, Support Vector Classifiers: Overview and Details, Support Vector Machines: Classification with Non-linear Decision Boundaries, SVM, Application, SVMs with More than Two Classes, Relationship to Logistic Regression, Unsupervised Learning: The Challenge of Unsupervised Learning: Principal Components Analysis, Clustering Methods: K-Means Clustering, Hierarchical Clustering, Practical Issues in Clustering.

Text Books:

1. Cathy O'Neil and Rachel Schutt: Doing Data Science, First Edition, 2014, O'reilly Publications, ISBN: 978-1-449-35865-5
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani: An Introduction to Statistical Learning with Applications in R, First Edition, 2013, Springer-Verlag New York, ISBN: 978-1- 4614-7137-0.

Reference Book:

Nina Zumel, John Mount: Practical Data Science with R, First Edition, 2014, Manning Publications Co., ISBN: 9781617291562.

5KS04 INTERNET OF THINGS [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Internet and Microprocessor & Assembly Language Programming

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Internet of Things by being able to do each of the following:

- To learn and understand fundamental of IoT
- To study the design methodology and different IoT platform
- To understand usefulness of IoT for society
- To design and implement application of IoT using various sensor

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Understand the basics of IoT
2. Understand design methodology and platforms involved in IoT
3. Apply the knowledge to interface various sensors with IoT development
4. Design and Implement IoT system for real time application

Unit I: Hours: 6

Introduction to Internet of Things, Definition & Characteristics of IoT, Physical Design of IoT Logical Design of IoT, IoT Enabled Technologies like Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels & Deployment Templates, Domain Specific IoTs: Home, Cities, Environment, Energy systems, Logistics, Agriculture, Health & Lifestyle.

Unit II: Hours: 7

IOT & M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT, Software defined networks, network function virtualization, IoT Systems Management, Simple Network Management Protocol (SNMP) ,Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG, NETOPEER.

Unit III: Hours: 7

IoT Platforms Design Methodology, Case Study on IoT System for Weather Monitoring, Motivation for Using Python, IoT Systems - Logical Design using Python ,Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling l, Date/Time Operations, Classes, Python Packages of Interest for IoT

Unit IV: (**Hours: 7)** IoT Physical Devices & Endpoints, Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces serial, SPI, I2C, Programming Raspberry Pi with Python, Controlling LED with Raspberry Pi, Interfacing an LED and switch with Raspberry Pi, Interfacing Light Sensor with Raspberry Pi Other IoT Devices, pcDuino, BeagleBone Black, Cubieboard.

Unit V: Hours: 7

IoT Physical Servers & Cloud Offerings, Introduction to Cloud Storage Models & Communication APIs , WAMP - AutoBahn for IoT , Xively Cloud for IoT , Python Web Application Framework - Django , Designing a RESTful Web API , Amazon Web Services for ,SkyNet IoT Messaging Platform.

Unit VI: Hours: 7

Case Studies Illustrating IoT Design, Introduction, Home Automation: Smart Lighting, Home Intrusion detection, Cities: Smart parking, Environment: Weather Monitoring System, Weather reporting Bot, Air pollution monitoring, Forest fire detection, Agriculture: Smart Irrigation, Productivity Applications: IoT printer.

Text Book: Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN:0: 0996025510, 13: 978-0996025515.

Reference Books:

1. Fundamentals of Python, K.A.Lambert and B.L.Juneja, Cengage Learning, 2012.
2. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014

5KS04 INTRODUCTION TO CYBER SECURITY [L-3, T-0,C-3]

Course Prerequisite: Computer Programming, Data Structure, Data Communication & Networking.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Introduction to Cyber Security by being able to do each of the following:

- Understand basics of Cybercrime and Information Security.
- To familiarize various cyber threats, attacks, Cyber offenses.
- Understand Cybercrime on Mobile and Wireless devices.
- Understand tools and methods used in Cybercrime.
- Understand Access Control and Authentication.
- Understand Intrusion Detection and Prevention.

Course Outcomes (Expected Outcome): After completion of this course, the students should be able to:

1. Know fundamentals of Cybercrimes and Cyber offenses
2. Realize the Cyber threats, attacks and Vulnerabilities.
3. Explore the industry practices and tools.
4. Comprehend the Access Control and Authentication Process.
5. Implement Intrusion Detection and Prevention.

Unit I: Hours:6

Introduction to Cybercrime: Introduction, Cybercrime, Cybercrime and Information Security, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era.

Unit II: Hours: 6

Cyber offenses: Introduction, Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrime, Botnets, Attack Vector, Cloud Computing.

Unit III: Hours: 6

Cybercrime: Mobile and Wireless Devices Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Cards Frauds in Mobile and Wireless Computing, Security Challenges posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implementations for Organizations, Organizational Measures for Handling Mobile, Devices Related Security Issues Organizational Security Policies and Measures in Mobile Computing, Laptops.

Unit IV: Hours: 6

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

Unit V: Hours:6

Access Control and Authorization: Definitions, Access Rights, Access Control Systems, Authorization, Types of Authorization Systems, Authorization Principles, Authorization Granularity, Web Access and Authorization.
Authentication: Definition, Multiple Factors and Effectiveness of Authentication, Authentication Elements, Types of Authentication, Authentication Methods.

Unit VI: (**Hours: 6)** System Intrusion Detection and Prevention: Definition, Intrusion Detection, Intrusion Detection Systems (IDSs), Types of Intrusion Detection Systems, The Changing Nature of IDS Tools, Response to System Intrusion, Challenges to Intrusion Detection Systems, Implementing an Intrusion Detection System, Intrusion Prevention Systems (IPSs), Intrusion Detection Tools
Disaster Management: Introduction, Disaster Prevention, Disaster Response, Disaster Recovery, Make your Business Disaster Ready, Resources for Disaster Planning and Recovery.

Text Books:

1. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791,2013
2. Joseph Migga Kizza, "A Guide to Computer Network Security", Springer 2009.

Reference Books:

1. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
2. Nina Godbole, "Information Systems Security", Wiley India, New Delhi
3. Kennetch J. Knapp, "Cyber Security & Global Information Assurance", Information Science Publishing.
4. James Graham, Richard Howard, Ryan Olson, "Cyber Security Essentials" CRC Press.
5. Jeetendra Pande, "Introduction to Cyber Security" Uttarakhand Open University, 2017

5KS05 PRINCIPLES OF MARKETING FOR ENGINEERING [L-3, T-0, C-3]

Course Pre-requisite: Basic knowledge of Computers.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Principles of Marketing for Engineering by being able to do each of the following:

- To provide students with the knowledge about business advantages of the digital marketing and its importance for marketing success;
- To develop a digital marketing plan; to make SWOT analysis;
- To define a target group; to introduced to various digital channels, their advantages and ways of integration;
- To integrate different digital media and create marketing content to manage a digital marketing performance efficiently.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Identify the importance of the digital marketing for marketing success,
2. Manage customer relationships across all digital channels and build better customer relationships,
3. Create a digital marketing plan, starting from the SWOT analysis and defining a target group,
4. Identify digital channels, their advantages and limitations, to perceiving ways of their integration taking into consideration the available budget

Unit I: Introduction to e-Marketing: Hours: 7

Introduction, Wired-up world, B2C, B2B, C2B and C2C Model, Objectives: Sell, Serve, Speak, Save, Sizzle, Introduction to e-strategy.

Unit II: Remix and e-Models Hours: 7

Introduction to Remix: Product, Price, Place, Promotion, People, Process. Introduction to e-Models, e-Marketplace, Digital Communication market, Web & Social Network Models, Customer buying models, Loyalty models

Unit III: e-Customers Hours: 7

Introduction to e-Customers, Motivations, Expectations, Fears & Phobias, Online Buying Process, information processing, relationship & royalty, Communities & social networks, Customer profiles

Unit IV: e-Tools & Site Design Hours:7

Introduction to e-Tools, Technology development & customer impact, Interactive digital TV, Digital Radio, Mobile Devices, Interactive self-service kiosks, Convergence, Integrated Campaigns, Web-site design, Integrated design, online value proposition, Dynamic & aesthetics design

Unit V: Traffic Building Hours: 7

Search Engine Marketing, Online PR & Partnerships, Interactive Advertising, e-mail & viral marketing, Online traffic building, Control, Resourcing

Unit VI: e-CRM & e-Business Hours: 7

Introduction to e-CRM, Database marketing, e-CRM, Profiling, Personalization, Introduction to e-Business, e-Business Architecture & framework, e-business security.

Text Book: E-Marketing excellence: Planning & Optimizing your Digital Marketing, Dave Chaffey & P R Smith, 3rd Edition, Butterworth-Heinemann, Elsevier.

Reference Books:

1. Marketing 4.0: Moving from Traditional to Digital, Philip Kotler, H. Kartajaya, I. Setiawan, Wiley.
2. Business Marketing and Management Principles for IT and Engineering, D. N. Chorafas, CRC Press.
3. Marketing Management, Philip Kotler, Kevin Keller, 12th Edition, Pearson Prentice Hall.
4. Marketing Insights from A to Z, Philip Kotler, John Wiley & Sons..

5KS05 Open Elect. I (i) FUNDAMENTALS OF FINANCE & ACCOUNTING [L-3, T-0, C-3]

Course Prerequisite: Basic Knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Fundamentals of Finance & Accounting by being able to do each of the following:

- Know and apply accounting and finance theory
- Critically evaluate financial statement information
- Evaluate and compare different investments

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Define bookkeeping and accounting
2. Explain the general purposes and functions of accounting
3. Explain the differences between management and financial accounting
4. Describe the main elements of financial accounting information – assets, liabilities, revenue and expenses
5. Identify the main financial statements and their purposes.

Unit I: The basics of Accounting I Hours: 7

The Assets, Liabilities and Balance Sheets, Procedure for creating a Balance Sheet, Different forms of Balance Sheet, Basic concepts of Accounting

Unit II: The basics of Accounting II Hours: 7

The Profit & Loss Account, Cash Flow Statement, Creating Profit & Loss Account, Creating Cash Flow Statement, Book Keeping Basic terminology, Debt & Credit Convention

Unit III: Interpretation of Accounts Hours: 8

Accounting Rules, Reports, Assets, Liabilities, Shareholders' Equity, P&L Statement,

Unit IV: Introduction to Financial Management Hours:6

What is Finance, Forms of Business Organization, Stock Price & Shareholder Value, Intrinsic Value, Stock Price, Business trends and ethics, Conflicts management.

Unit V: Financial Markets and Institutions Hours: 7

Financial Markets, Capital Allocation, Financial Institutions, Stock Market, Market for Common Stock, Stock Market Returns, Stock Market Efficiency

Unit VI: Financial Statements & Analysis Hours: 7

Financial Statements & Reports, Stockholders' Equity, Free Cash Flow, Income Taxes, Analysis of Financial Statements: Ratio Analysis, Liquidity Ratios, Asset & Debt Management Ratio, Profitability Ratio, Trend Analysis

Text Books:

1. Accounts Demystified, 5th Edition, Anthony Rice, Pearson – Prentice Hall
2. Fundamentals of Financial Management, 6th Edition, E. F. Brigham, J.F. Houston, Cengage Learning.

Reference Books:

1. Engineering Economics: Financial Decision Making for Engineering, N. M. Fraser, E. M. Jewkes, 5th Edition, Pearson Publication.
2. Financial Fundamentals for Engineers, Richard Hill & George Slot, Butterworth-Heinemann, Elsevier.
3. Financial Accounting, Jerry Weygandt, Paul Kimmel, Donald Kieso, 9th Edition, Wiley
4. Financial Accounting: Tools for Business Decision Making, Jerry Weygandt, Paul Kimmel, Donald Kieso, 6th Edition, Wiley Plus.

5KS05 ENTREPRENEURSHIP [L-3,T-0,C-3]

Course Prerequisite:

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Entrepreneurship by being able to do each of the following:

- Understand basic concepts in the area of entrepreneurship
- Understand the role and importance of entrepreneurship for economic development
- Develop personal creativity and entrepreneurial initiative,
- Adopt the key steps in the elaboration of business idea

Course Outcomes (Expected Outcome): On completion of this course, the students should be able to:

1. Analyse the business environment in order to identify business opportunities,
2. Identify the elements of success of entrepreneurial ventures,
3. Evaluate the effectiveness of different entrepreneurial strategies,
4. Specify the basic performance indicators of entrepreneurial activity,
5. Explain the importance of marketing and management in small businesses venture,
6. Interpret their own business plan.

Unit I: Hours:6

Introduction to Entrepreneurship: Introduction, Common Myths About Entrepreneurs, Types of Start- Up Firms, Changing Demographics of Entrepreneurs, Entrepreneurship Importance.

Recognizing Opportunities and Generating Ideas: Identifying and Recognizing Opportunities, Finding Gaps in the Marketplace, Techniques for Generating Ideas, Encouraging and Protecting New Ideas.

Unit II: Hours:6

Feasibility Analysis: Product/Service Feasibility Analysis, Industry/Target Market Feasibility Analysis, Organizational Feasibility Analysis and Financial Feasibility Analysis.

Writing A Business Plan: The Business Plan, Outline of the Business Plan, Presenting the Business Plan to Investors.

Unit III: Hours:6

Industry and Competitor Analysis: Industry Analysis, Industry Trends, The Five Competitive Forces Model, The Value of the Five Forces Model, Industry Types and the Opportunities, Competitor Analysis, Identifying Competitors, Sources of Competitive Intelligence, Completing a Competitive Analysis Grid. Developing an Effective Business Model: Business Models, Components of an Effective Business Model.

Unit IV: Hours: 6

Ethical and Legal Foundation: Initial Ethical and Legal issues facing a New Firm, Drafting a Founders Agreement, Avoiding Legal Disputes, Business Licenses and Permits, Choosing a Form of Business Organization.

Assessing A New Venture's Financial Strength and Viability: Introduction to Financial Management, Financial Statements and Forecasts, Pro forma Financial Statements.

Unit V: Hours: 6

New Venture Team: Creating a New-Venture Team, Rounding out the Team: The Role of Professional Advisers.

Getting Financing or Funding: The Importance of Getting Financing or Funding, Sources of Equity Funding, Sources of DEBT Financing, Creative Sources of Financing and Funding.

Unit VI: Hours:6

Unique Marketing Issues: Selecting a Market and Establishing a Position, Key Marketing issues for New Ventures, The 4Ps of Marketing for New Ventures.

The Importance of Intellectual Property: The Importance of Intellectual Property, Patents, Trademarks, Copyrights, Trade Secrets, Conducting an Intellectual Property Audit.

Text Book: Bruce R. Barringer, R. Duane Ireland, "Entrepreneurship Successfully Launching New Ventures", Pearson Education, Third Edition.

Reference Books:

1. Ram Chandran, "Entrepreneurial Development", Tata McGraw Hill, New Delhi
2. Khanka, S S. "Entrepreneurial Development", S Chand & Company Ltd. New Delhi
3. Badhai, B "Entrepreneurship for Engineers", Dhanpat Rai & Co. (p) Ltd.
4. Gupta and Srinivasan, "Entrepreneurial Development", S Chand & Sons, New Delhi.
5. Arya Kumar, Entrepreneurship, Pearson, Delhi
6. Poornima MCH, Entrepreneurship Development –Small Business Enterprises, Pearson, Delhi
7. Sangeetha Sharma, Entrepreneurship Development, PHI Learning
8. Kanishka Bedi, Management and Entrepreneurship, Oxford University Press, Delhi

5KS06 DATABASE MANAGEMENT SYSTEMS LAB [P-2, C-1]

Course Prerequisite: Basic concept of programming, Basic concepts of data structures

Course Objectives:

- To study the ER model which provides a high level view of the issues in database design, to capture the semantics of realistic applications within the constraints of a data model.
- To study the primary data model (relational model) for commercial data processing applications.
- To study the standard structured query language and retrieve the information from the database in various ways.
- To study the integrity and security constraints of the database by enforcing constraints.

Course Outcomes (Expected Outcome) On completion of the course, the students will be able to

1. Design ER model for any kind of application.
2. Design and develop database.
3. Apply normalization.
4. Query the database.
5. Apply various integrity constraints
6. Build indices, views
7. Implement triggers, assertions

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

Practical 1: To Study a Database Modeling Tool.

Study of Data Modeling Tools:

- Take a description of the enterprise, create its corresponding ER Diagram and build a database model using any modeling tool. The following basic features of the modeling should be covered while building the model:
- Logical / Physical Modeling
- Adding an entity / its attributes, relationships (all kinds of relationships viz., parent-child, foreign key references, one to many, many to many etc)
- Forward / reverse engineering
- Details of forward engineering / schema generation
- Steps to generate the schema

Practical 2: To Study and implement DDL Commands

Implement the model created in Practical 1, in any of the DBMS like Oracle, MySQL, or Microsoft SQL Server database software.

- Creating the proper tables
- Insert the data into it.
- Study Dropping and Altering the Tables. Study the cascaded deletes.

Practical 3: To Study and implement DML Commands-I

- SQL queries : Write and execute different SQL queries
- Execute Simple queries using SELECT, FROM, WHERE clauses,
- In Where clause use different predicates involving OR,AND, NOT
- Rename operation
- Tuple Variables
- Write SQL for various String operations (%,_,*)
- Match beginning with
- Match ending with
- Substring
- Match exactly n characters
- Match at least n characters
- Sort the output of the query using Order by
- Write SQL using Having

Practical 4 : To Study and implement DML Commands-II Write SQL queries and perform

- Set membership operations
- In, not in
- Some
- All
- Exists and not exists, Test for emptyness using exists, not exists
- Test for absence of duplicates.
- Nested queries

Practical 5. Study and implement aggregation functions.

- Write different queries using following Aggregate functions
- Min (minimum 3 SQL queries)
- Max (minimum 3 SQL queries)
- Avg (minimum 3 SQL queries)
- Sum (minimum 3 SQL queries)
- Count (minimum 3 SQL queries)

Practical 6: Write SQL to create Views and Indexes.

Practical 7: Write SQL to perform the modifications to the database

Practical 8 : PL /SQL

Practical 9 : Database Access Using Cursors

Write a trigger to find the names and cities of customers who have more than xyz in any account.

Practical 10 : Triggers

- Write a trigger for dealing with the overdrafts (set the account balance to zero, and creating a loan in the amount of the overdraft. Keep account number as loan number in the loan table)
- Write a trigger for dealing with blank cities (set the city field to null when it is blank)

Practical 11: Procedures, functions

- Write atleast 2 functions, and demonstrate its use
- Write atleast 2 procedures, and demonstrate its use

Practical 12 : Web Programming with PL/SQL. (Contents beyond Syllabus)

HTTP, A Simple Example, Printing HTML Tables., Passing Parameters, Processing HTML Forms., Multi-Valued Parameters.

Practical 13: Develop a JDBC Applications, Retrieve the information by connecting to the database using a host language (JAVA, C, C++) (Contents Beyond Syllabus)

Practical 14: Web Programming with Java Servlets. (Connecting to the database) (Contents beyond Syllabus)

A Simple Servlet., HTTP Servlet API Basics.,HTML Form Processing in Servlets.

Practical 15: PHP : Develop a simple application to access the database using PHP (Contents beyond Syllabus)

Study of Open Source NoSQL Databases

Based on the concepts covered in text create a Mini Project:

Suggested Topics:

i. Bank database (Given in Korth book)
ii. University Database (Given in Korth book)
iii. Airline Flight Information System.
iv. Library Database Application.
v. University Student Database.
vi. Video Chain Database.
vii. Banking Database.
viii. BiBTeX Database.
ix. Music Store Database.
x. Online Auctions Database.
xi. A Web Survey Management System.

Text Book: Korth, Sudarshan, Silberschatz, Database System Concept, Mc-Graw Hill Mysql Reference Manual (for Mysql database)

Reference Books: (may be 5 to 6)

1. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emereopty Limited, ISBN: 1743045743, 9781743045749
2. Kristina Chodorow, Michael Dirolf, "MangoDB: The Definitive Guide" ,O"Reilly Publications, ISBN: 978-1-449-34468-9.
3. Adam Fowler, "NoSQL For Dummies", John Wiley & Sons, ISBN-1118905628
4. C J Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719.

5KS07 COMPILER DESIGN – Lab [P-2, C-1]

Course Prerequisite: Basic knowledge of C Programming, Data Structures, Theory of Computation.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:

- Know the basic components of a Compiler.
- To implement Lexical Analyzer using Lex tool and Syntax Analyzer using Yaac Tool.
- To implement various parsing methods.
- To implement code optimization techniques .

Course Outcomes (Expected Outcome):

On completion of the course, the students will be able to

1. Identify the fundamentals of compiler and its phases.
2. Use the powerful compiler generation tools such as Lex and Yacc.
3. Write a lexical scanner, either from scratch or using Lex.
4. Develop program for solving parser problems.
5. Examine the various optimization techniques.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language.
2. Write a C program to identify whether a given line is a comment or not.
3. Implement a C program to check parenthesis of regular expression is balanced or not.
4. Implement a C program to construct NFA from regular expression.
5. Implement a C program to simulate Deterministic Finite Automation (DFA) for a string which ending with 'a', 'a*b+', 'abb'.
6. Write a C program to construct of DFA from NFA.
7. Implement a Lex program to verify the parenthesis of a given expression is balanced.
8. Implement a Lex program to recognize the token like Digit, Identifier & Delimiter.
9. Implement the Lexical Analyzer using JLex, flex or other lexical analyzer generating tools.
10. Implement a Lex program to a valid arithmetic expression and to recognize the identifier and operators present.
11. Implement a Lex program to count words, characters, lines, vowels and consonants from given input.
12. Implement a Lex program to check given number is positive negative or zero.
13. Implement a Lex program to generate string which is ending with zeros.
14. Implement LEX and Yacc tool to implement desk calculator.
15. Write a C program for constructing of SLR parsing.
16. Write a C program for constructing of LL (1) parsing.
17. Write a C program for constructing of LALR parsing.
18. Write a C program for constructing recursive descent parsing.
19. Write a C program to implement Program semantic rules to calculate the expression that takes an expression with digits, + and * and computes the value.
20. Write a C program for Tokenizing the file which reads a source code in C/C++ from an unformatted file and extract various types of tokens from it
21. Write functions to find FIRST and FOLLOW of all the variables / given grammar.
22. Implement a Shift Reduce Parser for the following productions.
23. E → E+E / E*E / a / b
24. Implement a symbol table containing functions create(), modify(), search(), display() and delete().
25. Implement three address Code for the input a=b*c.
26. Implement Recursive Decent Parser for the productions.

List of Experiments beyond Syllabus: (Maximum 05)

1. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree.
2. Write a C program to generate machine code from abstract syntax tree generated by the parser.
3. Write a Lex program to find out total number of vowels, and consonants from the given input string.
4. Implementation of Finite State machines DFA, NFAs .
5. Computation of Leading & Trailing Sets.

Text Book: Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: "Principles, Techniques and Tools", Pearson Education, Second Edition.

Reference Books:

1. Doug Brown, John Levine, and Tony Mason, "Lex & Yacc", O'Reilly & Associates, Inc., Second Edition.
2. Andrew Appel, "Modern Compiler Implementation in C", Cambridge University press.
3. K C. Louden "Compiler Construction - Principles and Practice" India Edition, CENGAGE.
4. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs and Koen Langendoen, "Modern Compiler Design", Second Edition, John Wiley & Sons Publication.
5. Keith Cooper and Linda Torczon, "Engineering: A Compiler", Second Edition, Morgan Kaufmann Publication.

5KS09 C-Skill Lab – III [P-2, C-1]

Course Prerequisite: Basic knowledge of Web Development, HTML, CSS, JavaScript and IDE.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of C-Skill Lab - III by being able to do each of the following:

- To develop an ability to set up a local JS Library/Framework development Environment.
- To be able to install and implement different JS Libraries and Frameworks
- To be able to develop single-page/multi-page static and dynamic Web Applications.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Explain the various tools, packages and modules required for Web Development.
2. Discuss the workings of web server, cookies, routes, etc.
3. Develop a mobile application using JS Framework.
4. Design GUI using JS framework and/or Libraries.
5. Create applications using Angular, React, Node and Express.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

1. Introduction to the Node.js and its installation to print Hello World
2. To study built-in modules and implement the user defined built-in modules in the Node.js
3. To study HTTP module and implement Node.js as a web server
4. To study and implement Node.js File system module to read, write, create, update, delete and rename the file
5. To study the URL module of the Node.js and write a program that opens the requested file and returns the content of the file to the client. If anything goes wrong, throw a 404 error.
6. To convert the output "Hello World!" into upper-case letters by installing the "upper-case" package of NPM.
7. To study event handling in Node.js and demonstrate it using event module and EventEmitter object.
8. To study and implement the Formidable module of Node.js to upload the file on the server.
9. To study and implement the Nodemailer module of Node.js to send emails from your server.
10. To install MySQL and its driver and create connection with it using Node.js.
11. To demonstrate the creation database and table in MySQL using Node.js
12. To demonstrate the insertion of single and multiple records in the MySQL using "INSERT" statement and Node.js
13. To demonstrate the display of records from the MySQL database using "SELECT" statement and display it using Node.js
14. To demonstrate the display the records based on condition from the MySQL database using "WHERE" statement using Node.js
15. To demonstrate deletion of records from database using "DELETE" statement and Node.js
16. To demonstrate updating existing records in a table by using the "UPDATE" statement and Node.js
17. To demonstrate combining rows from two or more tables, based on a related column between them, by using a JOIN statement using Node.js

List of Experiments beyond Syllabus: (Maximum 05)

1. Create an Email sender app using Node.js
2. Create an Basic User database: Site in which User can Sign up/Login and can see other User's Profile Information.
3. Create a User model covering Registration, Email verification(send an email), login (with remember me, display user details and allow to save/update user details(DOB, Location, Hobbies etc or anything)
4. A random number generator web application.

Text Books:

1. Simon Holmes: Getting Mean with Mongo, Express, Angular, and Node, 2nd Edition, Manning.
2. Alex Banks and Eve Porcello: Learning React: Functional Web Development with React and Redux, O'Reilly .

Reference Books:

1. ShyamSeshadri: Angular Up and Running, O'Reilly
2. Akshat Paul and Abhishek Nalwaya: React Native for Mobile development, Apress.
3. Jos Dirksen: Learn Three.js, 3rd Edition, Packt Publishing.
4. Patrick Mulder and Kelsey Breseman: Node.js for Embedded Systems, O'Reilly

5KS08 EMERGING TECHNOLOGY LAB I

5KS08 Emerging Technology Lab 1 is based on 5KS04 Professional Elective-I. Tentative FOSS Tools & Technology for Practical's are as follows:

AI : IBM Watson, Microsoft Cognitive Toolkit , TensorFlow, Apache SystemML, Caffe, OpenNN, Torch, Neuroph

DS :R, Python, Cassandra, Apache Hadoop,

IoT : Arduino, DeviceHive, Kaa, Home Assistant

Cyber Security: Kali Linux, OpenVPN, NMAP, Metasploit Framework

5KS08 DATA SCIENCE AND STATISTICS – LAB [P-2, C-1]

Course Prerequisite: Basic knowledge of Mathematics.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Science and Statistics by being able to do each of the following:

- Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
- Apply principles of Data Science to the analysis of business problems.
- Apply the learned concepts for the skillful data management.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Demonstrate proficiency with statistical analysis of data.
2. Build skills in transformation and merging of data for use in analytic tools.
3. Perform linear and multiple linear regression analysis.
4. Develop the ability to build and assess data-based models.
5. Evaluate outcomes and make decisions based on data.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus:

Introduction to R:

[1] To learn and implement the Basic Commands and Graphics in R

[2] To perform Indexing and Loading Data

Linear Regression:

[3] To learn different Libraries in R and To perform Simple Linear Regression and Multiple Linear Regression

[4] To learn Interaction Terms and to perform Non-linear Transformations of the Predictors

[5] To learn and evaluate Qualitative Predictors

[6] To learn to Write Functions

Logistic Regression, LDA, QDA, and KNN

[7] To perform Logistic Regression

[8] To perform Linear Discriminant Analysis

[9] To perform Quadratic Discriminant Analysis

[10] To implement K-Nearest Neighbors technique

[11] To use Caravan Insurance Data for LR, LDA, QDA, and KNN

Cross-Validation and the Bootstrap

[12] To learn and perform The Validation Set Approach

[13] To learn and perform Leave-One-Out Cross-Validation

[14] To learn and perform k-Fold Cross-Validation

[15] To learn and perform The Bootstrap

Subset Selection Methods

[16] To learn and perform Best Subset Selection

[17] To learn and perform Forward and Backward Stepwise Selection

[18] To learn to Choose Among Models Using the Validation Set Approach and Cross-Validation

Ridge Regression and the Lasso

[19] To learn and perform Ridge Regression

[20] To learn and perform The Lasso

PCR and PLS Regression

[21] To learn and perform Principal Components Regression

[22] To learn and perform Partial Least Squares

Non-linear Modeling

[23] To learn and perform Polynomial Regression and Step Functions

[24] To learn and perform Splines

[25] To learn and perform GAMs

Decision Trees

[26] To learn and perform Fitting Classification Trees
[27] To learn and perform Fitting Regression Trees
[28] To learn and implement Bagging and Random Forests
[29] To learn and perform Boosting

Support Vector Machines

[30] To learn and perform Support Vector Classifier
[31] To learn and perform Support Vector Machine
[32] To learn and perform ROC Curves
[33] To learn and perform SVM with Multiple Classes
[34] To use Gene Expression Data

Clustering

[35] To implement K-Means Clustering
[36] To implement Hierarchical Clustering

NCI60 Data Example

[37] To implement PCA on the NCI60 Data
To Cluster the Observations of the NCI60 Data

List of Experiments beyond Syllabus: (Maximum 05)

1. To implement the Association Rules
2. To implement the kernel method to increase data separation
3. Develop a data model and deploy it as R HTTP Services or by export
4. Develop a data model and present it to end user with proper presentations
5. Carry out your assigned task and present it to other data scientist with proper presentations

Text Books:

1. Cathy O'Neil and Rachel Schutt: Doing Data Science, First Edition, 2014, O'reilly Publications, ISBN: 978-1-449-35865-5
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani: An Introduction to Statistical Learning with Applications in R, First Edition, 2013, Springer-Verlag New York, ISBN: 978-1- 4614-7137-0

Reference Book:

Nina Zumel, John Mount: Practical Data Science with R, First Edition, 2014, Manning Publications Co., ISBN: 9781617291562.

B.E. (COMPUTER SCIENCE & ENGINEERING) SEM. VI

6KS01 SECURITY POLICY & GOVERNANCE [L-3, T-0, C-3]

Course Prerequisite: Data Communication and Networking,

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Security Policy & Governance by being able to do each of the following:

1. Understand the legal and regulatory environment and its relationship to Information Security.
2. Understand Information Security Concepts.
3. Understand the role of Information Security governance and planning within the organizational context.
4. Understand how to develop, implement and maintain various types of Information Security policies.
5. Understand risk management and its role in the organization.
6. Understand how to identify risk control classification categories

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. List and discuss the key characteristics of Information Security, Leadership and Management
2. Differentiate between Law and Ethics
3. Describe why ethical codes of conduct are important to Information Security
4. Discuss the importance, benefits and desired outcomes of Information Security Governance
5. Discuss the process of developing, implementing and maintaining various types of Information Security Policies.
6. Define Risk Management and its role in the organization.

Unit I: Hours:6

Introduction to the Management of Information Security: Introduction to Security, Key Concepts of Information Security: Threats and Attacks, Management and Leadership, Principles of Information Security Management.

Unit II: Hours:6

Compliance: Law and Ethics: Introduction to Law and Ethics, Ethics in information Security, Professional Organizations and Their Codes of Conduct, Information Security and Law Organizational Liability and the Management of Digital Forensics.

Unit III: Hours:6

Governance and Strategic Planning for Security: The Role of Planning, Strategic Planning, Information Security Governance, Planning for Information Security Implementation.

Unit IV: Hours:6
Information Security Policy: Policy, Enterprise Information Security Policy, Issue-Specific Security Policy, System-Specific Security Policy, Guidelines for Effective Policy Development and Implementation.
Unit V: Hours:6
Risk Management: Assessing Risk: Introduction to the Management of Risk in Information Security, The Risk Management Process.
Unit VI: Hours:6
Risk Management: Treating Risk: Introduction to Risk Treatment, Managing Risk, Alternative Risk Management Methodologies.
Text Book: Michael E. Whitman, Herbert J. Mofford, "Management of Information Security" Sixth Edition, Cengage Learning, 2016.

Reference Books:

[1] Robert F Smallwood, "Information Governance for Business Documents and Records" Wiley 2014
[2] Michael E. Whitman and Herbert J. Mofford, "Principles of Information Security" Sixth Edition, Cengage Learning, 2018
[3] Krag Brotby, "Information Security Governance: A Practical Development and Implementation Approach" 2009 by John Wiley & Sons.
[4] Brijendra Singh, "Network Security and Management" Second Edition, PHI.
[5] Alan Calder and Steve Watkins, "IT Governance an international guide to data security and ISO27001/ISO27002" 2015, Kogan Page Limited.
[6] Evan Wheeler, "Security Risk Management, Building an Information Security Risk Management Program from the Ground Up" 2011, Syngress publications.
[7] Mike Chapple, James Michael Stewart and Darril Gibson, "CISSP® Certified Information Systems Security Professional Official Study Guide" Eighth Edition, 2018, John Wiley & Sons.

6KS02 DESIGN AND ANALYSIS OF ALGORITHMS [L-4, T-0, C-4]

Course Prerequisite: Any programming language, Discrete Mathematics and Data Structures.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:
1. To understand asymptotic analysis of algorithms.
2. To apply algorithmic strategies while solving problems.
3. Ability to analyze time and space complexity.
4. Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

Unit I: Iterative Algorithm Design Issue: Hours: 8
Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion
Unit II: Divide And Conquer Hours: 8
Introduction, Multiplication Algorithm and its analysis, Introduction to Triangulation, Covex Hulls, Drawbacks of D & C & Timing Analysis.
Unit III: Greedy Methods Hours: 8
Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Prim's Algorithms, Kruskal's Algorithm, Dijkstras Shortest Path Algorithm.
Unit IV: Dynamic Programming Hours: 8
Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation, Single Source Shortest Paths.
Unit V: Backtracking Hours: 8
Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework, and Some typical State Spaces.
Unit VI: Efficiency of Algorithm Hours: 8
Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

Text Book: Dave and Dave: "Design and Analysis of Algorithms" Pearson Education.

Reference Books:

[1] Aho,Hopcroft & Ullman "The Design & Analysis of Computer Algorithms", Addison-Wesley
[2] G. Brassard, P.Bratley: "Fundamentals of Algorithmics" , PHI
[3] Horowitz & Sahani: " Fundamental Algorithms" , Galgotia.
[4] Cormen, T.H, Lierson & Rivest: " Introduction to Algorithms", Mc Graw-Hill.

6KS03 SOFTWARE ENGINEERING [L-3, T-0, C-3]

Course Prerequisite: Fundamentals of Programming Languages.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Software Engineering by being able to do each of the following:
1. To learn and understand the principles of Software Engineering
2. To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
3. To apply Design and Testing principles to S/W project development.
4. To understand project management through life cycle of the project.
5. To understand software quality attributes.
6. To understand of the role of project management including planning, scheduling, risk management.

Course Outcomes (Expected Outcome): On completion of the course, student will be able to–
1. Decide on a process model for a developing a software project
2. Classify software applications and identify unique features of various domains
3. Design test cases of a software system.
4. Understand basics of Project management.
5. Plan, schedule and execute a project considering the risk management.
6. Apply quality attributes in software development life cycle.
7. Understand quality control and to ensure good quality software.

Unit I: Introduction to Software Engineering, Software Process Models Hours: 6
Evolving role of Software, Software crises & myths, Software engineering, Software process & process models, Linear sequential, prototyping ,RAD ,Evolutionary Product & Process, Project management concepts, People, Product, Process, Project W5HH principles, critical practice

Unit II: Project Management: Process, Metrics, And Estimations & Risks Hours:6
Measures, Metrics & Indicators. Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks: identification, risk projection, refinement & RMMM plan

Unit III: Project Scheduling & Quality Management Hours: 6
Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

Unit IV: Requirement Engineering & System Engineering Hours:6
System engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

Unit V: Software architecture & User interface design Hours: 6
Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User interface design: Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design: Structure programming, Comparison of design notation.

Unit VI: Software Testing Hours: 6
Software testing fundamentals; test case design, White box testing. Basis path, control structure-, Black box-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, and system testing. Debugging. Technical metrics for software.

Text Book: Pressman Roger. S: Software Engineering, A Practitioner's Approach, TMH.

Reference Books:

[1] Somerville: Software Engineering (Addison-Wesley) (5/e)
[2] Fairly R: Software Engineering (McGraw Hill)
[3] Davis A: Principles of Software Development (McGraw Hill)
[4] Shooman, M.L: Software Engineering (McGraw-Hill)

6KS04 NATURAL LANGUAGE PROCESSING [L-3, T-0, C-3]

Course Prerequisite: Fundamentals of Artificial Intelligence.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Natural Language Processing by being able to do each of the following:
1. To learn the fundamentals of natural language processing
2. To understand the use of CFG and PCFG in NLP
3. To understand the role of semantics of sentences and pragmatics
4. To gain knowledge in Information Extraction.

Course Outcomes (Expected Outcome): On completion of the course, student will be able to–
1. Understand how to tag a given text with basic Language features
2. Design an innovative application using NLP components
3. Implement a rule-based system to tackle morphology/syntax of a language
4. Design a tag set to be used for statistical processing for real-time applications
5. Compare and contrast the use of different statistical approaches for different types of NLP applications.

Unit I: Overview and Morphology Hours: 6
Introduction, Models and Algorithms, Regular Expressions Basic Regular Expression Patterns, Finite State Automata, Morphology, Inflectional Morphology, Derivational Morphology, Finite-State Morphological Parsing

Unit II: Word Level Analysis Hours: 6
Role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models. Part Of Speech Tagging and Sequence Labeling Lexical syntax. Hidden Markov Models. Maximum Entropy models.

Unit III: Syntactic Analysis Hours: 6
Context-Free Grammars, Grammar rules for English, Treebanks, and Normal Forms for grammar, Dependency Grammar, Syntactic Parsing, Ambiguity, Probabilistic CFG, and Probabilistic Lexicalized CFGs.

Unit IV: Semantic Analysis Hours: 6
Representing Meaning, Meaning Structure of Languages, First Order Predicate Calculus, Syntax-Driven Semantic Analysis, Semantic Attachments, Syntax-Driven Analyzer, Robust Analysis, Relations among Lexemes and their Senses, Word Sense Disambiguation

Unit V: Learning to Classify Text: Hours: 6
Supervised classification, further examples of supervised classification, Evaluation, Decision Trees, Naïve Bayes classifiers, Modelling Linguistic Patterns.

Unit VI: Extraction Information from Text: Hours: 6
Information Extraction, Chunking, Developing and Evaluating Chunks, Recursion in Linguistic Structure, Named Entity Recognition, Relation Extraction.

Text Books:

[1] Daniel Jurafsky, James H. Martin - Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
[2] Steven Bird, Ewan Klein and Edward Loper - Natural Language Processing with Python, First Edition, OReilly Media, 2009.
[3] Christopher D.Manning and Hinrich Schuetze - Foundations of Statistical Natural Language Processing, MIT press, 1999.

Reference Books:

[1] Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
[2] Richard M Reese, Natural Language Processing with Java, OReilly Media, 2015.
[3] Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
[4] Roland R.Hausser - Foundations of Computational Linguistics: Human Computer Communication in Natural Language, Paperback, MIT press,2011
[5] Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008
[6] Daniel Jurafsky and James H. Martin - Speech and Language Processing, 2nd
[7] Edition , Prentice Hall,2008.
[8] Charu C.Aggarwal - Machine Learning for Text, Springer,2018 edition

6KS04 BIG DATA ANALYTICS [L-3, T-0, C-3]

Course Prerequisite: Knowledge of basic computer science principles and skills, Basic knowledge of Linear Algebra and Probability Theory, Basic knowledge of Data Base Management Systems

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Big Data Analytics by being able to do each of the following:
1. To know the fundamental concepts of big data and analytics.
2. To explore tools and practices for working with big data.
3. To know about the research that requires the integration of large amounts of data.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Work with big data tools and its analysis techniques.
2. Analyze data by utilizing clustering and classification algorithms.
3. Learn and apply different algorithms and recommendation systems for large volumes of data.
4. Perform analytics on data streams.
5. Learn NoSQL databases and management.

Unit I: Big Data Analytics and Lifecycle Hours: 6

Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics, Data Analytics Lifecycle: Overview, Phase 1: Discovery, Phase 2: Data Preparation, Phase 3: Model Planning, Phase 4: Model Building, Phase 5: Communicate Results, Phase 6: Operationalize, Case Study: Global Innovation Network and Analysis (GINA).

Unit II: Review of Basic Data Analytics Methods, Clustering and Association Rules Hours: 7

Exploratory Data Analysis, Statistical Methods for Evaluation: Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, Type I and II Errors, ANOVA, Overview of Clustering, K-means: Use Cases, Overview, Number of Clusters, Diagnostics, Additional Algorithms, Overview, Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules, An Example: Transactions in a Grocery Store, The Groceries Dataset, Frequent Itemset Generation, Rule Generation and Visualization, Validation and Testing, Diagnostics.

Unit III: Regression and Classification Hours: 7

Linear Regression: Use Cases, Model Description, Diagnostics, Logistic Regression: Use Cases, Model Description, Diagnostics, Reasons to Choose and Cautions, Additional Regression Models, Decision Trees: Overview of a Decision Tree, The General Algorithm, Decision Tree Algorithms, Evaluating a Decision Tree, Decision Trees, Naïve Bayes: Bayes' Theorem, Naïve Bayes Classifier, Smoothing, Diagnostics, Naïve Bayes, Diagnostics of Classifiers, Additional Classification Methods.

Unit IV: Time Series Analysis and Text Analysis Hours: 6

Overview of Time Series Analysis: Box-Jenkins Methodology, ARIMA Model: Autocorrelation Function (ACF), Autoregressive Models, Moving Average Models, ARMA and ARIMA Models, Building and Evaluating an ARIMA Model, Reasons to Choose and Cautions, Additional Methods, Text Analysis Steps, A Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency—Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments, Gaining Insights.

Unit V: Tool and Techniques: MapReduce & Hadoop Hours: 7

Big Data Tool and Techniques: Big Data Storage, High-Performance Architecture, HDFS, MapReduce and YARN, Big Data Application Ecosystem, Zookeeper, HBase, Hive, Pig, Mahout, Developing Big Data Applications: Parallelism, Myth, Application Development Framework, MapReduce Programming Model, Simple Example, More on MapReduce, Other Frameworks, The Execution Model, Analytics for Unstructured Data: Use Cases, MapReduce, Apache Hadoop, The Hadoop Ecosystem: Pig, Hive, HBase, Mahout, NoSQL.

Unit VI: Database Analytics, NoSQL and Graph Analytics Hours: 7

SQL Essentials, In-Database Text Analysis, Advanced SQL, NoSQL Data Management: What is NoSQL, Schema-less Models, Key-Value Stores, Document Stores, Tabular Stores, Object Data Stores, Graph Database, Communicating and Operationalizing an Analytics Project, Creating the Final Deliverables, Graph Analytics: Model, Triples, Graphs and Network Organization, Graph Analytics and Use Cases, Graph Analysis Algorithms, Technical Complexity, Features of Graph Analytic Platform, Data Visualization Basics.

Text Books:

[1] EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", 2015, John Wiley & Sons, Inc., ISBN: 978-1-118-87613-8.
[2] David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", First Edition, 2013, Morgan Kaufmann/Elsevier Publishers, ISBN: 978-0-12-417319-4.

Reference Books:

[1] Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", First Edition, 2014, Wiley Publishers, ISBN: 978-1-118-89271-8.
[2] Mohammad Guller, "Big Data Analytics with Spark A Practitioner's Guide to Using Spark for Large-Scale Data Processing, Machine Learning, and Graph Analytics, and High-Velocity Data Stream Processing", First Edition, 2015, Apress Publisher, ISBN-13 (pbk): 978-1-4842-0965-3.
[3] Arshdeep Bahga & Vijay Madisetti, "Big Data Science & Analytics: A Hands-On Approach", First Edition, 2019, ISBN: 978-1-949978-00-1.

6KS04 SENSORS AND ACTUATORS [L-3, T-0, C-3]

Course Prerequisite: Internet of Things, Micro-technology

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Sensors and Actuators by being able to do each of the following:
1. To understand the fundamentals of sensors and actuators
2. An exposure to sensors and its importance in the real world
3. To understand functional safety in machinery and emergency stop applications

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Fabricate some of those sensors
2. Simulate sensors and characterize before fabricating it
3. Design application with sensors and actuators for real world

Unit I: Hours: 7
Introduction: Sensors and Actuators, Technologies related to Sensors: Data Logger, Metal Detector, Photoelectric Sensor, Global Positioning System, Wireless Sensor Network, Sonar, Echo Sounding, Level Sensor, Biosensor, Blood Glucose Monitoring, Load Cell

Unit II: Hours: 7
Application of Sensors: On-board Automobile Sensors, Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Medical Diagnostic Sensors, Sensors for Environmental Monitoring

Unit III: Hours: 7
Varied Types of Actuators: Pneumatic Actuator, Hydraulic Cylinder, Linear Actuator, Plasma Actuator, Rotary Actuator

Unit IV: Hours: 7
Actuators: Technologies and Devices- Pneumatic Motor, Pneumatic Cylinder, Hydraulic Press, Jackscrew, Hoist (Device), Electroactive Polymers, Roller Screw, MEMS Magnetic Actuator.

Unit V: Hours: 7
Remote Sensing: An Overview- Water Remote Sensing, Remote Sensing, Lidar, ERDAS Imagine, TerrSet, Remote Sensing (Archaeology)

Unit VI: Hours: 7
Rader and its application: Radar, Radar Imaging, Radar Navigation

Text Books:

[1] Princeton Brown, “Sensors and Actuators: Technology and Applications”, Library Press, 2017.
[2] D. Patranabis, “SENSORS AND TRANSDUCERS”, Second Edition, PHI Learning Private Limited, 2003.

Reference Books:

[1] D.A. Hall and C.E.Millar, “Sensors and Actuators”, CRC Press, 1999.
[2] Nathan Ida, “Sensors, Actuators, and their Interfaces: A multidisciplinary introduction (Materials, Circuits and Devices)”, Large Print, 2011.

6KSO4 CRYPTOGRAPHY [L-3,T-0,C-3]

Course Prerequisite: Discrete Structure & Graph Theory, Data Communication and Networking, Introduction to Cyber security

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cryptography by being able to do each of the following:
1. Understand Security Concepts.
2. Know about various encryption techniques.
3. Understand the concept of public key cryptography.
4. Study about message authentication and hash functions.
5. Impart knowledge on Network security, Internet Security Protocols.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Classify the symmetric encryption techniques
2. Illustrate various public key cryptographic techniques
3. Evaluate the authentication and hash algorithms.
4. Discuss authentication applications
5. Summarize the intrusion detection and its solutions to overcome the attacks.
6. Understand basic concepts of system level security

Unit I: Hours: 6
Attacks on Computers and Computer Security: Introduction, Need for Security, Security Approaches, Principles of Security, Types of Attacks. Cryptography: Concepts and Techniques Introduction, Plain Text and Cipher Text, Substitution and Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Stenography, Key Range and Key Size, Possible Types of Attacks

Unit II: Hours: 6
Symmetric Key Algorithms and AES: Introduction, Algorithm Types and Modes, An Overview of Symmetric Key Cryptography, Data Encryption Standard(DES), International Data Encryption Algorithm(IDEA), RC4, RC5, Blowfish, Advanced Encryption Standard(AES).

Unit III: Hours:6
Asymmetric Key Algorithms, Digital Signatures and RSA: Introduction, History and Overview of Asymmetric Key Cryptography, The RSA Algorithm, Symmetric and Asymmetric Cryptography, Digital Signatures, Knapsack and other Algorithms.

Unit IV: Hours:6

Digital Certificates and Public Key Infrastructure (PKI): Introduction, Digital Certificates, Private Key Management, The PKIX Model, Public Key Cryptography Standards (PKCS), XML,PKI and Security, Creating Digital Certificate.

Unit V: Hours:6

Internet Security Protocols: Introduction, Concepts, Secure Socket Layer(SSL), Transport Layer Security(TLS), Secure Hypertext Transport Protocol(SHTTP), Time Stamping Protocol(TSP), Secure Electronic Transaction(SET), SSL Versus SET, 3-D Secure Protocol, Electronic Money, Email Security, Wireless Application Protocol(WAP)Security, Security in GSM, Security in 3G.

Unit VI: Hours:6

User Authentication and Kerberos: Introduction, Authentication Basics, Passwords, Authentication Tokens, Certificate-based-Authentication, Biometric Authentication, Kerberos, Key Distribution Center(KDC), Security Handshake Pitfalls, Single Sign On (SSO) Approaches.

Text Book:

[1] Atul Kahate, " Cryptography and Network Security", McGraw Hill, Second Edition.

Reference Books:

[1] William Stallings, "Cryptography and Network Security, Principles and Practice", PHI Fourth Edition.
[2] Behrouz A. Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", McGraw Hill, Second Edition.
[3] Matt Bishop, "Computer Security Arts and Science", Pearson Education.
[4] Douglas R Stinson, "Cryptography, Theory and Practice" CRC Press.
[5] Keith M Martin, "Everyday Cryptography, Fundamental Principles and Applications", Oxford University Press, Second Edition.

6KSO5 COMPUTATIONAL BIOLOGY [L-3, T-0, C-3]

Course Pre-requisite:

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computational Biology by being able to do each of the following:

1. To familiarize the students with most basic and useful algorithms for sequence analysis
2. To aware the students with basic file formats
3. To transform the basic molecular data for interpreting their patterns for various analysis
4. To compare genomes of different species, gene finding, and gene regulation

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Understand what types of biological questions can be investigated using computers, and what limitations computational methods impose on the understanding of biology.
2. Describe the properties of DNA, RNA, and proteins, the relationships among these molecules.
3. Analyze how to convert a biological question into a computational problem that can be solved using computers.
4. Explain general approaches for solving computational problems, and will be able to apply these approaches to new problems you encounter.
5. Understand how implement the algorithms by writing computer programs.

Unit I: Cellular and Molecular Biology Fundamentals Hours: 6

The structure of DNA & RNA, Gene Structure and control, Tree of Life and evolution, Primary & Secondary Structure of Protein, Implications for Bioinformatics Protein fold to form compact structures. Dealing with Databases: Structure of databases, Types of databases, Data Quality.

Unit II: Sequence Alignments Hours: 6

Principles of sequence alignments, scoring alignments, substitution matrices, Inserting gaps, Types of Alignments, Searching Databases, Searching with Nucleic Acid or protein sequences, Protein Sequences Motifs or Patterns, Searching using Motifs and patterns, Patterns & protein function.

Unit III: Pairwise Sequence Alignments & Database Searching Hours:6

Substitution Matrices and scoring, Dynamic Programming Algorithms, Indexing Techniques & Algorithmic approximations, Alignments score significance, aligning complete genome sequences

Unit IV: Patterns Profiles and Multiple Alignments Hours:6

Profile & sequence logos, Profile Hidden Markov Models, Aligning Profiles, Multiple Sequence Alignment by Gradual Sequence Addition, Sequence Pattern Discovery.

Unit V: Revealing Genome Features Hours:6

Preliminary examination of Genome Sequence, Gene Predictions, Splice site Detection, Prediction of Promoter Regions, Confirming Predictions, Genome Annotation, Large Genome Comparisons.

Unit VI: Gene Detection and Genome Annotation Hours:6

Detection of Functional RNA Molecules using Decision Trees, Algorithms for Gene Detection in Prokaryotes, Features used in Eukaryotic Gene Detection, Predicting Eukaryotic Gene Signals, Predicting Exon/Intron Structure, Beyond the Prediction of Individual Genes.

Text Books:

[1] Understanding Bioinformatics , Marketa Zvelbil and Jeremy O. Baum, Garland Sceincem Taylor & Francis Group, LLC
[2] Bioinformatics: Principles and Applications, Bal, H. P. (2005), Tata McGraw-Hill.

Reference Books:

[1] Bioinformatics Algorithms – Design and Implementation in Python, Miguel Rocha & Pedro Ferreira, Academic Press, Elsevier Inc.
[2] Bioinformatics Algorithms: An Active Learning Approach, Edition 2, Volume 1. Phillip Compeau & Pavel Pevzner.
[3] Bioinformatics computing, Bergeron, B. P. (2003), Prentice Hall Professional.
[4] Bioinformatics Technologies, Chen, Y. P. P. (Ed.). (2005). Springer.
[5] Bioinformatics for dummies, Claverie, J. M., & Notredame, C. (2011), John Wiley & Sons.
[6] Fundamental Concepts of Bioinformatics, Dan. E. Krane, & Raymer, M. L. (2003), Pearson Education International.

6KSO5 CYBER LAWS & ETHICS [L-3,T-0,C-3]

Course Prerequisite: Basic Knowledge of Internet

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cyber Laws & Ethics by being able to do each of the following:

1. Understand Cyber Space, Cyber Crime, Cyber Laws, Information Technology, Internet, Internet Services
2. Know Legal Aspects of Regulation concerned with Cyber Space, Technology and Forms of Cyber Crimes
3. Understand Computer Crimes and Cyber Crimes, Cyber Crime in Global and Indian Response.
4. Understand Criminal Liability, Cyber Crime implications and challenges.
5. Learn Precaution & Prevention of Cyber Crimes, Human Rights perspective of Cyber Crime

Course Outcomes (Expected Outcome): On completion of this course, the students should be able to:

1. Understand Cyber Space, Cyber Crime, Information Technology, Internet & Services.
2. List and discuss various forms of Cyber Crimes
3. Explain Computer and Cyber Crimes
4. Understand Cyber Crime at Global and Indian Perspective.
5. Describe the ways of precaution and prevention of Cyber Crime as well as Human Rights.

Unit I: Hours:6

Information Technology & Cyber Crimes: Introduction, Glimpses, Definition and Scope, Nature and Extent, Know no Boundaries, Rapid Transmission and Accuracy, Diversity and Span of Victimization, Cyber World, Inadequacy of Law, Influence of Teenagers Information Technology: Definition & Perspective, Growth & Future, Various Facets & Dimensions. Regulatory Perspective on Technology: Impact of Information and Technology, Regulation of Cyber Space, Legal Aspects of Regulation.

Unit II: Hours:6

Technology & Forms of Cyber Crimes: Influence of Technology on Criminality, Forms of Cyber Crimes.
Computer Crimes & Cyber Crimes: A Criminological Analysis Computer Crimes and Cyber Crimes: Terminological Aspects, Opportunities to Cyber Criminals, Motives of Offenders, Problems Affecting Prosecution, Cyber Crimes: Challenges of Prevention and Control, Need and Prospects (~f Criminological Research.

Unit III: Hours:6

Cyber Crimes 'and Global Response: Global Perspective, Country wise Legal Response, Country wise Analysis. Cyber Crimes and Indian Response: Introduction, The Indian Information Technology Act 2000,
Preamble & Coverage, Nature of Offences and Penalties, Miscellaneous and Subsidiary Provisions Certain Shortcomings, Future Prospects and Needs.

Unit IV: Hours:6

Mens Rea & Criminal Liability: Introduction, Historical Perspectives, Mens Rea in Indian Criminal Law, Mens Rea in English Criminal Law, Abetment of Offence, Criminal Liability and Role of Mens Rea in Indian Information Technology Act, 2000 Investigation in Cyber Crimes: Implications and Challenges: : Introduction, Procedural Aspects, Issues, Complications and Challenges Concerning Cyber Crimes, Problems and Precautionary measures for Investigation.

Unit V: Hours:7

Cyber Crimes : Discovery and Appreciation of Evidences: Introduction, Law of Evidence, Evidences in Cyber Crimes : Challenges and Implications, Computer Generated Evidence and their Admissibility, Judicial Interpretation of Computer related Evidence Prevention of Cyber Crimes :National and International Endeavours: Introduction, International Services on Discovery and Recovery of Electronic and Internet Evidence, International Organisation on Computer Evidence (IOCE), OECD Initiatives, Efforts of G-7 and G-8 Groups, Endeavours of Council of Europe, Measures of United Nations, Efforts of WTO, Measures of World Intellectual Property Organisation (WIPO),Interpol and its Measures, Efforts in India, Need of International Assistance and Appropriate Amendments, U.S. Laws on Cyber Crimes, U.S. Case-law on Cyber Evidences and Related Issues

Unit VI: Hours:7

Human Rights Perspectives Cyber Crimes: Introduction, Ideological Aspects, Fundamental Rights and Civil Liberties, Various Issues and Challenges. Cyber Crimes : Precaution and Prevention: Introduction, Awareness and Law Reforms, Improving Criminal Justice Administration, Increasing International Cooperation, Curricular Endeavours and Checking Kids' Net Addiction, Role of Guardians, Mobile Pornography: No Nearer Solution in Sight, Self-regulation in Cyber Space.

Text Book:

[1] Dr Pramod Kr.Singh, "Laws on Cyber Crimes [Along with IT Act and Relevant Rules]" Book Enclave Jaipur India.

Reference Books:

[1] Craig B, "Cyber Law: The Law of the Internet and Information Technology". Pearson Education.
[2] Pawan Duggal, "Cyber Laws" Universal Law Publishing.
[3] K.Kumar," Cyber Laws: Intellectual property & E Commerce, Security", First Edition, Dominant Publisher, 2011.
[4] Rodney D. Ryder, "Guide to Cyber Laws", Second Edition, Wadhwa And Company, New Delhi, 2007.
[5] Vakul Sharma, "Handbook of Cyber Laws" Macmillan India Ltd, Second Edition, PHI, 2003.
[6] Justice Yatindra Singh, "Cyber Laws", Universal Law Publishing, First Edition, New Delhi, 2003.
[7] Sharma, S.R., "Dimensions of Cyber Crime", Annual Publications Pvt. Ltd., First Edition, 2004.
[8] Augastine, Paul T., "Cyber Crimes and Legal Issues", Crecent Publishing Corporation, 2007.

6KS05 INTELLECTUAL PROPERTY RIGHTS [L-3,T-0,C-3]

Course Prerequisite: Basic knowledge of Communication skills, Soft skills, Presentation and Ethics.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Intellectual Property Rights in the following:

1. This course is intended to impart awareness on Intellectual Property Rights (IPR) and various regulatory issues related to IPR
2. To make familiarizing students with the shades of Intellectual Property Rights (IPR) so as to help them integrate the IPR process in their project and research activities.
3. To make the students familiar with basics of IPR and their implications in Project research, development and commercialization.
4. To impart awareness on intellectual property rights and various regulatory issues related to IPR.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Demonstrate a breadth of knowledge in Intellectual property.
2. Assess fundamental aspects of Intellectual Property Rights.
3. Discuss Patents, Searching, filling and drafting of Patents
4. Discuss the basic principles of geographical indication, industrial designs, and copyright.
5. Explain of Trade Mark and Trade Secret.
6. Investigate current trends in IPR and Government initiatives in fostering IPR.

Unit I: Overview of Intellectual Property Rights Hours: 06

Discovery, Invention, Creativity, Innovation, History & Significance of Intellectual Property Rights (IPR), Overview of IPR - Patent, Copyright, Trade Mark, Trade Secret, Geographical Indication, Industrial Design & Integrated Circuit, Non-patentable criteria.

Unit II: Patents Hours: 08

Patents: Patents- Patentability Criteria, Types of Patents-Process, Product & Utility Models, Software Patenting and protection, Overview of Patent Search-Types of Searching, Public & Private Searching Databases, Basics of Patent Filing & Drafting, Indian Patents Law Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board.

Unit III: Copyrights Hours: 06

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights.

Unit IV: Trademarks Hours: 07

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

Unit V: Design & Geographical Indication Hours: 07

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection. Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection.

Unit VI: IPR: Current Contour Hours: 06

India`s New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP - IPR in current scenario with case studies.

Text Books:

[1] K. V. Nithyananda (2019), "Intellectual Property Rights: Protection and Management", IN: Cengage Learning India Private Limited.
[2] P. Neeraj and D. Khusdeep (2014), "Intellectual Property Rights", PHI learning Private Limited.

Reference Books:

[1] Deborah E. Bouchoux, "Intellectual Property for Paralegals – The law of Trademarks, Copyrights, Patents & Trade secrets", 4th Edition, Cengage learning, 2012.
[2] N. S. Gopalakrishnan and T. G. Agitha, "Principles of Intellectual Property", Eastern Book Company, Lucknow, 2009.
[3] M. M. S. Karki, "Intellectual Property Rights: Basic Concepts", Atlantic Publishers, 2009.
[4] Ganguli Prabuddha, "Intellectual Property Rights--Unleashing the Knowledge Economy", Tata McGrawHill, 2001.
[5] V. K. Ahuja, "Law relating to Intellectual Property Rights". India, IN: Lexis Nexis, 2017.
[6] P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
[7] Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd, 2006.
[8] B. L. Wadehra. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.
[9] Ganguli Prabuddha, "Gearing up for Patents… The Indian Scenario", Universities Press, 1998.

6KS06 DESIGN AND ANALYSIS OF ALGORITHMS – LAB [P-2, C-1]

Course Prerequisite: Any programming language, Discrete Mathematics and Data Structures

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:
1. To understand asymptotic analysis of algorithms.
2. To apply algorithmic strategies while solving problems.
3. Ability to analyze time and space complexity.
4. Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

[1] Implement C programs to perform recursive calls using the following searching algorithms.
   1. Linear Search when the list is given.
   2. Binary Search when the given list is not sorted.

[2] Study and analyze to sort an array of integers using merge sort.
[3] Implement and analyze to sort an array of integers using quicksort.
[4] Write a program to implement the Closest Pair of Points problem using the divide and conquer strategy.
[5] Study and Implement the Divide and Conquer strategy using the Merge sort Algorithm and determine the complexity of an algorithm. DATA- {23, 12, 3, 5, 89, 1, 24}
[6] Write a C program for Implementing (n X n) matrix multiplication using the Strassen matrix multiplication algorithm.
[7] Explain the knapsack algorithm to find an optimal solution of getting maximum profit and implement using the program.
[8] Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm and implement using C.
[9] Implement programs to find minimum cost spanning trees from a given graph using Prim's algorithm.
[10]Implement Prim's algorithm to find the Minimum Cost Spanning Tree of an undirected graph using the program.
[11] Develop a program to implement Floyd's algorithm which will produce the shortest distance between all vertex pairs of a weighted graph.

[12] Implement programs to find the shortest path in a given graph using Dijkstra's algorithm.
[13] Implement programs factorial knapsack problem.
[14] Develop a program to implement Strassen's matrix multiplication algorithm.
[15] Implement programs to implement LCS problems using Dynamic Programming.
[16] Develop a program to implement matrix chain multiplication problems using dynamic programming.
[17] Explain Breadth-First Search and Implement BFS to print all the nodes reachable from a given starting node in a digraph.
[18] Develop a program to Print all the nodes reachable from a given starting node in a digraph using Depth First Search.
[19] Study an algorithm Tower of Hanoi where the aim is to move the entire stack to another rod for n=3 and understand the concept of recursion.
[20] Implement C programs N Queen's problem using Back Tracking.

List of Experiments beyond Syllabus: (Maximum 05)

[1] Implement the Work Function Algorithm and the Greedy Algorithm for the k-Server problem on graph metrics.
[2] Design and Implement Boyer Moore Algorithm for Pattern Searching.
[3] Design and Implement Topological Sort of a graph using departure time of vertex.
[4] Implement programs to find an s-t cut of minimum capacity. Minimum Cut Problem s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 A Capacity = 10 + 8 + 10 = 28
[5] Implement programs to s-t flow of maximum value. Maximum Flow Problem 10 9 9 14 4 10 4 8 9 1 0 0 0 14 capacity flow s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 0 Value = 28

Text Books:

[1] Dave and Dave: "Design and Analysis of Algorithms" Pearson Education.

Reference Books:

[1] Aho,Hopcroft & Ullman "The Design & Analysis of Computer Algorithms", Addison-Wesley
[2] G. Brassard, P.Bratley: "Fundamentals of Algorithmics" , PHI
[3] Horowitz & Sahani: " Fundamental Algorithms" , Galgotia.
[4] Cormen, T.H, Lierson & Rivest: " Introduction to Algorithms", Mc Graw-Hill.

6KS07 SOFTWARE ENGINEERING LAB.

Course Prerequisite: A Scripting Language, IDEs (Integrated Development Environment), Databases, Software Development Life Cycle (SDLC)

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Software Engineering by being able to do each of the following:
1. Impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner
2. Present case studies to demonstrate the practical applications of different concepts
3. Provide a scope to the students where they can solve small, real-life problems
4. All the while it is intended to present Software Engineering as an interesting subject to the students where learning and fun can go alongside.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Understand basic Software engineering methods and practices, and their appropriate application.
2. Describe software process models such as the waterfall and evolutionary models.
3. Discuss role of project management including planning, scheduling and, risk management.
4. Explain data models, object models, context models and behavioral models.
5. Understand of different software architectural styles and Process frame work.

List of experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

[1] Identifying the Requirements from Problem Statements
Requirements, Characteristics of Requirements, Categorization of Requirements, Functional Requirements, Identifying Functional Requirements

[2] Estimation of Project Metrics
Project Estimation Techniques, COCOMO, Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Advantages of COCOMO, Drawbacks of COCOMO, Halstead's Complexity Metrics

[3] Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
Use case diagrams |,Actor , Use Case , Subject , Graphical Representation , Association between Actors and Use Cases , Use Case Relationships , Include Relationship , Extend Relationship , Generalization Relationship ,Identifying Actors , Identifying Use cases , Guidelines for drawing Use Case diagrams

[4] E-R Modeling from the Problem Statements
Entity Relationship Model , Entity Set and Relationship Set , Attributes of Entity , Keys , Weak Entity , Entity Generalization and Specialization ,Mapping Cardinalities , ER Diagram , Graphical Notations for ER Diagram , Importance of ER modeling

[5] Identifying Domain Classes from the Problem Statements
Domain Class , Traditional Techniques for Identification of Classes ,Grammatical Approach Using Nouns , Advantages , Disadvantages ,Using Generalization ,Using Subclasses , Steps to Identify Domain Classes from Problem Statement , Advanced Concepts

[6] State chart and Activity Modeling
State chart Diagrams , Building Blocks of a State chart Diagram , State , Transition , Action , Guidelines for drawing State chart Diagrams , Activity Diagrams , Components of an Activity Diagram, Activity , Flow , Decision , Merge , Fork ,Join , Note , Partition ,A Simple Example , Guidelines for drawing an Activity Diagram
[7] Modeling UML Class Diagrams and Sequence diagrams
Structural and Behavioral aspects , Class diagram , Elements in class diagram , Class , Relationships , Sequence diagram , Elements in sequence diagram , Object , Life-line bar , Messages
[8] Modeling Data Flow Diagrams
Data Flow Diagram, Graphical notations for Data Flow Diagram, Explanation of Symbols used in DFD , Context diagram and leveling DFD
[9] Estimation of Test Coverage Metrics and Structural Complexity
Control Flow Graph, Terminologies, McCabe's Cyclomatic Complexity, Computing Cyclomatic Complexity, Optimum Value of Cyclomatic Complexity, Merits , Demerits
[10] Designing Test Suites
Software Testing , Standards for Software Test Documentation , Testing Frameworks , Need for Software Testing , Test Cases and Test Suite , Types of Software Testing , Unit Testing , Integration Testing , System Testing , Example , Some Remarks.

Software Requirements: StarUML

Text Book: Pressman Roger. S: Software Engineering, A Practitioner's Approach, TMH.

Reference Books:

[1] Somerville: Software Engineering (Addison-Wesley) (5/e)
[2] Fairly R: Software Engineering (McGraw Hill)
[3] Davis A: Principles of Software Development (McGraw Hill)
[4] Shooman, M.L: Software Engineering (McGraw-Hill).

6KS09 C SKILL LAB IV– LAB (DevOps) [P-2, C-1]

Course Prerequisite: Basic knowledge on SDLC and STLC

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of DevOps learning by being able to do each of the following:
1. Learn what Jenkins, continuous integration is and where does Jenkins fits into SDLC (Software Development Life Cycle)
2. Learn how to setup Jenkins and use Jenkins on their systems, create and configure jobs in Jenkins
3. Learn how to use and manage plugins, how to create and manage users in Jenkins
4. Learn how to deploy application on server, how to work with multiple nodes
5. Learn how to create pipelines

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Install and setup of Jenkins on your systems
2. Create and run jobs in Jenkins
3. Add and manage plugins. Use plugins in jobs
4. Create and run pipelines in Jenkins
5. Setup, configure, and deploy jobs

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

1. Study and implement Linux commands
2. Study practical on installation of java, Tomcat Server
3. Study practical on software development life cycle
4. Study practical on DevOps life cycle & stages
5. Study practical on DevOps Tools (Docker, Jenkins, Git, Jira, copado)
6. Learn about DevOps Pipeline (CI /CD) using any tool
7. Study Practical on AWS for DevOps
8. Study Practical on Microsoft Azur for DevOps
9. Study Practical on Google Cloud for DevOps
10. Study Practical on Salesforce with Copado for DevOps
11. To setup and configure of Jenkins
12. To create Job and manage it using Jenkins
13. To experiment plugin management with jenkins
14. To study and demonstrate User role creation and management using Jenkins
15. To study and demonstrate Integration with Git using Jenkins
16. To study and demonstrate Automated deployments using Jenkins
17. To study and demonstrate Build and delivery pipelines using Jenkins
18. To study and demonstrate Job Parameterization using Jenkins
19. To study and demonstrate Command line executions using Jenkins
20. To study and demonstrate Jenkins node management

List of Experiments beyond Syllabus: (Maximum 05)

1. Learn how to setup Jenkins on docker
2. Learn how to do Jenkins maintenance
3. Learn how to work with Git and Jenkins

Text Book: John Ferguson Smart: Jenkins: The Definitive Guide, O'Reilly Media, Inc.

Reference Books:

[1] Gene Kim, Jez Humble, Patrick Debois, and John Willis,: The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations
[2] Gene Kim, Kevin Behr, and George Spafford,: The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win,
[3] Andrew Davis, : Mastering Salesforce DevOps: A Practical Guide to Building Trust While Delivering Innovation, Apress

6KS08 EMERGING TECHNOLOGY LAB II

6KS08 Emerging Technology Lab II is based on 6KS04 Professional Elective-II. Tentative FOSS Tools & Technology for Practical's are as follows:

AI : Natural Language Toolkit (NLTK),SpaCy, PyTorch-NLP, Natural, Retext, TextBlob

DS : KNIME, Spark, Neo4J, MongoDB, Hive, Storm,

IoT : Devicehub, Zetta, Node-RED, Flutter, M2MLabs Mainspring

Cyber Security : VeraCrypt, ModSecurity, AdBlocker, CheckShortURL, SPAMfighter, SpamBully

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SYLLABUS PRESCRIBED FOR B.E. (INFORMATION TECHNOLOGY) SEM. V

5IT01 DATABASE MANGEMENT SYSTEMS

Course Objectives:

1. Identify role of database system, find out its applications and learn about database file systems.
2. Understand concept of designing database schema and its mapping to relational table.
3. Apply the concepts of database integrity and security, encryption, authorization and Normalization.
4. Evaluate query expression, query cost, query optimization and different operation.
5. Understand the concept of transaction management and its properties.
6. Understand concept of concurrency control and various type of protocol.

Course Outcomes:

1. To understand concept of database system.
2. To understand and apply the concept related with data model
3. Apply concepts of database querying, integrity and security using SQL.
4. To understand query processing and query optimization.
5. To understand concept of transaction management and its properties.
6. To understand the concept of Concurrency control and study of various database protocols.

Unit I: **Introduction:** Database, types of databases, DBMS, Purpose of DBMS & its Applications, RDBMS, File System, DBMS Architecture & its types, DBMS: SQL, MYSQL, ORACLE, PostgreSQL, DB2, SQL Server, Database Users and Administrator **Data Models:** Types of data Models: network, relational, object based data model; Data model schema, Data dependence, types of database languages, ACID properties. E-R Model Concepts, E-R diagram Notations, Mapping Constraints, DBMS Keys, E-R diagram to Table conversion.

Unit-II: **Relational Data Model:** Concepts, Relational algebra, Join operation, Integrity constraint nd its type, relational calculus, Normalization: functional dependencies, Decomposition, Domain & data dependency, types of Normal forms: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF; **Transaction processing:** Operations on transaction**,** Properties: Atomicity, Consistency, Isolation and Durability, States, schedule, deadlock in DBMS.

Unit-III: SQL Introduction:

SQL: Characteristic, advantages, data types, operators, wildcard operators, expressions, **Database commands:** create, drop, select and show database, Create table, drop table, Query with Select statements, Insert statement, Update statement, Delete statement with use of where, and, or clauses, Use of like and top clause, Alter command, Distinct Command, View in SQL, Create view using one or multiple table, delete view, Index creation & Drop, Null Values, SQL sub queries rules, sub queries using select, insert, update, delete statements, **SQL clauses:** having, group by, order by, join, **SQL Aggregate functions:** Count, sum average, max, min; Date function, **SQL Join:** inner, left, right, full, **SQL Set Operations**, Cursors, triggers

Unit-IV: **Concurrency Control:** Lock based protocol, Timestamp based schedulers,Validation based protocol, Serializability of scheduling, multiple granularity, and Concurrency Control schemes.

Unit-V: **Database Security:** Authentication, Authorization and access control, DAC, Mandatory Access Control and Role-Based Access Control models, Intrusion detection, SQL injection.

Unit-VI: **Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text Book: Korth, Sudarshan : Database System Concept , Mc Graw Hill, 6th Edition

Reference Books:

1. Raghu Ramkrishnan : Database system
2. C.J.Date : Database System, 7th ed.
3. Connolly &Begg : Database System, Low Price Ed.

5IT02: THEORY OF COMPUTATION

Course Prerequisite: Discrete Mathematics, Data Structures.

Course Objectives:

1. To understand different automata theory and its operation.
2. To understand mathematical expressions for the formal languages
3. To study computing machines and comparing different types of computational models
4. To understand the fundamentals of problem decidability and Un-Decidability.

Course Outcomes:

On completion of the course, the students will be able to

1. To construct finite state machines to solve problems in computing.
2. To write regular expressions for the formal languages.
3. To construct and apply well defined rules for parsing techniques in compiler
4. To construct and analyze Push Down, Turing Machine for formal languages
5. To express the understanding of the Chomsky Hierarchy.
6. To express the understanding of the decidability and un-decidability problems.

Unit I: Finite State Machines :

Alphabet, String, Formal and Natural Language, Operations, Definition and Design DFA (Deterministic Finite Automata), NFA (Non Deterministic Finite Automata), Equivalence of NFA and DFA: Conversion of NFA into DFA, Conversion of NFA with epsilon moves to NFA, Minimization Of DFA, Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines. Minimization of Finite Automata. (Construction of Minimum Automaton)

Unit II: Regular Expression and Regular Grammar :

Definition and Identities of Regular Expressions, Construction of Regular Expression of the given Language, Construction of Language from the RE, Conversion of FA to RE using Arden‟s Theorem, Inter-conversion RE to FA, Pumping Lemma for RL, Closure properties of RLs (proofs not required), Regular grammar, Equivalence of RG (RLG and LLG) and FA.

Unit III: Context Free Grammar and Languages:

Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, Derivation Trees, Construction of Context-Free Grammars and Languages, Pumping Lemma for CFL, Simplification of CFG, Normal Forms (CNF and GNF), Chomsky Hierarchy.

Unit IV: Pushdown Automata:

Introduction and Definition of PDA, Construction of PDA, Acceptance of CFL, Equivalence of CFL and PDA: Inter-conversion , Introduction of DCFL and DPDA, Enumeration of properties of CFL, Context Sensitive Language, Linear Bounded Automata.

Unit V: Turing Machines:

Formal definition of a Turing Machine, Design of TM, Computable Functions, Church‟s hypothesis, Counter machine, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine.

Unit VI: Decidability and Un-Decidability:

Decidability of Problems, Halting Problem of TM, Un-Decidability: Recursive enumerable language, Properties of recursive & non-recursive enumerable languages, Post Correspondence Problem, Introduction to Recursive Function Theory.

Text Books:

1. Hopcraft H.E. & Ullman J: Introduction to Automata Theory, Languages and Computation
2. Peter Linz: An Introduction to Formal Languages and Automata .

Reference Books:

1. Rajesh K. Shukla: Theory of Computation, CENGAGE Learning, 2009.
2. K V N Sunitha and N Kalyani: Formal Languages and Automata Theory, McGraw Hill, 2010
3. Lewis H.P. and Papadimition C.H.: Elements of Theory of Computation
4. Mishra &Chandrashekharan: Theory of Computation
5. C.K.Nagpal: Formal Languages and Automata Theory, Oxford University Press, 2011.
6. Vivek Kulkarni: Theory of Computation, OUP India, 2013.

5IT03 SOFTWARE ENGINEERING

Course Objectives:

1. To understand the nature of software complexity in various application domains, disciplined way of software development and software lifecycle process models.
2. To know methods of capturing, specifying, visualizing and analyzing software requirements.
3. To learn about project planning, execution, tracking, audit and closure of project.
4. To introduce principles of agile software development, the SCRUM process and agile practices.
5. To understand project management through life cycle of the project.
6. To understand current and future trends and practices in the IT industry.

Course Outcomes:

1. To identify unique features of various software application domains and classify software applications.
2. To analyze software requirements by applying various modeling techniques.
3. To choose and apply appropriate lifecycle model of software development.
4. To describe principles of agile development, discuss the SCRUM process and distinguish agile process model from other process models.
5. To understand IT project management through life cycle of the project and future trends in IT Project Management.

Unit I: Evolving role of Software. Software crises & myths. Software engineering. Software process & process models: Linear sequential, prototyping, RAD, Evolutionary Product & Process. Project management concepts: People, Product, Process, Project. W5HH principles, critical practice.

Unit II: Measures, Metrics & Indicators. Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks : identification, risk projection, refinement & RMMM plan.

Unit III: Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

Unit IV: System Engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

Unit V: Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User interface design : Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design : Structure programming, Comparison of design notation.

Unit VI: Software testing fundamentals; test case design, Whitebox testing. Basis path, control structure-, Blackbox-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing. Debugging. Technical metrics for software.

Text Book: Pressman Roger. S: Software Engineering, A Practitioner’s Approach, TMH. (5/e)

Reference Books:

1. Fairly R: Software Engineering (McGraw Hill)
2. Davis A: Principles of Software Development (McGraw Hill)
3. Shooman, M.L: Software Engineering (McGraw-Hill)

5IT04 PROFESSIONAL ELECTIVE - I (i) INFORMATION SECURITY SYSTEM

Course Objectives:

1. Understand the basics of Information Security
2. Know the legal, ethical and professional issues in Information Security
3. Know the aspects of risk management
4. Become aware of various standards in this area
5. Know the technological aspects of Information Security

Course Outcomes:

The learning outcomes are:

1. Study the foundational theory behind information security.
2. Discuss the basic information security.
3. Illustrate the legal, ethical and professional issues.
4. Discuss the aspects of risk management.
5. Summarize various standards for information security.
6. Explain the security techniques.

Course Contents:

UNIT I: Introduction to Information Security: History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

UNIT II : Security Investigation: Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues.

UNIT III : Legal, Ethical, and Professional Issues in Information Security: Law and Ethics in Information Security, International Laws and Legal Bodies, Ethics and Information Security.

UNIT IV : Security Analysis: An Overview of Risk Management, Risk Identification, Risk Assessment, Risk Control Strategies.

UNIT V : Planning for Security: Information Security Planning and Governance. Information Security Policy, Standards, and Practices, the Information Security Blueprint, Security Education, Training, and Awareness Program. Continuity Strategies .

UNIT VI : Cryptography: Foundations of Cryptology, Cipher Methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems.

TEXT BOOK : Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003.

REFERENCE BOOKS:

1. Micki Krause, Harold F. Tipton, " Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 2004.111
2. William Stallings ,"Cryptography and Network Security: Principles and Practice", 6th Edition, Prentice Hall
3. M. Stamp, "Information Security: Principles and Practice," 2nd Edition, Wiley, ISBN: 0470626399, 2011.
4. Nina Godbole, " Information Systems Security", Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6
5. Mark Merkow, " Information Security-Principles and Practices", Pearson Ed. 978-81-317-1288- 7.

5IT04 PROFESSIONAL ELECTIVE - I (ii) DATA SCIENCE & STATISTICS

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Data Science & Statistics by being able to do each of the following:

1. Organize, manage and present data.
2. Understand basic theoretical and applied principles of statistics.
3. Analyze statistical data using measures of central tendency, dispersion and location.
4. Introduce students to the basic concepts and techniques of Data Science.
5. Acquire knowledge of regression methods and classification methods.

Course Outcomes:

On completion of the course, the students will be able to:

1. Gain knowledge about basic concepts of Data Science & Statistics.
2. Demonstrate proficiency with statistical analysis of data.
3. Analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
4. Develop the ability to build and assess data-based models.
5. Evaluate models generated from data

UNIT I Python for Data Science :

Mean, Median, Mode, Variance, Standard Deviation Numpy: The Basics of NumPy Arrays, Universal Functions, Aggregators, Broadcasting, Fancy Indexing; Pandas: Introducing Pandas Objects, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Datasets: Concat, Append, merge and join, aggregation and grouping , pivot Tables.

UNIT II Exploratory Data Analysis and Statistics:

EDA: Matplotlib and Seaborn: Simple Line Plots, Simple Scatter Plots, Density and Contour Plots, Histograms, Binnings, and Density ,Random Sampling, Distributions: Uniform Distribution, Normal Distribution, Poisson's Distribution, Binomial Distribution.

UNIT III Statistical Experiments and Significance Testing:

Hypothesis Test: The Null Hypothesis, Alternative Hypothesis, One way, Two way Hypothesis Test; Statistical Significance and P-Values: P-value, alpha, type 1 error , type 2 error; t-Tests, Degrees of Freedom, ANOVA: F statistics, Two-way Anova; Chi-Square Test: A Resampling Approach.

UNIT IV Regression Techniques:

Introduction to Machine Learning, Hyper parameter and Model Validation, Feature engineering, Assumptions in Regression, Simple Linear Regression, Multiple Linear Regression.

UNIT V Classification: Logistic regression:

Logistic Response Function and Logit, Predicted Values from Logistic Regression, Interpreting the Coefficients and Odds Ratios; Evaluating Classification Models: Confusion Matrix, Precision, Recall, and Specificity, ROC Curve, AUC

UNIT VI Decision Tree and Radom Forest:

A Simple Example, The Recursive Partitioning Algorithm, Measuring Homogeneity or Impurity, Stopping the Tree from Growing, Predicting a Continuous Value; Random Forest

Text Books:

[1] Practical Statistics for Data Scientists By Peter Bruce, Andrew Bruce, O'Reilly Media, Inc.

[2] Python Data Science Handbook By Jake VanderPlas O'Reilly Media, Inc

Reference Books:

[1] Introduction to Machine Learning with Python By Andreas C. Müller, Sarah Guido, O'Reilly Media, Inc.

[2] Think Stats By Allen B. Downey O'Reilly Media, Inc.

5IT04 PROFESSIONAL ELECTIVE - I (III) INTERNET OF THINGS

Course Objectives:

The educational objectives of this course are:

To explore various components of Internet of things
To Recognize various devices, sensors and applications
To build a couple of applications that will communicate with IoT hardware and software.
To understand the IoT Reference Architecture and Real World Design Constraints.

Course Outcomes:

At the end of this course, the student would be able:

- To design small scale as well as sophisticated embedded system.
- To implement standalone application and GUI based application for real life projects.
- To recognize the role of professional societies in providing solution for real world problem.

Unit I: Introduction to IoT:

Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

Unit II: M2M to IoT:

From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains.

Unit III: M2M vs IoT An Architectural Overview:

Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT.

Unit IV: IoT Reference Architecture:

Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment, Constraints affecting design in IoT world- Introduction, Technical design Constraints.

Unit V: Developing IoT solutions:

Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi. Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities

Unit VI: Security, Privacy & Trust:

IoT security challenge, Spectrum of security considerations, Unique security challenges of IoT devices, Internet of things privacy background, Unique privacy aspects of internet of things, Trust for IoT.

Text Books:

[1] Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1 st Edition, VPT, 2014
[2] Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI

Reference Books:

[1] "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", Ovidiu Vermesan, Peter Friess, River Publishers.

[2] Bernd ScholzReiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer.

5IT05 OPEN ELECTIVE - I (I) SOFT SKILLS & INTERPERSONAL COMMUNICATIONS

Course objectives:

1. Explain and elaborate fundamentals of communication
2. Apply knowledge of verbal and nonverbal communication in business cases
3. Elaborate the barriers of communication and apply it improve communication

Course outcomes:

Student will be able to

1. Use and apply interaction skills
2. Use and apply leadership skills
3. Use and apply negations skills.

Unit I: Introduction, Need for Communication, Process of Communication, Written and Verbal Communication, Visual communication, Signs, Signals and Symbols, Silence as a Mode of Communication, Inter-cultural, Intra-cultural, Cross-cultural and International communication, Communications skills, Communication through Questionnaires, Business Letter Writing, Electronic Communication.

Unit II: Business Cases and Presentations, Letters within the Organizations, Letters from Top Management, Circulars and Memos, Business Presentations to Customers and other stakeholders, Presenting a Positive Image through Verbal and Non-verbal Cues, Preparing and Delivering the Presentations, Use of Audio-visual Aids, Report Writing.

Unit III: Barriers to Communication, Improving Communication Skills, Preparation of Promotional Material, Non-verbal communication, Body language Postures and gestures, Value of time , Organizational body language, Importance of Listening, Emotional Intelligence.

Unit IV: Individual Interaction and skills, Basic Interaction Skills –Within family, Society, Personal and interpersonal intrapersonal skills, Types of skills; conceptual, supervisory, technical, managerial and decision making skills. Problem Solving, Lateral Thinking, Self Awareness and Self Esteem, Group Influence on Interaction Skills, Human relations examples through role – play and cases.

Unit V: Leadership Skills, Working individually and in a team, Leadership skills, Leadership Lessons through Literature, Team work & Team building, Interpersonal skills – Conversation, Feedback, Feed forward, Interpersonal skills – Delegation, Humor, Trust, Expectations, Values, Status, Compatibility and their role in building team – work Conflict Management – Types of conflicts, how to cope with them, Small cases including role – plays will be used as teaching methodology.

Unit VI : Negotiation Skills (To be Taught through Role Plays and Cases) ,Types of Negotiation ,Negotiation Strategies, Selling skills – Selling to customers, Selling to Superiors, Selling to peer groups, team mates & subordinates, Conceptual selling, Strategic selling, Selling skills – Body language,

Books Recommended:

1. Peggy Klaus, The Hard Truth about Soft Skills.
2. Nitin Bhatnagar. Effective Communication and Soft Skills. Pearson Education India.
3. Eric Garner. Team Building. 4. Wendy Palmer and Janet Crawford. Leadership Embodiment.

5IT05 OPEN ELECTIVE - I (II) COMPUTATIONAL BIOLOGY

Unit I: Introduction: Molecular Biology Introduction, Cell, Nucleus, Genes, DNA, RNA, Proteins, And Chemical structure of DNA, RNA, Transcription and Translation Process. Protein Structure and Functions, Nature of Chemical Bonds Molecular Biology tools, Polymerase chain reaction

Unit II: Sequence Alignment: Simple alignments, Gaps, Scoring Matrices, Global and Local Alignments, Smith-Waterman Algorithm, Multiple sequence Alignments, Gene Prediction, Statistical Approaches to Gene Prediction

Unit III: Genome Algorithms: Genome Rearrangements, Sorting by Reversals, Block Alignment and the Four-Russians Speedup, Constructing Alignments in Sub-quadratic Time, Protein Sequencing and Identification, the Peptide Sequencing Problem, Introduction to Nature Inspired Algorithms.

Unit IV: Microarray Data Analysis: Microarray technology for genome expression study, Image analysis for data extraction, Data analysis for pattern discovery, gene regulatory network analysis

Unit V: Phylogenetic: Neighbor's relation method, Neighbor-joining method, Maximum likelihood Approaches, Multiple Sequence Methods Structural Biology, Sequence, organisms, 3D structures, complexes, Assemblies, Case Studies, examples

Unit VI: Drug Discovery &Next Gen Sequencing: Similarities/differences between drugs and receptors, protein-ligand docking, Massively Parallel Signature Sequencing (MPSS), SOLiD sequencing, Single molecule real time (SMRT) sequencing .

Text Books:

1) Dan E. Krane, Michael L. Raymer, "Fundamental Concepts of Bioinformatics,", Pearson Education, Inc. Fourth Edition, 9780805346336.

2) Harshawardhan P. Bal, "Bioinformatics Principles and Applications", Tata McGraw-Hill, seventh reprint, 9780195692303.

Reference Books:

1) Teresa Attwood, David Parry-Smith, "Introduction to Bioinformatics", Pearson Education Series, 9788180301971

2) R. Durbin, S. Eddy, A. Krogh, G. Mitchison., "Biological Sequence Analysis: Probabilistic Models of proteins and nucleic acids", Cambridge University Press, 9780521629713.

5IT05 OPEN ELECTIVE - I (III) CYBER LAW & ETHICS

Course Objectives:

1. To identify and describe the major types of cyber crime.
2. To identify cyber crime vulnerabilities and exploitations of the Internet.
3. To understand the law with regards to the investigation and prosecution of cyber criminals.
4. To identify appropriate law enforcement strategies to both prevent and control cyber crime.
5. Explain jurisdictional challenges that nations face when responding to cybercrime

Course outcomes:

1. Understand Cyber laws
2. Describe Information Technology act and Related Legislation
3. Demonstrate Electronic business and legal issues.
4. Interpret Cyber Ethics.

Unit I: Introduction to Cyber law: Evolution of computer Technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, CyberspaceWeb space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

Unit II Information Technology Act: Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

Unit III : Cyber law and Related Legislation: Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution, Online Dispute Resolution (ODR).

Unit IV : Electronic Business and legal issues: Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.

Unit V: Cyber Ethics: The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

Unit VI : Case Study On Cyber Crimes: Harassment Via E-Mails, Email Spoofing (Online A Method Of Sending E-Mail Using A False Name Or E-Mail Address To Make It Appear That The E-Mail Comes From Somebody Other Than The True Sender, Cyber Pornography (Exm.MMS),Cyber-Stalking.

Reference Books:

1. Cyber Laws: Intellectual property & E Commerce, Security- Kumar K, dominant Publisher
2. Cyber Ethics 4.0, Christoph Stuckelberger, Pavan Duggal, by Globethic
3. Information Security policy & Implementation Issues, NIIT, PHI
4. Computers, Internet and New Technology Laws, Karnika Seth, Lexis Nexis Butterworths Wadhwa Nagpur.
5. Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi,
6. Cyber Law, Jonthan Rosenoer, Springer, New York, (1997).
7. The Information Technology Act, 2005: A Handbook, OUP Sudhir Naib,, New York, (2011) .

5IT06 DATABASE MANGEMENT SYSTEMS - LAB

1. **Practical 1**: To Study a Database Modeling Tool. Study of Data Modeling Tools
   - Take a description of the enterprise, create its corresponding ER Diagram and build a database model using any modeling tool. The following basic features of the modeling should be covered while building the model:
     - Logical / Physical Modeling
     - Adding an entity / its attributes , relationships (all kinds of relationships viz., parent-child, foreign key references, one to many, many to many etc)
     - Forward / reverse engineering
     - Details of forward engineering / schema generation
     - Steps to generate the schema

2. **Practical 2**: To Study and implement DDL Commands
   Implement the model created in Practical 1, in any of the DBMS like Oracle, MySQL, or Microsoft SQL Server database software.
     - Creating the proper tables
     - Insert the data into it.
     - Study Dropping and Altering the Tables. Study the cascaded deletes.

3. **Practical 3**: To Study and implement DML Commands-I
   - SQL queries : Write and execute different SQL queries
   - Execute Simple queries using SELECT, FROM, WHERE clauses,
   - In Where clause use different predicates involving OR,AND, NOT
   - Rename operation
   - Tuple Variables
   - Write SQL for various String operations (%,_,*)
     - Match beginning with
     - Match ending with
     - Substring
     - Match exactly n characters
     - Match at least n characters
   - Sort the output of the query using **Order by**
   - Write SQL using **Having**

4. **Practical 4** : To Study and implement DML Commands-II
   Write SQL queries and perform
     - Set membership operations
     - In, not in
     - Some
     - All
     - Exists and not exists, Test for emptyness using exists, not exists
     - Test for absence of duplicates.
     - Nested queries

5. **Practical 5**. Study and implement aggregation functions.
   Write different queries using following Aggregate functions
     a. Min (minimum 3 SQL queries)
     b. Max (minimum 3 SQL queries)
     c. Avg (minimum 3 SQL queries)
     d. Sum (minimum 3 SQL queries)
     e. Count (minimum 3 SQL queries)

6. **Practical 6:** Write SQL to create Views and Indexes.
7. **Practical 7**: Write SQL to perform the modifications to the database
8. **Practical 8** : PL /SQL
9. **Practical 9** : Database Access Using Cursors
   Write a trigger to find the names and cities of customers who have more than xyz in any account.
10. **Practical 10** : Triggers
    - Write a trigger for dealing with the overdrafts (set the account balance to zero, and creating a loan in the amount of the overdraft. Keep account number as loan number in the loan table)
    - Write a trigger for dealing with blank cities (set the city field to null when it is blank)

11. **Practical 11**: Procedures, functions
    - Write atleast 2 functions, and demonstrate its use
    - Write atleast 2 procedures, and demonstrate its use
12. **Practical 12** : Web Programming with PL/SQL. **(Contents Beyond Syllabus)**
    HTTP, A Simple Example., Printing HTML Tables., Passing Parameters., Processing HTML Forms., Multi-Valued Parameters.
13. **Practical 13**: Develop a JDBC Applications, Retrieve the information by connecting to the database using a host language (JAVA, C, C++) **(Contents Beyond Syllabus)**
14. **Practical 14**: Web Programming with Java Servlets. **(Connecting to the database) (Contents Beyond Syllabus)**
    A Simple Servlet., HTTP Servlet API Basics.,HTML Form Processing in Servlets.
15. **Practical 15**: PHP : Develop a simple application to access the database using PHP **(Contents Beyond Syllabus)**
16. Study of Open Source NoSQL Databases
17. Based on the concepts covered in text create a Mini Project:

Suggested Topics:

i. Bank database (Given in Korth book)
ii. University Database (Given in Korth book)
iii. Airline Flight Information System.
iv. Library Database Application.
v. University Student Database.
vi. Video Chain Database.
vii. Banking Database.
viii. BiBTeX Database.
ix. Music Store Database.
x. Online Auctions Database.
xi. A Web Survey Management System.

5IT07 SOFTWARE ENGINEERING LAB.

Minimum eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units and **a mini project based on the syllabus using case studies.**

LIST OF EXPERIMENTS:

1. Preparing Software Requirements Specifications
2. Identifying Domain Classes from the Problem Statements
3. Modeling UML Class Diagrams and Sequence diagrams
4. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
5. E-R Modeling
6. State chart and Activity Modeling
7. Modeling Data Flow Diagrams
8. Estimation of Project Metrics
9. Estimation of Test Coverage Metrics and Structural Complexity
10. Designing Test Suites
11. Preparing Final Project Report

5IT08 PROFESSIONAL ELECTIVE – I (I) INFORMATION SECURITY SYSTEM LAB .

Minimum eight experiments/programming assignments must be completed based on the syllabus uniformly covering each of the units.

5IT08 PROFESSIONAL ELECTIVE - I (II) DATA SCIENCE & STATISTICS

Minimum eight experiments/programming assignments must be completed based on the syllabus uniformly covering each of the units

List of Experiments:

Experiment No.	EXPERIMENT DESCRIPTION
01	Study of setting up the Python environment of and how it is useful for data science.
02	Study of Pandas, NumPy, SciPy and Matplotlib Libraries in Python and their importance in data science and statistics.
03	Write a python program to plot a sine wave using Matplotlib library.
04	Write a python program to understand the tokenization of string data.
05	Write a python program to handle the data in series and Data Frame format using NumPy Library.
06	Write a python program to read a csv file and display data from specific rows and specific columns from it.
07	Write a python program to print a 3D plot using matplotlib library.
08	Write a python program to understand the linear regression of data and display it.
09	Write a python program to read a time series data from a csv file and display it in a graph.
10	Write a python program to understand and implement the Naïve Bayes Algorithm.

5IT08 PROFESSIONAL ELECTIVE - I (III) INTERNET OF THINGS

Minimum eight experiments must be completed based on the syllabus uniformly covering each of the units.

LIST OF EXPERIMENTS:

1. To Interface **PRI Motion Sensor** with Raspberry Pi and write a program to control LED.
2. To Interface **Optical Sensor** with Raspberry Pi and write a program to control LED.
3. To Interface **Rain Drop Sensor** with Raspberry Pi and write a program to sound an alarm.
4. To Interface **Moisture Sensor** with Raspberry Pi and write a program to display value.
5. To Interface **Touch Sensor** with Raspberry Pi and write a program to detect and record physical touch.
6. To Interface **Gas Sensor** with Raspberry Pi and write a program to sounds an alarm.
7. To Interface **Pressure Sensor** with Raspberry Pi and write a program to display value.
8. To Interface **Ultrasonic Sensor** with Raspberry Pi and write a program to measure the distance between any two objects.

5IT 09 COMPUTER SKILL LAB - III

Minimum eight experiments/programming assignments must be completed based on the syllabus uniformly covering each of the units.

LIST OF EXPERIMENTS:

Sr. No.	Title for Experiment
1	Understanding and use of HTML & CSS Programming
2	Understanding and use of Java Script
3	Understanding and use of Type Script
4	Introduction to Angular
5	Angular Environment Set up
6	Creating Angular Project and basic introduction about project structure / directory.
7	Understanding Components and how to create components in Angular
8	Understanding of data binding in Angular component and view files.
9	Understanding and use of different types of Angular directives
10	Understanding of modules and routing in angular.
11	Understanding of services and component ‘s life cycle method
12	Understanding of package. json file in Angular Project.
13	Understanding of how to fetch data from the API using services.

Pre-requisites -Before proceeding with this Angular tutorial course, students should have a basic understanding of HTML, CSS, and JavaScript, basic oops concept.https://dotnettutorials.net/lesson/creating-angular-project/
Angular Tutorials Links:
https://angular.io/
https://www.javatpoint.com/angular-7-tutorial
https://www.tutorialsteacher.com/angular
https://www.tutorialspoint.com/angular7/index.htm

Reference Books:

1. “Angular in Action **”by Jeremy Wilken: Manning Publications**
2. “Angular: Up and Running: Learning Angular, Step by Step” by Shyam eshadri: Shroff/O'Reilly PUBLICATIONS
3. “ Beginning Angular with Typescript” By : Greg Lim
4. “Learning Angular” By **Aristeidis Bampakos and** Pablo Deeleman **Packt Publishing Limited.**

B.E. SEMESTER VI [INFORMATION TECHNOLOGY]

6IT01 COMPILER DESIGN

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:

1. To learn concepts of programming language translation and phases of compiler design
2. To understand the common forms of parsers.
3. To study concept of syntax directed definition and translation scheme for the representation of language
4. To illustrate the various optimization techniques for designing various optimizing compilers.

Course Outcomes:

On completion of the course, the students will be able to:

1. Describe the fundamentals of compiler and various phases of compilers.
2. Design and implement LL and LR parsers
3. Solve the various parsing techniques like SLR, CLR, LALR.
4. Examine the concept of Syntax-Directed Definition and translation.
5. Assess the concept of Intermediate Code Generation and run-time environment
6. Explain the concept code generation and code optimization.

Unit I: Introduction to Compiling: Definition of Compiler, Phases of a Compiler, Grouping of Phases, Compiler Construction Tools.
Lexical Analysis: The role of lexical analyzer, input buffering, specification of tokens, recognition of tokens, language for specifying lexical analysis, lex and yacc tools, finite automata, from regular expressions to finite automata and state minimization of DFA.

Unit II: Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis.
Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, Non recursive predictive parsing, FIRST and FOLLOW, Construction of predictive parsing tables, LL (1) grammars. Non recursive predictive parsing, Error recovery in predictive parsing.

Unit III: Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing, LR parsers: LR parsing algorithm, Construction of SLR parsing table, canonical LR parsing tables and canonical LALR parsing tables. Error recovery in LR parsing, The parser generator Yacc.

Unit IV: Syntax Directed Translation: Syntax directed definitions, synthesized and inherited attributes, dependency graphs, Evaluation orders. Construction of syntax trees. Syntax directed definition for constructing syntax trees, directed acyclic graphs for expressions. Bottom up evaluation of s-attributed definitions, L-attributed definition. Top down translation, Design of a predictive translator.

Unit V: Run Time Environments: Source language issues: Activation trees, control stacks, storage organization, scope of a declaration, Storage Organization, Storage allocation strategies, static allocation, stack allocation, dangling references, heap allocation. Access to non-local names, Parameter passing, Symbol table: Entries, Storage allocation, Hash tables, Scope information.

Unit VI: Intermediate Code Generation: Intermediate languages, Translation of Declarations & Assignments statements. Design issues of a Code generator, Target machine, Runtime storage management, Basic blocks and flow graphs. Introduction to Code Optimization, Principal Sources of Optimization.

Text Book: Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman Compilers: "Principles, Techniques and Tools", Pearson Education (Low Price Edition).

Reference Books:

[1] D. M. Dhamdhere, Compiler Construction—Principles and Practice, (2/e), Macmillan India.
[2] Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: "Principles, Techniques and Tools", Pearson Education Second Edition
[3] Andrew Appel, Modern Compiler Implementation in C, Cambridge University press
[4] K C. Louden "Compiler Construction—Principles and Practice" India Edition, CENGAGE
[5] Bennett J.P., "Introduction to Compiling Techniques", 2/e (TMH).

6IT02 DESIGN & ANALYSIS OF ALGORITHM

Course Objectives:

1. To teach paradigms and approaches used to analyze and design algorithms and to appreciate the impact of algorithm design in practice.
2. To make students understand how the worst-case time complexity of an algorithm is defined, how asymptotic notation is used to provide a rough classification of algorithms.
3. To explain different computational models (e.g., divide-and- conquer), order notation and various complexity measures.
4. Study of various advanced design and analysis techniques such as greedy algorithms, dynamic programming
5.Synthesize efficient algorithms in Common Engineering situations.

Course Outcomes:

- Analyze worst-case running times of algorithms using asymptotic analysis.
- Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
- Describe the greedy paradigm and explain when an algorithmic design situation calls for it.
- Able to understand the concept of Backtracking, Polynomial Time & Non Polynomial Time Algorithms.

Unit I: Top-Down Design: Structured Programming, Control Constructs, Procedures & Functions, Recursion. Iterative Algorithm Design Issue: Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion.

Unit II: Divide and Conquer: Multiplication Algorithm and its analysis, Application to Graphics Algorithms: Introduction to Triangulation, Covex Hulls.

Unit III: Greedy Methods: Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Prim's Algorithms, Kruskal's Algorithm, Dijkstras Shortest Path Algorithm.

Unit IV: Dynamic Programming: Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation. Single Source Shortest Paths

Unit V: Backtracking: Combinational Search, Search & Traversal, Backtracking Strategy, BacktrackingFramework-8-Queen's problem, graph coloring , Some Typical State Spaces, Branch-and-Bound Algorithms.

Unit VI: Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

Text Book: Dave and Dave: "Design and Analysis of Algorithms" Pearson Education

Reference Books:

1. Aho,Hopcroft & Ullman "The Design & Analysis of Computer Algorithms", Addison-Wesley
2. G. Brassard, P.Bratley: "Fundamentals of Algorithmics" , PHI
3. Horowitz & Sahani: " Fundamental Algorithms" , Galgotia.
4. Cormen, T.H, Lierson & Rivest: " Introduction to Algorithms", Mc Graw-Hill .

6IT03 ARTIFICIAL INTELLIGENCE

Course Objectives:

1. Familiarity with basic principles of AI
2. Capable of using heuristic searches
3. Aware of knowledge based systems
4. Able to use fuzzy logic
5. Learn various applications domains AI.

Course Outcomes: Students will be able to

1. Define Artificial Intelligence and identify problems for which solution by AI methods can be devised.
2. Evaluate of different uninformed search algorithms on well formulate problems along with stating valid conclusions that the evaluation supports.
3. Design and Analysis of informed search algorithms on well formulated problems.
4. Formulate and solve given problem using Propositional and First order logic.
5. Apply reasoning for non-monotonic AI problems.
6. have a basic understanding of some of the more advanced topics of AI such as learning, Understanding, Natural Language Processing.

Unit-I: Introduction to Artificial Intelligence: The AI Problems, The Underlying Assumption, What is an AI Technique; Tic-Tac-Toe**, Problems, Problem Spaces, and Search,** Production Systems, Problem Characteristics , Production System Characteristics, Issues in the Design of Search Programs.

Unit-II: Basic Problem Solving methods: Reasoning, Problem trees and graphs, Knowledge Representation, **Uninformed Search Strategies:** Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search.

Unit–III: Informed Search Strategies Generate-and-Test, Hill Climbing, Best-first Search, A* Algorithm, Problem Reduction, AND-OR Graphs, The AO* Algorithm, Constraint Satisfaction, Means ends Analysis.

Unit –IV: Knowledge Representation Issues: Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation, **Predicate Logic:** Representing Simple Facts in Logic, Representing Instance and *ISA* Relationships, Computable Functions and Predicates, Resolution, Natural Deduction **Representing Knowledge Using Rules,** Procedural Versus Declarative Knowledge, Logic Programming Forward Versus Backward Reasoning.

Unit-V: Symbolic Reasoning Under Uncertainty Introduction to Non Monotonic Reasoning, Logics for Non Monotonic Reasoning, Semantic Nets, Statistical Reasoning, Fuzzy logic: fuzzy set definition and types, membership function. Probability and Bayes' theorem, Bayesian Networks.

Unit-VI: Understanding What is Understanding?, Understanding as Constraint Satisfaction, **Natural Language Processing,** Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural Language Processing, Spell Checking, **Common Sense** Qualitative Physics.

TEXT BOOK: Artificial Intelligence – Elaine Rich, Kevin Knight, Nair (Third Edition) [Mc Graw Hill]

REFERENCE BOOKS:

1. Introduction to Artificial Intelligence and expert system – Dan W. Patterson
2. Introduction to Artificial Intelligence – Rajendra Akerkar
3. Nils Nilson: " Principles of Artificial Intelligence".(Addison-Wesley)
4. R. J. Winston: " Artificial Intelligence".(Wiley)
5. Patterwson "Introduction to Artificial Intelligence and Expert Systems" (PHI).
6. Rolston "Principles of Artificial Intelligence and Expert Systems", McGraw Hill.

6IT04 PROFESSIONAL ELECTIVE – II (I) CRYPTOGRAPHY AND NETWORK SECURITY

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Cryptography & Network Security by being able to do each of the following:

• To understand the fundamental concepts of Cryptography & Network Security.
• To familiarize the students with basic taxonomy and terminology of Cryptography & Network Security.
• To understand various protocols for network security to protect against the threat in the network.
• To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

Course Outcomes:

On completion of the course learner will be able to

- Understand the principles and fundamental concept of Cryptography & Network Security.
- To learn Encryption and Decryption Techniques.
- Evaluate various Key Encryption Algorithms.
- Understand IP Security system and protocols.
- Identify and understand Network Security controls.
- Explore web and system security and its applications to digital world.

Unit I: Introduction : OSI Security Architecture, Security Attacks: Threats, Vulnerability and Controls, Security Services: Confidentiality, Integrity, Availability, Introduction to Cryptography, Conventional Encryption: Conventional encryption model - classical encryption techniques.

Unit II: Encryption and Decryption: Characteristics of Good Encryption Technique: Properties of Trustworthy Encryption Systems; Types of Encryption Systems: Based on Key, Based on Block; Confusion and Diffusion; Cryptanalysis.

Unit III: Symmetric Key Encryption and Public Key Encryption: Data Encryption Standard (DES) Algorithm: Double and Triple DES, Security of the DES; Advanced Encryption Standard (AES) Algorithm, DES and AES Comparison, RSA Technique, Digital Signature.

Unit IV IP Security: Overview of IP Security (IPSec); IP Security Architecture; Modes of Operation; Security Associations, Security Parameter Index (SPI), SA Management, Security Policy: Authentication Header (AH); Encapsulating Security Payload (ESP); Internet Key Exchange.

Unit V Network Security: Network Concepts; Threats in Networks, Threats in Transit: Eavesdropping and Wiretapping, Protocol Flaws, Impersonation; Network Security Controls: Architecture, Encryption, Virtual Private Networks, Public Key Infrastructure (PKI) and Certificates.

Unit VI Web and System Security: Web Security: Secure socket layer and transport layer security, Secure Electronic transaction, System Security: Intruders, Viruses and related threads; Network Security Controls: Architecture, Public Key Infrastructure (PKI) and Certificates, Security Features of Trusted Operating Systems.

Text Book: William Stallings, "Cryptography and Network security Principles and Practices", Pearson/PHI.

Reference Books:

1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education.
2. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", Pearson.
3. Charles P. Pfleeger, Shari Lawrence Pfleeger "Security in computing", Prentice Hall of Ind

6IT04 PROFESSIONAL ELECTIVE – II (II) BIG DATA ANALYTICS

Course Objectives:

1. To make the students aware about the basics concepts of big data analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop and NoSql
3. To discuss the basic concepts and operations of map-Reduce
4. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
5. To introduce several new algorithms for big data mining like classification, clustering and finding frequent patterns
6. To introduce to the students several types of big data like social media, web graphs and data streams and help them to solve real world problems in for decision support.

Course Outcomes:

On completion of the course the student(s) will be able to

1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
2. Acquire fundamental enabling techniques like Hadoop, and NO SQL in big data analytics.
3. Achieve basic knowledge and operations of Map-Reduce
4. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
5. Implement algorithms for Clustering, Classifying and finding associations in Big Data 6. Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications.

UNIT I: Introduction to Big Data:

Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach, Case Study of Big Data Solutions.

UNIT II: Introduction to big data frameworks: Hadoop and NoSQL:

Introduction to Hadoop, Hadoop Components; Hadoop Ecosystem; Overview of : Apache Spark, Pig, Hive, Hbase, Sqoop ,Introduction to NoSQL, NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Mongo DB.

UNIT III: MapReduce Paradigm:

MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures. Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce , Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce.

UNIT IV: Mining Big Data Stream:

The Stream Data Model: A DataStream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream : Sampling Techniques. Filtering Streams: The Bloom Filter. Counting Distinct Elements in a Stream : The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements . Counting Ones in a Window: The Cost of Exact Counts, The Datar-Gionis-IndykMotwani Algorithm, Query Answering in the DGIM Algorithm.

UNIT V: Big Data Mining Algorithms:

Frequent Pattern Mining : Handling Larger Datasets in Main Memory Basic Algorithm of Park, Chen, and Yu. The SON Algorithm and MapReduce. Clustering Algorithms: CURE Algorithm. Canopy Clustering, Clustering with MapReduce. Classification Algorithms: Parallel Decision trees, Overview SVM classifiers, Parallel SVM, K-Nearest Neighbor classifications for Big Data, One Nearest Neighbour.

UNIT VI: Big Data Analytics Applications

Link Analysis : PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine, Efficient computation of Page Rank, PageRank Iteration Using MapReduce, Topic sensitive Page Rank, link Spam, Hubs and Authorities, HITS Algorithm, Mining Social- Network Graphs : Social Networks as Graphs, Types , Clustering of Social Network Graphs, Direct Discovery of Communities, Counting triangles using Map-Reduce. Recommendation Engines: Content based Recommendation, Collabrative Filtering.

Text Books:

1. Radha Shankarmani, M Vijayalakshmi, "Big Data Analytics", Wiley Publications
2. Anand Rajaraman and Jeff Ullman "Mining of Massive Datasets", Cambridge University Press.

Reference Books:

1. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Bart Baesens , WILEY Big Data Series.
2. Alex Holmes "Hadoop in Practice", Manning Press, Dreamtech Press.
3. Professional NoSQL Paperback, by Shashank Tiwari, Dreamtech Press
4. MongoDB: The Definitive Guide Paperback, Kristina Chodorow (Author), Michael Dirolf,O'Reilly Publications
5. Big Data Analytics with R and Hadoop by Vignesh Prajapati Paperback, Packt Publishing Limited Hadoop: The Definitive Guide by Tom White, O'Reilly Publications.

6IT04 PROFESSIONAL ELECTIVE – II (III) SENSORS & ACTUATORS

Course Learning Objectives:

- To learn concept behind working of various types of Sensors.
- To understand available sensor to measure each physical parameters used in Industry and normal measurement applications.
- To interface real sensors for meaningful output in Electrical form.

Course Outcomes:

- Concept behind working of measurement systems and different types of sensors and actuators.
- Understanding of electric and magnetic sensors and actuators and their applications.
- Understanding of optical sensors and other sensors and their applications.
- Understanding of smart sensors and their uses.

UNIT I: Introduction:

Definitions, Classification of Sensors and Actuators, General Requirements for Interfacing, Measuring Units. Performance Characteristics of Sensors and Actuators, Input and Output characteristics.

UNIT II: TEMPERATURE SENSORS AND THERMAL ACTUATORS:

Introduction, Thermosensitive Sensors: Thermistors, Resistance Temperature Sensors and Silicon Resistive Sensors, Thermoelectric Sensors, P-N junction Sensors. Optical and Acoustical Sensors, Thermomechanical Sensors and Actuators.

UNIT III: OPTICAL SENSORS AND ACTUATORS:

Introduction, Optical Units, Materials, Effects of Optical Radiation, Quantum Based Optical Sensors, Photoelectric Sensors, Coupled Charge (CCD) Sensors and Detectors, Thermal-Based Optical Sensors, Optical Actuators.

UNIT IV: ELECTRIC AND MAGNETIC SENSORS AND ACTUATORS:

Introduction, Units, The Electric Field: Capacitive Sensors and Actuators, Magnetic Fields: Inductive Sensors and Hall Effect Sensors, MHD Sensors and Actuators, Magnetic Actuators, Voltage and Current Sensors.

Unit V: MECHANICAL / ACOUSTIC SENSORS AND ACTUATORS :

Introduction, Definitions/Units, Force Sensors, Accelerometers, Velocity Sensing. Microphones, Acoustic Actuators, Ultrasonic Sensors and Actuators. Piezoelectric Actuators, Resonators and SAW Devices.

Unit VI: MEMS AND SMART SENSORS:

Introduction, MEMS Sensors and Actuators with Applications, Smart Sensors/Actuators Issues. Wireless Sensors and Actuators, Modulation/Demodulation, Encoding/Decoding Sensor Networks.

Text Book: Nathan Ida, "Sensors, Actuators, and their Interfaces: A Multidisciplinary Introduction", SciTech Publishing.

Reference Books:

1. Patrick F Dunn, "Fundamentals Of Sensors For Engineering And Science" CRC Press, Taylor & Francis Group, 2014
2. Patranabis D., "Sensors and Transducers", Prentice-Hall India, 2nd Ed., 2004.
3. Shawhney A. K., "Electrical and Electronics Measurements and Instrumentation", Dhanpat Rai & Sons, 1994.
4. J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press,

6IT05 OPEN ELECTIVE II (I) ECONOMIC POLICY IN INDIA

Course Objectives:

1. Student will be able explain and elaborate fundaments Indian economy
2. Student will be able to explain, elaborate and identify the role of agriculture in Indian economy
3. Student will be able to explain elaborate and identify the role of industrial sector in Indian economy.

Course Outcomes:

1. Student will be able to explain, elaborate and indentify the impact of external sector on Indian economy
2. Student will be able to explain, elaborate and indentify the impact monetary and fiscal policies in India
3. Student will be able to explain ,elaborate and analyze the issues of Indian economy.

UNIT - I : Indian Economy and Development Basic characteristics of the Indian economy - Major issues of development - The determinants of economic development - sustainable development - Demographic features of Indian population - Rural Urban Migration - poverty and Inequality.

UNIT - II : The Agricultural Sector The Role of Agriculture in Economic development - Place of Agriculture in the Economy of India - Land Reforms in India - Inter dependency of Agriculture and Industry - Agricultural Finance - Agricultural prices, polices and Food problem - Agricultural development.

UNIT - III : The Industrial Sector A review on Industrial Policy - Role of large scale and small scale Industries in development. Private Sector and public sector - Industrial sickness - Industrial Finance - Industrial monopoly and Multinational corporations - Role of Information Technology in Industrial development.

UNIT - IV : External Sector Structure and Direction of Foreign trade, Balance of Trade & Balance of payments - composition of Trade - Important of Foreign trade for developing economy - Exchange rate - Foreign capital and MNCs in India - Globalisation and its impact on Indian economy - WTO and its impact on the different sectors of the economy.

UNIT V: Monetary and Fiscal Policies in India, Credit and Monetary Policy, Capital Market and its Regulation, Public Finance and Fiscal Policy, Fiscal Federalism in India.

UNIT VI: Some Issues of Indian Economy: National Institution for Transforming India (NITI Aayog), National Development Council (NDC); Developing Grass-Root Organizations for Development: Panchayatiraj; Role of Non Government Organizations (NGOs) and Pressure Groups in India's Economy. Public Private Partnership (PPP).

Text Books:

1. Ahluwalia, IJ and IMD Little (Eds) (1999), Indian Economic Reforms and Development. (Essays in Honour of Manmohansingh) Oxford University, Press, New Delhi.
2. Bardhan, P.K (9th edition) (1999), The political economy of development in India, Oxford University, Press, New Delhi.

Reference Books:

1. Bawa, R.S and P.S.Raikhy (Ed) (1997) structural changes in Indian economy, Guru Nanak Dev University Press, Amritsar.
2 Brahmananda, P.R. and V.R Panchmukhi (Eds) (2001) Development Experience in the Indian economy: Interstate Perspectives, Bookwel Delhi.
3. Chakravartym .S (1987), Development Planning : The Indian Experience, Oxford University, Press, New Delhi.
4. Government of India, Econimic Survey (Animal) Ministry of Finance, New Delhi.
6. Jaban. B,(1992) The Indian Economy —problems and prospects, Viking New Delhi.
7. Parikh.K.S (1999) India Development Report — 1999 — 2000 Oxford University, Press, NeW Delhi.
8. Reserve Bank of India, Report on currency and finance (Annual) 10. Sri R.K. and B. Chatterjee (2001) Essays in Honour of Prof.P.R.Brahmanandha), Deep & Deep Publications, New Delhi.

6IT05 OPEN ELECTIVE II (II) HUMAN RESOURCE DEVELOPMENT & ORGANIZATION BEHAVIOR

Course Objective:

The objective of the course is to familiarise the students about the different aspects of managing people in the organisations from the stage of acquisition to development and retention.

Course Outcome:

1. To have an understanding of the basic concepts, functions and processes of human resource management
2. To be aware of the role, functions and functioning of human resource department of the organizations.
3. To Design and formulate variours HRM processes such as Recruitment, Selection, Training, Development, Performance appraisals and r Reward Systems, Compensarion Plans and Ethical Behaviour.
4. Develop ways in which human resources management might diagnose a business strategy and then facilitate the internal change necessary to accomplish the strategy.
5. Evaluate the developing role of human resources in the global arena.

UNIT I: Introduction: Conceptual foundations; Human aspect of management, Human Relations; Human Resource Management- Concept, Scope and Importance; Competencies of HR Manager: Employer branding and Competency mapping; Changing role of HRM- Workforce diversity, Technological change, Restructuring and rightsizing, Empowerment; TQM, Managing ethical issues.

UNIT II: Human Resource Planning, Job Analysis, and Job Design: Assessing Human Resource requirements; Human resource forecasting; Work load analysis ; Job analysis; Job description and specifications; Job design; Job characteristic approach to job design

UNIT III: Recruitment, Selection, Training, and Development: Factors affecting recruitment; Sources of recruitment (internal and external); Basic selection model; Psychological tests for selection; Interviewing; Placement and Induction; Job Changes- Transfers, Promotions, and Separations; An overview of Training and Development; Emerging trends in Recruitment, Selection, and development.

UNIT IV: Understanding Organisation: Significance of Scientific Study of Human Behaviour, Hawthorn Studies it's importance & implication, Approaches-Cognitive, Behaviourstic & Social learning framework Human Need, theory, Maslow & Herzberg Motivation Process.

UNIT V: Perspectives of Organisation: Perception & Impression, Personality & Attitudes, Learning Values. Group Dynamics, Group formation, Group interaction, Conflict Management, Team Management "Morale"

UNIT VI: Leadership: Managerial styles Managerial effectiveness, Indian Manager & His effectiveness, Delegation, Decision Making.

Text Books:

1) D'Cenzo, David A., Stephen P. Robbins, and Susan L. Verhulst, *Human Resource Management*, JohnWiley and Sons, NewDelhi.

2) Keith Devis Human Behaviour at Work.

3) Kundson&Fleeror Management of Organizational Behaviour.

Reference Books:

1. Gomez-Mejia, Luis R., D. B. Balkin, and R. L. Cardy, Managing Human Resources, Prentice Hall NewJersey.
2. Ian, Beardwell, and Len Holden, Human Resource Management, Prentice Hall.
3. Dessler, Garry, Human Resource Management, Prentice Hall of India.
4. Saiyadain, Mirza S., Human Resource Management, Tata McGraw-Hill Pub. Co. Ltd., New Delhi.
5. 6. Noe, Raymond A., John R. Hollenbeck, BarryGerhart and Patrick M. Wright , Human Resource Management, Tata McGraw Hill.
6. Korman A.K. Organizational Behaviour.
7. Prasad Organization Theory & Behaviour.

6IT05 OPEN ELECTIVE II (III) INTELLECTUAL PROPERTY RIGHT

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Intellectual Property Rights in the following:

1. This course is intended to impart awareness on Intellectual Property Rights (IPR) and various regulatory issues related to IPR
2. To make familiarizing students with the shades of Intellectual Property Rights (IPR) so as to help them integrate the IPR process in their project and research activities.
3. To make the students familiar with basics of IPR and their implications in Project research, development and commercialization.
4. To impart awareness on intellectual property rights and various regulatory issues related to IPR.

Course Outcomes:

On completion of the course, the students will be able to

1. Demonstrate a breadth of knowledge in Intellectual property.
2. Assess fundamental aspects of Intellectual Property Rights.
3. Discuss Patents, Searching, filling and drafting of Patents
4. Discuss the basic principles of geographical indication, industrial designs, and copyright.
5. Explain of Trade Mark and Trade Secret,
6. Investigate current trends in IPR and Government initiatives in fostering IPR.

UNIT I: Overview of Intellectual Property Rights:

Discovery, Invention, Creativity, Innovation, History & Significance of Intellectual Property Rights (IPR), Overview of IPR - Patent, Copyright, Trade Mark, Trade Secret, Geographical Indication, Industrial Design & Integrated Circuit, Non-patentable criteria.

UNIT II: Patents:

Patents: Patents- Patentability Criteria, Types of Patents-Process, Product & Utility Models, Software Patenting and protection, Overview of Patent Search-Types of Searching, Public & Private Searching Databases, Basics of Patent Filing & Drafting, Indian Patents Law

Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board.

UNIT III: Copyrights:

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights.

UNIT IV: Trademarks:

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

UNIT V: Design & Geographical Indication:

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection.

Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection.

UNIT VI: IPR: Current Contour: India`s New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP - IPR in current scenario with case studies.

Text Books:

1. K. V. Nithyananda (2019), "Intellectual Property Rights: Protection and Management", IN: Cengage Learning India Private Limited.
2. P. Neeraj and D. Khusdeep (2014), "Intellectual Property Rights", PHI learning Private Limited.

Reference Books:

[1] Deborah E. Bouchoux, "Intellectual Property for Paralegals – The law of Trademarks, Copyrights, Patents & Trade secrets", 4th Edition, Cengage learning, 2012.

[2] N. S. Gopalakrishnan and T. G. Agitha, "Principles of Intellectual Property", Eastern Book Company, Lucknow, 2009.

[3] M. M. S. Karki, "Intellectual Property Rights: Basic Concepts", Atlantic Publishers, 2009.

[4] Ganguli Prabuddha, "Intellectual Property Rights--Unleashing the Knowledge Economy", Tata McGrawHill, 2001.

[5] V. K. Ahuja, "Law relating to Intellectual Property Rights". India, IN: Lexis Nexis, 2017.

[6] P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.

[7] Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd, 2006.

[8] B. L. Wadehra. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.

[9] Ganguli Prabuddha, "Gearing up for Patents… The Indian Scenario", Universities Press,1998.

6IT06 COMPILER DESIGN LAB

Suggested List of Experiments:

Experiment No.	*EXPERIMENT DESCRIPTION*
01	Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces,tabs and new lines.
02	Write a C program to identify whether a given line is a comment or not.
03	Write a C program to recognize strings under 'a*', 'a*b+', 'abb'.
04	Write a C program to test whether a given identifier is valid or not.
05	Write a C program to simulate lexical analyzer for validating operators.
06	Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.
07	Write a LEX Program to scan reserved word and Identifiers of C Language.
08	Design Predictive Parser for the given language.
09	Implement SLR(1) Parsing algorithm.
10	Design a LALR bottom up parser for the given language.
11	Write a C program to generate three address codes.
12	Write a LEX Program to convert the substring abc to ABC from the given input string.
13	Write a lex program to find out total number of vowels, and consonants from the given input sting.

6IT07 DESIGN & ANALYSIS OF ALGORITHM LAB

Suggested List of Experiments:

1. To study various algorithm designing strategies.
2. Implement Multiplication algorithm using divide and conquer technique and analyze time complexity.
3. Implement Knapsack problem using greedy method
4. Implement Dijkstras Shortest Path Algorithm.
5. Implement Prim's algorithm using greedy method.
6. Implement travelling salesman problem using dynamic programming.
7. Implement search and traversal using backtracking approach.
8. To study polynomial time and non-polynomial time algorithms.

6IT08 PROFESSIONAL ELECTIVE – II (I) CRYPTOGRAPHY & NETWORK SECURITY- LAB.

Concerned faculty member should suitably frame at least 8 laboratory assignments from the following list or can design suitably 1 or 2 practical from each unit. Study practical are highly discouraged instead of that you can add comparison between different algorithms.

Suggested List of Experiments:

1. To download various security tools which are available on Internet.
2. WAP to demonstrate any substitution stream cipher algorithm.
3. WAP to demonstrate any transposition stream cipher algorithm.
4. WAP to implement Fesital Cipher Algorithm for 8 bit data, for single round.(Assume that the session Key is 1100& complex function 'F' be simple 'XOR'.
5. WAP to demonstrate authentication using password.
6. Activation of Firewall on the system & their setting.
7. How to detect Trojans by using –Netstat,fPort,TCPview
8. Steganography using tools: Merge Streams, image hide,Stealth Files
9. Scanning for vulnerabilities using(Angry IP,HPing2,IPSacnner)
10. Braking Mono-alphabetic Substation cipher.

6IT08 PROFESSIONAL ELECTIVE – II (II) BIG DATA ANALYTICS LAB

List of Experiments :

1. Installation of Hadoop & R
2. Building Hadoop MapReduce Application for counting frequency of words/phrase in simple text file.
3. Study of R: Declaring Variable, Expression, Function and Executing R script.
4. Creating List in R – merging two lists, adding matrices in lists, adding vectors in list.
5. Manipulating & Processing Data in R – merging data sets, sorting data, plotting data, managing data usingmatrices & data frames 4. Implementation of K-Means Clustering with R
6. Text Analysis using R: analyzing minimum three different data sets
7. Twitter Data Analysis with R
8. Sentiment Analysis of Whatsapp data with R

6IT08 PROFESSIONAL ELECTIVE – II (III) SENSORS & ACTUATORS LAB

Concerned faculty member should suitably frame at least 8 laboratory assignments from the entire syllabus or can design suitably 1 or 2 practical from each unit. Study practical are highly discouraged.

6IT09 - COMPUTER SKILL LAB IV

(# C Skill Lab IV - Mini project based on Software Engineering to be decided by Individual Dept. of respective College)

While designing a Mini Project student should follow the following steps;

1. Identifying the Requirements from Problem Statements
2. Estimation of Project Metrics
3. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
4. E-R Modeling from the Problem Statements
5. Identifying Domain Classes from the Problem Statements
6. Statechart and Activity Modeling
7. Modeling UML Class Diagrams and Sequence diagrams
8. Modeling Data Flow Diagrams
9. Estimation of Test Coverage Metrics and Structural Complexity
10. Designing Test Suites

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NOTIFICATION

No. 136 /2021 Date : 02/12/2021

Subject :- Implementation of new syllabi of Semester V & VI of B.E. (Electronics & Telecommunication Engg.) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum from the session 2021-2022 & onwards.

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabus of **V & VI** of B.E. in Electronics & Telecommunication Engineering (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2021-2022 and onwards in phase wise manner as per **Appendix – A** :

Sd/-
(Dr.T.R.Deshmukh)
Registrar
Sant Gadge Baba Amravati University

Appendix – A

SYLLABUS PRESCRIBED FOR B.E. SEMESTER V & VI (ELECTRONICS & TELECOMMUNICATION ENGG.]

5ETC01: MICROCONTROLLER

Course Pre-Requisite:
3ETC03**:** Digital System Design

Course Objectives:

1. To study fundamentals of microprocessor systems
2. To deal with interfacing of different peripheral devices with Microprocessor
3. To study fundamentals of microcontroller systems with Assembly Language Programming
4. To understand microcontroller C Language Programming concepts.
5. To know the importance of different peripheral devices and their interfacing to microcontrollers
6. To get familiar with RISC Architecture

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Attain the knowledge of Microprocessor 8085
2. Understand the Interfacing of various peripheral devices with Microprocessor 8085
3. Attain the knowledge of Microcontroller 8051
4. Understand assembly language & C Programming for Microcontrollers
5. Understand the Interfacing of various peripheral devices with Microcontroller 8051
6. Gain knowledge of advance Microcontrollers

	Subject: MICROCONTROLLER	L
Unit-1	**Introduction to Microprocessor** 8085: Pin Diagram and Architecture,Addressing Modes, Instruction Set, Stack & Subroutine, Interrupt system, Data transfer schemes	8
Unit-2	**I/O Interfacing of 8085** Address space partitioning schemes, Architecture and interfacing of: PPI 8255, PIT 8254, USART 8251.	8
Unit-3	**Introduction to Microcontroller 8051** Architecture, Signal description, Memory organization, Interrupt structure, Timers and its modes, Addressing Modes, Instruction set, Assembly Language Programming, Serial communication modes	9
Unit-4	**8051 Programming in C :** Data types, IO programming, Logic operations, Data conversion programs, Accessing code ROM space, Data serialization.	8
Unit-5	**Interfacing and Programming using C with 8051:** LED, LCD display, Keyboard, Stepper Motor, DC motor, Relays, ADC 0808, DAC 0809	8
Unit-6	**Introduction to RISC Processors:** RISC Features, Difference between CISC and RISC, 32 bit ARM7 Philips NXP LPC2148 Microcontroller : Architecture, Registers, Pipeline	7
	Total	**36**

Text Books:

1. Gaonkar R.S: "Microprocessor Architecture Programming and Applications with the 8085", Penram International Pub.
2. M. A. Mazidi, J. G. Mazidi and R. D. McKinley : "The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson Education (2nd Ed.)
3. Furber: "ARM System on Chip Architecure", 2nd Edition, Person India

References:

1. K. J. Ayala : "The 8051 Microcontroller", Penram Int. Pubs., 1996
2. Phillips NXP LPC 2148 User Manual.
3. Data Sheet Manual by INTEL

5ETC02: CONTROL SYSTEM

Course Pre-Requisite:

1. (IA1) Engineering Mathematics-I
2. (IB1) Engineering Mathematics-II
3. (4ETC3) Signals and Systems

Course Objectives:

1. To understand the fundamental concepts of Control systems and mathematical modeling of the physical systems.
2. To analyze time response of the LTI system.
3. To analyze LTI system using frequency response.
4. To develop and analyze State Variables of the system.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Understand mathematical models of electrical, mechanical and electromechanical systems.
2. Determine transfer functions from block diagrams and signal flow graph.
3. Evaluate transient response and steady state response parameters.
4. Analyze stability of the LTI system using Routh criterion and root locus
5. Analyze stability of the LTI system using bode plot and Nyquist criterion
6. Create the state model and Evaluate response of the system using state variable method.

	Subject: CONTROL SYSTEM	L
Unit-1	**Basics of Control system** Types of control systems Classification of control system, Mathematical modeling of Physical Systems, Electrical Analogous Systems, Force -voltage analogy, force- Current analogy.	5
Unit-2	**Control system Representation** Block diagram reduction technique, rules for block diagram reduction. Analysis of multiple input multiple output systems, properties of signal flow graphs, Mason's gain formula basic control actions.	6
Unit-3	**Time Response Analysis:** Standard test signals, Time response of first order and second order system, impulse response function, Transient domain specifications, Steady state analysis: steady state error and error constants, dynamic error coefficients	6
Unit-4	**Stability of Control System:** Concept of stability, necessary conditions for stability, Routh stability criterion. Root locus Techniques: Introduction, Construction of root locus, construction rules, Stability analysis of systems using root locus, Effect of addition of open loop zeros & poles.	7
Unit-5	**Frequency- Domain analysis:** Introduction, correlation between time and frequency response, Bode plot: general procedure for construction, Gain margin and phase margin, Stability analysis of systems using Bode plots. Polar plots, Nyquist stability criterion.	6
Unit-6	**State Variable Analysis:** Space model representation of LTI systems using physical, phase and canonical variables, Relationship between state variable model and transfer function, state transition matrix and its computation, Solution of state equations. Controllability and Observability.	6
	Total	**36**

Text Books:

1. Nagrath I. J. and M. Gopal, "Control Systems Engineering", 5th Ed. New Age International.
2. K. Ogata: Modern Control Engineering, Fourth Edition (PHI)

References:

1. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11th Ed., Pearson Education.
2. M. Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.
3. Norman S. Nise, "Control System Engineering", 5th Edition, Wiley.
4. Bhattarcharya: Control System Engineering, 2nd Edition (Pearson Education).
5. Benjamin C. Kuo , Automatic Control System "JOHN WILEY & SONS, INC. 9th Edition.
6.

5ETC03: DIGITAL SIGNAL PROCESSING

Course Pre-Requisite:

1. 3ETC01 Engineering Mathematics-III
2. 4ETC04 Signals and Systems

Course Objectives:

1. Learndiscretesignalandsystemfundamentals.
2. Learn the discrete-time signals in the frequency domain, using Z-transform and DFT.
3. UnderstandtheimplementationoftheDFTintermsofthe FFT
4. LearnthebasicformsanddesignofFIRandIIR filters.
5. Learn the application filter bank in multirate DSP.
6. Become aware of some applications of digital signal processing.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Manipulatethediscretetimesignalsandidentifythetypesystem.
2. Compute the Z-transform of a sequence, identify its region of convergence and compute the inverse Z-transform.
3. Evaluate the Fourier transform of a signal.
4. DesignFIRandIIRfilters.
5. Understand the concepts of Multirate Digital Signal Processing and need of Filter banks.
6. Understand the application of Digital Signal Processing

	Subject: DIGITAL SIGNAL PROCESSING	L
Unit-1	**Introduction to Discrete Time Signals[DTS]:** Discrete Time Signal, representations of DTS, Basic Signal Operations, Linear Convolution by using Analytical and Graphical Method.	6
Unit-2	**Z-Transform:** Definition and Properties of Z-Transform, Concept of Region of Convergence [ROC], Inverse Z-transform using long division method, PFE method and residue method.	6
Unit-3	**Discrete and Fast Fourier Transform:** Definition and Properties of DFT, IDFT. Circular convolution of sequences using DFT and IDFT. Fast Fourier Transforms (FFT), Radix-2 decimation in time and decimation in frequency FFT. [Numerical based on DIT-FFT & DIF-FFT]	6
Unit-4	**Finite Impulse Response (FIR) filters:** Design techniques for FIR filter by windowing method: Rectangular window. Realization of basic structure FIR system: Direct form and Cascade.	5
Unit-5	**Infinite Impulse Response (IIR) filters:** IIR Filter Design by Mapping of S-plane to Z-plane: impulse invariance method, bilinear transformation method. Realization of basic structure IIR system: Direct form-I, Direct Form-II, Cascade & Parallel.	6
Unit-6	**Multirate Digital Signal Processing:** Sampling, Sampling rate conversion, multi-level filter bank. Overview and architecture of DSP processor TMS320C54XX.Applications of DSP (Only Block Diagram): Speech Signal, RADAR & SONAR.	7
	Total	**36**

Text Books:

1. Nagoorkani,"Digital Signal Processing",Tata McGraw-Hill Education, Second Edition.
2. S.Salivahanan, A.Vallavaraj,"DigitalSignalProcessing",TataMcGraw-HillEducation,2001.

References:

1. Oppenheim&Schafer,"DiscretetimeProcessing",PHI.
2. Proakis&ManolakisD.G.,"Digital Signal Processing",PHI.
3. MitraS.K.,"Digital Signal Processing", TMH.
4. Roman Kuc,"Digital Signal Processing", MGH.
5. IfeacherE.C.,JervisB.W.,"Digital Signal Processing",AddisonWesley.
6. P.P.Vaidyanathan,"DSP and Multirate Systems", PHI.

5ETC04 Professional Elective - I (PE-I): (i) POWER ELECTRONICS

Course Pre-Requisite:

1. 1B3Basic Electrical Engineering.
2. 3ETC02 Electronic Devices and Circuits.

Course Objectives:

1. To introduce power electronics devices; SCR, TRIAC, IGBT, MOSFET and to learn their characteristics.
2. To develop the ability to analyze the dynamics in power electronic converters/drives systems.
3. To study AC-DC converters and effect of freewheeling diode.
4. To study AC-AC, DC-AC, DC-DC converters.
5. To build and test circuits using power devices such as SCR
6. To study applications of power converters in DC drives.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Analyze the characteristics of various power electronics devices .
2. Understand SCR firing circuits, commutation techniques.
3. Analyze and design controlled rectifiers and dual converters
4. Analyze and design DC to DC, AC to AC converters and DC to AC inverters,
5. Design and develop power electronic circuits for various applications.
6. Know various applications of power converters in DC drives.

	Subject: POWER ELECTRONICS	L
Unit-1	SCR -construction, characteristics, two transistor analogy for turning ON-OFF a SCR, different methods of turning ON of a SCR, turn OFF mechanism, Thyristor firing circuit using UJT, Protection of SCR (snubber circuit)	6
Unit-2	Triac, Diac-construction, characteristics. power transistor, power MOSFET, IGBT - their construction & characteristics, Introduction to GTO, Classification of circuit for forced commutation.	7
Unit-3	Principle of phase control, single phase half wave controlled rectifier, half controlled bridge & fully controlled bridge rectifier for resistive and RL load, derivation for output voltage and current, effect of freewheeling diode, single phase dual converters.	6
Unit-4	Series inverter, improved series inverter, parallel inverter, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase transistorized bridge inverter.	6
Unit-5	Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper circuit, Jones chopper, step-up chopper, step up/down chopper and AC chopper.	6
Unit-6	Basic principle of cyclo-converter, single phase to single phase cyclo-converter. speed control of DC series motors speed control of DC shunt motor using phase controlled rectifiers UPS, fan speed regulator	5
	Total	**36**

Text Books:

1. M.D.Singh, K.B. Khanchandani, “Power Electronics”, Tata McGraw-Hill.
2. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.

References:

1. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
2. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
3. V.R.Moorthi, “Power Electronics”, Oxford University Press.
4. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
5. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International
6. Publishers. SCR manual from GE, USA.

5ETC04 Professional Elective - I (PE-I): (ii) FIBER OPTICS COMMUNICATION

Course Pre-Requisite:

1. 3ETC04 Electromagnetic Waves
2. 4ETC01 Analog and Digital Communication

Course Objectives:

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
2. To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors
3. To learn the various optical source materials, LED structures, quantum efficiency, Laser diode
4. To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
5. To learn the fiber optical network components, variety of networking aspects, operational principles WDM.
6. To learn and understand the applications.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Understand the principles fiber-optic communication, the components and Losses and dispersion in fiber.
2. Understand the properties of the optical fibers and optical components in sources.
3. Understand operation of lasers, LEDs, and detectors in fiber
4. Analyze system performance of optical communication systems in networks
5. Understand the block diagram of FOC System with Power budgeting parameters.
6. To apply the knowledge of fiber optical components, links, and systems.

	Subject: FIBER OPTICS COMMUNICATION	L
Unit-1	**Optical Fiber Communication System:** Basic optical laws and definitions, Optical fiber modes andconfigurations, N.A. Attenuation: Units, absorption, scattering losses radioactive losses, core and cladding losses.Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index.Material dispersion, wave guide dispersion, intermodal dispersion. [Numerical based on N.A. and mode calculations]	6
Unit-2	**Optical Sources:** Light Emitting Diodes: Structure, Light source materials. Laser Diodes: Structure, threshold conditions, Modulations of laser diodes. Light source linearity, reliability considerations.	6
Unit-3	**Optical Detectors:** Principles of photodiodes, Photo detector noise, Detector response time, Avalanche multiplication noise, Temperature effect on avalanche gain.	6
Unit-4	**Optical switches** Coupled mode analysis of directional couplers, electro-optic-switches. Optical amplifiers - EDFA, Raman amplifier	6
Unit-5	WDM and DWDM systems. Principles of WDM networks. Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and solution based communication.	6
Unit-6	Block Diagram of fiber optic communication, selection of optical fiber types for short haul, long haul and high speed data links, optical power and dispersion budget calculations of fiber optic communication link, Repeaters, optical fiber amplifiers, optical fiber transmitter and optical fiber receiver design considerations. [Numerical are not expected]	6
	Total	**36**

Text Book: G. Keiser, "Optical Fibre Communication", McGraw Hill International.

Reference:

1. Seniors J. M., "Optical Fibre Communication and Applications", Prentice Hall of India Pvt. Ltd., New Delhi

5ETC04 Professional Elective - I (PE-I): (iii) SPEECH AND AUDIO PROCESSING

Course Pre-Requisite:

1. 3ETC01 Engineering Mathematics-III
2. 4ETC04 Signals and Systems
3. 4ETC01 Analog and Digital Communication

Course Objectives:

1. To be able to relate human physiology and anatomy with signal processing paradigms.
2. To acquire the knowledge of speech generation and speech recognition models.
3. To understand methods/techniques used in speech signal estimation & detection.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Illustrate how the speech production is modeled
2. Summarize the techniques involved in collecting the features from the speech signal in time and frequency domain.
3. Summarize the various speech coding techniques.
4. Understand the process Speech Synthesis.
5. Apply techniques/methods used for speech enhancement.
6. Apply techniques/methods used for speech recognition.

	Subject: SPEECH AND AUDIO PROCESSING	L
Unit-1	**Speech Production and Acoustic Phonetics:** Process of speech production, Articulatory phonetics, Acoustic Phonetics, Acoustic theory of speech production, Co- articulation, Prosody, Digital models of speech signals, Brief applications of speech & audio processing	6
Unit-2	**Speech Analysis:** Time and frequency domain methods for analysis of speech: Methods for extracting energy ,average magnitude, zero crossing rate, silence discrimination using ZCR and energy, short time Fourier analysis, Formant extraction, Pitch extraction, Cepstral analysis.	6
Unit-3	**Coding of Speech Signals:** Introduction, Quantization, Speech redundancies, Time domain waveform coding, Linear predictive coding: Linear Delta Modulation ,Adaptive Delta Modulation, Adaptive Differential Pulse Code Modulation	6
Unit-4	**Speech Synthesis:** Principles of speech synthesis, Articulatory synthesis, Formant synthesis and LPC synthesis.	6
Unit-5	**Speech Enhancement:** Introduction, Nature of interfering sounds, speech enhancement techniques: spectral subtraction and filtering, harmonic filtering, Spectral subtraction, Adaptive noise cancellation	6
Unit-6	**Speech Recognition:** Introduction, Baye's rule, Segmental feature extraction, MFCC, DTW, HMM approaches for speech recognition	6
	Total	**36**

Text Books:

1. "Speech Communications: Human & Machine", Douglas O'Shaughnessy, Universities Press.
2. "Digital Processing of Speech Signals", Rabiner and Schafer, Prentice Hall, 1978.

References:

1. "Discrete-Time Speech Signal Processing: Principles and Practice", Thomas F. Quatieri,Publisher: Prentice Hall.
2. "Speech and Audio Signal Processing: Processing and Perception of Speech and Music",Nelson Morgan and Ben Gold, John Wiley & Sons.
3. "Speech Analysis Synthesis and Perception", J. L. Flanagan, Second edition, Springer-Verlag(1972).
4. "Speech and Audio Signal Processing", Gold & Morgan, 1999, Wiley and Sons.

5ETC05 Open Elective - I (OE-I): (i) SENSORS AND TRANSDUCERS

Course Pre-Requisite:

1. 1B3 Basic Electrical Engineering.
2. 3ETC02 Electronic Devices and Circuits.

Course Objectives:

1. To provide a basic knowledge about Sensors and transducers.
2. To learn about the various sensor and transducer for measurement of physical quantities.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Understand the basic aspect of transducers and sensors
2. Gain knowledge of statistical characteristic and Errors of system.
3. Realize the fundamental concept about temperature and Velocity measurement
4. Acquire knowledge of measurement of displacement and Humidity.
5. Familiarize the basic information about measurement of Pressure, Flow, Level
6. Aware about the basics of Strain gauge and smart sensors

	Subject: SENSORS AND TRANSDUCERS	L
Unit-1	**Sensor & Transducers:** Definition, Types & selection of sensors, Need of sensor, Difference between Sensors & Transducers, Classification of Transducer, Selection criteria. Introduction to Generalized Instrumentation system with example.	6
Unit-2	**Characteristic, parameters and Errors** Characteristics of instruments – static characteristics, Statistical Parameters with numericals. Error and its Types: Gross error, Systematic Error, Random Error with remedies.	6
Unit-3	**Temperature Measurement:** Introduction to Thermistor, RTD, Thermocouple and LM 335,Total Radiation Pyrometer **Velocity Measurement:** Velocity measurement system by encoder, Magnetic Pickup and Photo detector (Linear and Angular Measurement)	6
Unit-4	**Measurement of Displacement:** Resistive, Inductive (LVDT), Capacitive Methods **Humidity Measurement:** Resistive, Capacitive, Piezoelectric, and Infrared	6
Unit-5	**Measurement of Pressure:** Primary pressure sensors - elastic elements like bourdon tube and diaphragm Electrical/Secondary Pressure Transducers: Capacitive, piezo-electric and its material, Low Pressure (Vacuum): Pirani gauge. **Measurement of Flow:** Hot wire anemometer **Measurement of Level:** Resistive method, Ultrasonic level detector	6
Unit-6	**Strain Measurement:** Introduction, types of strain gauge, gauge factor calculation, materials for strain gauge, resistance strain gauge bridges, temperature compensationand applications of strain gauges. **Introduction to smart sensors**: Objective, block diagram, advantages and disadvantages.	6
	Total	**36**

Text Books:

1. Sawney A K and Puneet Sawney, "A Course in mechanical measurements and instrumentation and control", 12th edition, DhanpatRai and Co, new delhi,2013.
2. Electronics instrumentation" by H. S. Kalsi [TMH]

References:

1. David A. Bell, Electronic Instrumentation and Measurements, Third Edition, Oxford Higher Education
2. D.Patranabis, Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd., New Delhi, 1999.
3. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999.
4. Ernest O.Doebelin, Measurement systems Application and Design, International Student Edition, IV Edition, McGraw Hill Book Company, 1998.

5ETC05 Open Elective - I (OE-I): (ii) DATA STRUCTURE

Course Pre-Requisite:

1. 3ETC05 Object Oriented Programming

Course Objectives:

To impart the concepts of data structures and algorithms.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Able to understand basics and applications of different linear and nonlinear data structures
2. Able to design and implement various data structure algorithms and analyze the efficiency of an algorithm.
3. Able to understand Linked List and implement algorithm.
4. Able to understand the working principle and Implementation of stacks and queues.
5. Able to implement learn Trees, Graph and their applications
6. Able to write an algorithm on different sorting methods and analyze the complexities of algorithms.

	Subject: DATA STRUCTURE	L
Unit-1	**Introduction and Overview** Basic Terminologies: Elementary Data Organizations, Introduction to Linear Array, Types and Representation in Memory, Data Structure Operations, Algorithms: Complexity, Time-Space Tradeoff, Searching Methods:Linear Search and Binary Search Techniques and their Complexity Analysis..	6
Unit-2	**Linked List:** Introduction to Linked List, Representation of Linked List in Memory, Traversing a Linked List, Searching a Linked List, Memory Allocation; Garbage Collection, Insertion into a Linked List, Deletion from linked list, Header Linked Lists, Circular Linked Lists, Two-Way Lists (Doubly linked list) and Operations.	6
Unit-3	**Stacks, Queues and Its Applications:** Introduction to Stack, Array and Linked List Representation of Stack, Applications of Stacks: Arithmetic Expressions: Polish Notation, Recursion, Tower of Hanoi Problem, Queues: Linked Representation of Queues, Circular queue, Deques, Priority Queues.	6
Unit-4	**Tree** Basic Tree Terminologies and Representing Binary Trees in Memory, Traversing Binary Trees, Header Nodes; Threads, Threaded Binary Trees, Binary Search Trees, Searching and Inserting in Binary Search Trees, Deleting in a Binary Search Tree, Balanced Binary Trees, AVL Search Trees, Heap and Heapsort, Pathlengths; Huffman's Algorithm. General trees.	6
Unit-5	**Graph and Their Applications** Introduction, Graph Theory Terminology, Sequential Representation of Graphs; Adjacency Matrix; Path Matrix, Warshall's Algorithm; Shortest Paths, Linked Representation of Graph, Traversal algorithms, Operations on Graph, BFS, DFS, Spanning Trees	6
Unit-6	**Sorting And Hashing** Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Radix Sort, Performance and Complexity Analysis of various Sorting Methods, Hashing.	6
	Total	**36**

Text Books:

1. "Introduction to data structures with C" by Seymour lipschutz.
2. Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press.

References:

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. Data Structures through C by YashwantKanetkar

5ETC05 Open Elective - I (OE-I): (iii) INTRODUCTION TO JAVA

Course Pre-Requisite:

1. 3ETC05 Object Oriented Programming.

Course Objectives:

1. To Learn basics of programming
2. To understand the foundation of Object-Oriented Programming
3. To learn basic principles of Object-Oriented Programming
4. To study the process of building an application in a modular fashion using Java Programming Language

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Fundamentals of Object Oriented Programming and can build & run a basic application at their own
2. Use of selection & repetition statements in Java Program, dealing with methods and playing with classes and objects in real world
3. To create and process single dimensional & multidimensional arrays, to handle strings in Java
4. To create interactive graphical user interface in a desktop application using AWT and/or SWING Components.
5. To handle exceptions and create user defined exception, also learns file handling in Java.
6. To learn concept of multithreading; create, manage threads; and purpose of synchronization.

	Subject: INTRODUCTION TO JAVA	L
Unit-1	**Java Basics:** History of Java, Characteristics of Java, Types of Java Program, an introduction to Classes & Objects, Messages & methods, introduction to Inheritance, Software Engineering & Software Life Cycle, Structure of a java application, Edit-Compile-Run cycle of a java program. **Java Building Elements**: Identifiers, Variables, Constants, Data types, Arithmetic Expressions, Standard Input & Output, Programming Style & Documentation	6
Unit-2	**Control Structure:** Selection Statements- if, if…else, Nested if, switch. Repetition Statements- for loop, While loop & do loop, using break & Continue. **Methods:** Creating Methods, Calling a method, Overloading Methods, Concept of Recursion **OOP:** Objects & classes, Passing Objects to methods, Instance Variables & class Variables, Instance Methods & Class Methods, Scope of Variables, Introduction to Packages, the Math Class	6
Unit-3	**Arrays:** Declaring & Creating Arrays, Initializing & Processing Arrays, Array of Objects, Multidimensional arrays. **Strings:** The String Class, The String Buffer Class, The String Tokenizer Class, Command Line Arguments **Inheritance:** Super classes and Subclasses, the super keyword, the *this*keyword, the Object class, the final and abstract modifiers, the concept of Wrapper Classes, Introduction to Interfaces.	6
Unit-4	**Graphics Programming:** The AWT Class Hierarchy, Frames, Event Driven Programming (Delegation Event Handling Model), Layout Managers, Panels, The Color Class, The repaint(), update() and paint(), Methods, Drawing Lines & different shapes, introduction to adapter classes. **Creating GUI:** Button, Label, Text Field, Text Area, Choice, List, Checkbox, Dialog, Menu, Creating Multiple Windows, introduction to swing components.	6
Unit-5	**Exception Handling:** Exceptions & Exception Types, Understanding Exception Handling, Creating Exception classes, the finally clause. **File Input & output:** File & J File Chooser Objects, Low-Level File I/O, High Level File I/O.	6
Unit-6	**Multi-Threading:** Concept of thread, The Thread class, The runNable interface, Thread Life cycle, Thread Priority, Thread Groups, concept of synchronization.	6
	Total	**36**

Text Books:

1. Y. Daniel Liang, "An Introduction to Java Programming" Eastern Economy Edition, PHI
2. C. Thomas Wu, "An Introduction to Object-Oriented Programming JAVA", Fourth Edition, Tata McGraw Hill

References:

1. Kathy Sierra & Bert Bates, "Head First Java", O'REILLY
2. E Balagurusamy, "Programming with JAVA, A Primer", Third Edition, TMH

5ETC06- MICROCONTROLLER- LAB

- Minimum Eight Experiments based on syllabus of **5ETC01: MICROCONTROLLER** must be conducted.
- Course Objectives and Course Outcomes shall be specified based on the experiments conducted

5ETC07- DIGITAL SIGNAL PROCESSING LAB

- Minimum Eight Experiments based on syllabus of **5ETC03: DIGITAL SIGNAL PROCESSING** must be conducted.
- Course Objectives and Course Outcomes shall be specified based on the experiments conducted

5ETC08- POWER ELECTRONICS LAB

- Minimum Eight Experiments based on syllabus of **5ETC04: PE(1): (i) POWER ELECTRONICS** must be conducted.
- Course Objectives and Course Outcomes shall be specified based on the experiments conducted

5ETC09: ELECTRONIC LAB BASED ON INSTRUMENTATION

Course Outcomes:

At the end of this course student will demonstrate the ability to

1. Learn about various Sensors
2. Examine the measurement of various physical quantities using transducers
3. be aware of statistical data analysis of different transducers
4. Understand computerized data acquisition

Minimum Eight Experiments from the list give must be conducted

List of Experiments:

1. Temperature measurement using temperature sensor.
2. Measurement of linear displacement using LVDT.
3. Study of instrumentation amplifier
4. Measurement of force using strain gauge
5. Measurement of Pressure using Piezo-electric Transducer.
6. To measure the speed of a motor shaft with the help of non-contact type pick-ups (magnetic or photoelectric).
7. Displacement measurement by Capacitive Transducer
8. Temperature measurement by thermistor.
9. Liquid level measurement using level transducers.
10. Displacement measurement by resistive Transducer.
11. Comparative study of temperature measurement using: RTD, Thermistor and Thermocouple.
12. Study of Smart Sensors and Data Acquisition Systems

Note:

An orientation program of 15 hours duration / MOOC to be offered to the students during

(a) Vthsemester : Indian Constitution

(b) VIthsemester : Indian Traditional Knowledge

B.E. [ELECTRONICS & TELECOMMUNICATION ENGG. (VI SEM)

6ETC01 COMMUNICATION NETWORK

Course Objectives:

1. To understand the general principles of network design and compare the different network Topologies.
2. To understand the general principles of switching and various routing algorithms.
3. To acquire the knowledge of functions and protocols of OSI and TCP/IP models.
4. To understand Application layer Protocols.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Identify different types of network devices and their functions within a network.
2. Understand the basic functions of data logical link control and media access control and protocol used in this layers.
3. Distinguish between the layers of the OSI and TCP/IP model.
4. Analyze, specify and design routing strategies for an IP based networking infrastructure
5. Understand the concept of reliable and unreliable transfer protocol of data and how TCP and UDP implement these concepts.
6. Understand various Application layer Protocols.

	Subject: 6ETC01 COMMUNICATION NETWORK	L
Unit-1	**Data Communication Network:** A brief history of Internet, Protocols and Standards, Standard Organizations, Need for Protocol Architecture, OSI Reference Model, Overview of TCP/IP architecture, Addresses in TCP/IP. **Types of Network:** LAN, MAN, WAN. Network connecting Devices: Hubs, Repeater, Bridges, Switches, Routers, Gateways. **Network Topology:** Mesh, Bus, Tree, Ring, Star.	8
Unit-2	**Data Link Control Protocols:** Need for Flow control, Stop and Wait Flow Control, Sliding Window Flow Control, Stop and wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, Transmission efficiency of ARQ protocols.	6
Unit-3	**Multiple Access Control Protocols:** Random Access Techniques: ALOHA, Slotted ALOHA, Contention Techniques: CSMA, CSMA/ CD (IEEE 802.3), CSMA/CA.Controlled Access Techniques: Polling, Token Passing. **Medium Access Control Protocols:** Token Bus (IEEE 802.4), Token Ring (IEEE 802.5).	6
Unit-4	**Network layer:** TCP IP Reference Model, IPv4-Classful and Classless Addressing, Virtual circuit and Datagram networks, Router, Routing algorithms, Dijkstra's Algorithm (Problems expected), Bellman Ford Algorithm (Problems expected). Traffic Control: Leaky bucket algorithm, Token bucket algorithm.	5
Unit-5	**Transport layer:** Connectionless transport - UDP, Connection-oriented transport – TCP, Remote Procedure Call. **Congestion Control and Resource Allocation:** Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.	5
Unit-6	**Application Layer:** Domain Name Space (DNS), TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP.	6
	Total	**36**

Text Books:

1. B. Forouzan, "Data Communications and Networking", 4th Edition, McGraw-Hill.
2. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 5th Edition, Pearson Education, Inc.
3. William Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, Inc.

References:

1. James F. Kuross, Keith W. Ross, "Computer Networking A Top-Down Approach Featuring the Internet", Third Edition, Addison Wesley, 2004.
2. Nader F. Mir, "Computer and Communication Networks", Pearson Education,2007.
3. Comer, "Computer Networks and Internets with Internet Applications", Fourth Edition, Pearson Education, 2003.

6ETC02: COMPUTER ARCHITECTURE

Course Pre-Requisite:

1. 3ETC03 Digital System Design
2. 5ETC01 Microcontroller

Course Objectives:

1. To familiarize the basic concepts and structure of computers
2. To understand different types of instruction formats and concepts of arithmetic operations
3. To learn the concepts of microinstruction, its sequencing and execution.
4. To learn different types of memories and understand memory organization
5. To learn how I/O devices are organised and accessed.
6. To understand the concept of parallel processing and multi-processor architecture.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Learn how computers work
2. Analyse the performance of computers
3. Perform floating point arithmetic operations and design ALU as per the requirement
4. Know how computers are designed & built
5. Understand and design different types of memory systems
6. Understand issues affecting recent processors

	Subject: 6ETC02: COMPUTER ARCHITECTURE	L
Unit-1	**Basic Structure of Computers:** Hardware & software Functional units, Basic operational concepts, Bus structures, addressing methods and Machine program sequencing: Memory locations, Addresses, Instruction and Instruction sequencing, Addressing modes, Basic I/O operations.	8
Unit-2	**Processing Unit:** Processor organization, information representation, number formats, Instruction sets and its implementation. Arithmetic operation, ALU design, Floating point arithmetic, IEEE 754 floating point formats.	6
Unit-3	**Control Unit:** Micro operation, control of processor Hardwired implementation, micro program control: Concepts, microinstructions sequencing and execution, application of microprogramming.	6
Unit-4	**Memory Unit :**Concept of virtual memory, Memory hierarchies, Main memory allocation, Replacement policies, segments and pages, file organization, High speed memory, inter-board memories, Cache memories, Associative memories.	5
Unit-5	**I/O Organization :** Accessing I/O devices, Interrupts, Enabling and disabling interrupts, handling multiple devices, DMA, I/O Hardware, Standard I/O interfaces.	5
Unit-6	**Parallel Processing:** Basic concepts, types of parallel processors. Pipeline processor: Pipeline types, design, structures, Multiprocessors: Types, performance, parallel programming, Multiprocessor Architecture, interconnect network	6
	Total	**36**

Text Books:

1. Hayes J.P, "Computer Architecture and Organization", PHI, Second edition
2. A.S.Tanenbum, "Structured Computer Organization", PHI, Third edition
3. M.M.Mano, "Computer System Architecture", Edition

References:

1. V.Carl Hammacher, "Computer Organisation", Fifth Edition
2. Y.Chu, "Computer Organization and Microprogramming", II, Englewood Chiffs, N.J., Prentice Hall Edition
3. C.W.Gear, "Computer Organization and Programming", McGraw Hill, N.V. Edition

6ETC03 PROFESSIONAL ELECTIVE - II (PE-II): (I) CMOS DESIGN

Course Pre-Requisite:

1. 3ETC02 - Electronic Devices & Circuits.
2. 3ETC03 - Digital System Design

Course Objectives:

1. To study CMOS transistor theory and performance parameters.
2. To study layout design rules for size & power optimization.
3. To understand the concept of combinational CMOS circuit design.
4. To implement the concept of sequential circuit in CMOS design.
5. To learn the dynamic CMOS logic circuit

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. To understand the concept of CMOS circuit.
2. To draw Layout, Stick diagrams of CMOS Circuits.
3. To analyses the CMOS circuit performance parameter
4. To implement combinational CMOS circuit design using CMOS logic families.
5. To design sequential CMOS circuit.
6. To design the CMOS circuit using dynamic CMOS logic

	Subject: CMOS Design	L
Unit-1	**BCMOS Device Fundamentals:** Moore's Law, MOS structure capacitance, Channel capacitance, Junction capacitance,Review of MOS transistor models, Non-ideal behaviour of the MOS Transistor. Transistor as a switch, CMOS Inverter and its Characteristics.	8
Unit-2	**VLSI Circuit Design Processes:** VLSI Design Flow, CMOS Process enhancements –Interconnect, Circuit Elements, CMOS Lambda-based Design Rules, Stick Diagrams, Physical layout of simple CMOS Logic Gates, RC Parasitic, CMOS Fabrication [P-well process, N-well process].	6
Unit-3	**CMOS Performance Parameter:** Introduction to Delays in CMOS,RC Delay model, linear delay model, logical path efforts. Power, interconnect and Robustness in CMOS circuit layout.	6
Unit-4	**Combinational Circuit Design:** CMOS logic families, CMOS logic gates design, Complex CMOS circuit, Transmission gate, Pass transistor logic.	5
Unit-5	**Sequential Circuit Design:** Design of latches and Flip-flops, Static Read - Write Memory (SRAM) Circuits (6T), Dynamic Read-Write Memory (DRAM) Circuits (3T).	5
Unit-6	**CMOS Clocking Styles:** CMOS Clocking Styles, Clocks Skew, Clock distribution techniques, Clock Jitter. **Dynamic Logic Circuit:** Dynamic Pass transistor logic, Dynamic CMOS logic, Domino logic, NORA logic.	6
	Total	**36**

Text Books:

1. S. M. Kang and Y. Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", 3rd Edition, MH, 2002.
2. Neil H. Weste, D. Harris, "Principles of CMOS VLSI design A Circuit & System Perspective" 4th Edition, Pearson (Addison-Wesley), 2011.
3. Wayne Wolfe, "Modern VLSI Design: IP based Approach", 4th Edition, PHI.
4. Jan M. Rabaey, A. Chandrakasan, B. Nikolic, "Digital Integrated Circuits: A Design Perspective", 2nd Edition, Pearson

References:
1. S.K. Ghandhi, "VLSI Fabrication Principles", John Wiley Inc., New York, 1994 (2nd Edition).
2. Plummer, Deal, Griffin, "Silicon VLSI Technology: Fundamentals, Practice &Modeling" PH, 2001.
3. S.M. Sze (Ed), "VLSI Technology", McGraw Hill.
4. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.

6ETC03 PROFESSIONAL ELECTIVE - II (PE-II): (II) SATELLITE COMMUNICATION

Course Pre-Requisite:

1. 3ETC04 Electromagnetic Waves
2. 4ETC01 Analog and Digital Communication

Course Objectives:

1. To understand the frequency bands used in satellite communication
2. Toknowthebasicsoforbitalmechanism,thetypesof satelliteorbitsandorbitalaspectsof Satellitecommunication.
3. To understand the various typical phenomenon in satellitecommunication.
4. To understand different satellite channel parameters.
5. To understand the working of different satellitesubsystems
6. To understand the various services ofsatellite.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

At the end of this course students will demonstrate the ability to
1. Visualizethearchitectureof satellitesystems as ameansof highspeed,highrange communicationsystem.
2. Statevariousaspectsrelatedtosatellitesystemssuchas orbitalequations,sub-systemsin asatellite
3. Solvenumerical problemsrelatedtoorbitalmotionanddesignoflinkbudgetforthe given parametersandconditions.
4. Learnadvancedtechniquesandregulatoryaspectsofsatellitecommunication
5. Understand role of satellite in variousapplications
6. Understand VSAT and GPS

	Subject: Satellite Communication	L
Unit-1	**Introduction to Satellite Communication:** Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication, satellite types – LEO, MEO, GEO, HEO.	6
Unit-2	**Orbital Mechanics:** Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity, look angle determination of a satellite, concepts of Solar day and Sidereal day. Geo stationary and non-Geo- stationary orbits.	6
Unit-3	**Typical Phenomena in Satellite Communication :**Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift, space launch vehicles.	6
Unit-4	**Satellite Channels:** Electromagnetic field propagation, Atmospheric losses, Receiver noise, Carrier to Noise ratio, Satellite system link model: Uplink, Downlink, Cross link, Transponder, Satellite system parameters, Satellite link analysis, Frequency reuse and depolarization.	6
Unit-5	**Satellite sub-systems:** Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc. Satellite link budget.	6
Unit-6	**Very Small Aperture Satellite (VSAT):** Overview of VSAT system, Network architecture, Access control protocols, Signal format, Modulation coding and interference issues, VSAT antennas, Transmitter and Receiver, Link analysis for VSAT network. **Satellite Navigation and Global Positioning System (GPS):** Radio and Satellite navigation, Position, Location in GPS, GPS receivers and codes, GPS navigation message and signal levels, Timing accuracy, GPS receiver operation, Differential GPS.	6
	Total	**36**

Text Books:

1. Timothy Pratt Charles W. Bostian, Jeremy E.Allnutt: Satellite Communications: Wiley India. 2nd Edition, 2002
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill,2009

Reference: Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill, 2009

6ETC03 PROFESSIONAL ELECTIVE - II (PE-II): (III) ADAPTIVE SIGNAL PROCESSING

Course Pre-Requisite:

1. 3ETC01 Engineering Mathematics-III
2. 4ETC04 Signals and Systems
3. 5ETC03 Digital Signal Processing

Course Objectives:

1. To introduce with adaptive signal processing and adaptive systems.
2. To be acquainted with desired response,mean square error performance and Wiener Filters.
3. To make familiar with gradient search algorithms and functions.
4. To Understand LMS algorithms and its performance analysis.
5. To Understand Linear LeastSquare Estimation and RLS algorithms
6. To study the applications of adaptive signal processing

Course Outcomes:

Upon successful completion of this course, the student will be able to:

At the end of this course students will demonstrate the ability to :

1. Comprehend adaptive system and functions.
2. Evaluate the performance of various methods for designing adaptive filters through estimation of different parameters.
3. Understand the concepts of gradient and mean square error performance in adaptive systems
4. Analyse convergence and stability issues associated with adaptive filter design and come up with optimum solutions.
5. Apply an adaptive filter algorithm that recursively finds the coefficients that minimize a weighted linear least squares cost function.
6. Implement applications of adaptive signal processing.

	Subject: Adaptive Signal Processing	L
Unit-1	**Adaptive Systems:** AdaptiveSystems: Definition and characteristics,General Properties, Applications and examples of an adaptive system. Review of probability, random variables and random processes.	6
Unit-2	**Wiener Filters:** Input signal and weight vectors, desired response and error, Mean Square Error (MSE), Principleof Orthogonally, FIR Wiener Filters, Wiener Hopfequation.	6
Unit-3	**Steepest Descent Algorithms:** Searching the performance surface – Methods & Ideas of Gradient Search methods – Gradient Searching Algorithm & its Solution – Stability & Rate of convergence – Learning Curves Gradient Search by Newton's Method, Method of Steepest Descent, Comparison of Learning Curves.	6
Unit-4	**Least Mean Square (LMS) Algorithms:** Derivation of LMS algorithm, Convergence, Stability and performance analysis of LMS Algorithm, Normalized Least-Mean-Square Algorithm.	6
Unit-5	**Recursive Least Square Algorithms:** Linear LeastSquare Estimation Problem, Introduction to RecursiveLeast-Squares Adaptive filters, Matrix Inversion Lemma, RLS Algorithm.	6
Unit-6	**Applications of Adaptive filtering:** System identification, Adaptive Equalization, noise cancellation, linear prediction, Echo Cancellation, Lattice Filters.	6
	Total	**36**

Text Books:

1. "Adaptive Filter Theory", Simon Haykin, 3rd Ed, Prentice HallInc, 2002.
2. Bernard Widrow & Samuel. D. Stearns, "Adaptive Signal Processing", Pearson Edu, 2001.

References:

1. "Adaptive Filtering Primer with MATLAB", Alexander D.Poulanikas & Zayed M Ramadan, Taylor & Francis Series, CRS Press.
2. "Adaptive Signal Processing", Bernard Widrow, Prentice-HallSignal Processing Series.
3. ."Real Time Digital Signal Processing: Implementation and Applications", Sen M. Kuo, Bob H. Lee and Wenshun Tian,2nd Ed, John Wiley & Sons, 2006.
4. "Adaptive Digital Filters", Maurice G Bellanger, 2nd Edition,
5. "Adaptive Nonlinear System Identification", Marcel DekkarInc. T Ogunfummi, Springer

6ETC04 Open Elective - II (OE-II): (i) INTRODUCTION TO PYTHON PROGRAMMING

Course Pre-Requisite:

1. (3ETC05) Object Oriented Programming

Course Objectives:

1. Describe the core syntax and semantics of Python programming language.
2. Discover the need for working with the strings functions.
3. Illustrate the process of structuring the data using Lists, Tuples, Sets and Dictionary.
4. Indicate the use of regular expressions and built-in functions to navigate the file system.
5. To understand steps involved in Python to Mongo DB communication.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Interpret the fundamental Python syntax and semantics
2. Be fluent in the use of Python control flow statements
3. Perform basic CURD operations on Mongo DB using Python.
4. Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, tuples and sets.
5. Identify the commonly used operations involving file systems and regular expressions.
6. To learn and use operators

	Subject: INTRODUCTION TO PYTHON PROGRAMMING	L
Unit-1	**Parts of Python Programming Language:**What is Python?, Features of Python, Identifiers, Keywords, Statements and Expressions, Variables, Data Types, Constants, Escape characters, Comments	6
Unit-2	**Operators:** Arithmetic Operators, Assignment Operators, comparison Operators, Logical Operators, Bitwise Operators, Membership Operator, Precedence and Associativity.	6
Unit-3	**Control Flow Statements:** Conditional statements: if, if-else, if-elif-else, Iterative statements: for, while Loops, Transfer statements: break, continue, pass.	6
Unit-4	**Tuples, Sets and Dictionaries:** List:Creation of List Objects, List Methods, Tuples: Creation of Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Sets: Sets Set Methods, Dictionary : Creation of Dictionary, Accessing, Modifying and Deleting Elements.	6
Unit-5	**Functions:** Built in Functions,User Defined Functions, Types of Arguments: Positional Arguments, Keyword Arguments, Default Arguments, Variable Length Arguments, Lambda expressions..	6
Unit-6	**Object Oriented Programming, MongoDB with Python3:** Classes and Objects, Creating Classes in Python, Creating Objects in Python, Mongo DB with Python3: Introduction to Mongo DB, use of pymongo, Steps in Python to MongoDB communication, Basic *CRUD* Operations.	6
	Total	**36**

Text Book:

1. Gowrishankar S, Veena A, **"Introduction to Python Programming",** 1st Edition, CRC Press/Taylor & Francis, 2019. ISBN-13: 978-0815394372

References:

1. Martin C. Brown, “Python: The Complete Reference”, Mc-Graw Hill Education (India) Edition 2018, New York
2. Niall O'Higgins, "MongoDB and Python", O’Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472, ISBN: 9781449310370.
3. Yashavant Kanetkar, Aditya Kanetkar, “Let Us Python”, bpb publication, 3rd Edition Dec.2020, ISBN : 9789389898521
4. R. Nageswara Rao, “Core Python Programming”, Dreamtech Press; 2nd edition, ISBN : 978-9386052308.
5. Paul Barry, :Head-First Python: A Brain-Friendly Guide” (2nd Edition), Shroff Publishers, ISBN: 9789352134823.

6ETC04 Open Elective - II (OE-II): (ii) DATABASE MANAGEMENT SYSTEM

Course Pre-Requisite: None

Course Objectives:

1. Basic knowledge of file structure and Data Base.
2. Knowledge of Entity Relation Diagram and data Modeling.
3. The basic knowledge of SQL query and structure.
4. The process of building normalization and apply to the database system.
5. Gaining the knowledge of transaction which applied on database.
6. Understanding the issues of concurrency and dead lock control.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Differentiate database systems from file systems by enumerating the features provided by database systems and describe each in both function and benefit.
2. Define the terminology, features, classifications, and characteristics embodied in database systems.
3. Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms, such as a data dictionary.
4. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
5. Understand the basic issues of transaction processing
6. Understanding the basic issues of concurrency control and dead lock in database.

	Subject: DATABASE MANAGEMENT SYSTEM	L
Unit-1	**Introduction to Database Systems:** Database System Applications, Database Systems versus File Systems, View of Data, Data Models, Transaction Management, Database System Structure, Application architectures. Entity Relationship Model, Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R Features, Design of an E-R Database Schema	6
Unit-2	**Data modelling using ER model (Entity Relationship Model):** Relational Model: Structure of Relational Databases, The Relational Algebra, Extended Relational-Algebra Operations, Modification of the Database, Views, The Tuple Relational Calculus, The Domain Relational Calculus.	6
Unit-3	**SQL Structure:** SQL: Basic Structure, Set Operations, Aggregate Functions, Null Values, Nested Subqueries, Views. Integrity and Security, Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization, Authorization in SQL	6
Unit-4	**Normalization:** Purpose of Normalization, Data Redundancy and Anomalies, Non-Loss decomposition and Functional Dependencies, First, Second and Third Normal Forms, Boyce/Codd Normal Form (BCNF)	6
Unit-5	**Transaction Processing:** The Concept of Transaction, States of Transaction, Concurrent Execution of Multiple Transactions, Serializability - Conflict and View Serializability	6
Unit-6	**Concurrency Control and Dead Lock: Concurrency Control and Deadlock Recovery:** Lock Based Protocols - Two Phase Locking Protocol and Time Stamp Based Protocol, Types of Locks, Deadlock Handling - Deadlock Detection, Deadlock Recovery, Deadlock Prevention	6
	Total	**36**

Text Book: Korth, and Sudarshan: Database System Concept, McGraw Hill, 4th Edition**.**

References:

1. Raghu Ramkrishnan :" Database System". McGraw Hill
2. C.J.Date : "Database System", 7th ed. (Pearson Education)
3. Connolly &Begg, : Database System,Low Price Ed.
4. Nawathe& Al-Masseri " Database Systems" (Pearson Education)

6ETC04 Open Elective - II (OE-II): (iii) RENEWABLE ENERGY SOURCES (SOLAR & ELECTRIC VEHICLES)

Course Pre-Requisite:

None

Course Objectives:

1. To learn the concept of Solar cell
2. To understand Solar Photovoltaic systems
3. Understand the working of hybrid electric vehicles
4. The process of building normalization and apply to the database system.
5. Gaining the knowledge of electric drives and storage

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Understand the concept of Solar cell and estimate solar energy availability
2. Learn Solar cell Technologies
3. Understand the concept of Power Electronic Converters
4. Learn about Hybrid Electric Vehicles
5. Learn Electric drives
6. Learn about electric storage

	Subject: **(iii) RENEWABLE ENERGY SOURCES (SOLAR & ELECTRIC VEHICLES)**	L
Unit-1	**Solar Cell Fundamentals and Solar Resource** Place of PV in World Energy Scenario, P-N Junction Diode: An Introduction to Solar Cells, solar radiation spectra, solar geometry, Earth Sun angles, and observer Sun angles, solar day length, Estimation of solar energy availability.	6
Unit-2	**Solar Cell Technologies** Production of Si, Si Wafer-based Solar Cell Technology, Advances in c-Si Cell Processes Suitable for Near Future Commercialization, Solar Cell Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array.	6
Unit-3	**Solar Photovoltaic Systems and Applications** Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms, Converter Control, Grid-Connected System and Standalone system, Solar Water Pumps, Solar street lights, Battery sizing.	6
Unit-4	**Introduction to Hybrid Electric Vehicle** Review of Conventional Vehicle: Introduction to Hybrid Electric Vehicles: Electric Vehicle Evolution, Types of EVs, Types of battery for EVs.	6
Unit-5	**Electric Drives:** Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains, Electric Propulsion unit, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, switched reluctance motor.	6
Unit-6	**Energy Storage:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles: - Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis.	6
	Total	**36**

Text Books:

1. Chetan Singh Solanki, "Solar Photovoltics- Fundamentals, Technologies And Applications" PHI third Edition.

2. D. P. Kothari, K. C. Singal and Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI Second Edition.

3. A. K. Babu, Electric and Hybrid Vehicles, Khanna Publishers, 2019

4. S. P. Sukhatme and J.K. Nayak, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 3 rd ed., 2008.

5. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004.

References:

1. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.

2. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons, 1991

3. B.H. Khan, "Non-Conventional Energy Resources", McGraw Hill 2nd Edition 2017.

4. Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press, 2003

5. Husain, I. "Electric and Hybrid Vehicles" Boca Raton, CRC Press, 2010.

6. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wiley and Sons, 2012

6ETC05: ENGINEERING ECONOMICS

Course Pre-Requisite:

1. 3ETC03 Digital System Design
2. 5ETC01 Microcontroller

Course Objectives:

1. To familiarize the basic concepts and structure of Engineering Economics
2. To understand different principles of Engineering Economics
3. To learn the concepts Production and cost associated with it
4. To learn different types of cash flow
5. To learn depreciation analysis
6. To understand the concept of Banking system in India

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Learn basics of Engineering Economics
2. Understand and compute the production cost
3. Study different cash flow methods
4. to evaluate Engineering alternatives
5. Understand depreciation analysis
6. Understand Indian Banking System

	Subject: 6ETC05: ENGINEERING ECONOMICS	L
Unit-1	Definition and Scope of Engineering Economics , Subject Matter of Economics, Principles of Engineering Economics, Micro-economics Vs Macro-economics , Utility Analysis, Laws of diminishing utility analysis, derivation of demand curve and law of Demand, Elasticity of demand	6
Unit-2	Theory of Production: Theory, Importance, Isoquants and its properties, Marginal rate of Technical substitution, Law of variable proportions, Returns to Scale, Cost of Production and Cost of Curves, The law of supply, Price determination	6
Unit-3	Time value of Money, Techniques for adjusting time value of money, Uniform Gradient series factor, annuity, annuity due, calculation of deferred annuity , Types and components of cash flow, cash flow diagrams, principles of equivalence, Uses, significance and limitation of Cash flow statement	6
Unit-4	Evaluation of Engineering alternatives, Present worth method, Future worth Method, Equivalent annual worth comparison , Rate of return method, Project evaluation and Cost benefit analysis	6
Unit-5	Depreciation Analysis, Causes of depreciation, Depreciable property, depreciation methods, Digit method, Break even analysis, determination of breakeven point, Breakeven point in terms of quantity, sales and as percentage of capacity, Break even chart, Breakeven analysis assumptions, Managerial uses, Limitations	6
Unit-6	Commercial Banking, Functions of Commercial Banks , Role of Commercial banks in developing economy, sound baking system for under-developed countries, types of banks, balance sheet of a bank, New developments in banking system.	6
	Total	**36**

Text Book: Engineering Economics and Costing, Second Edition, PHI, 2010 by Sasmita Mishra

References:

1. Engineering Economic Analysis, Volume 2, By Donald G. Newnan, Ted Eschenbach, Jerome P. Lavelle · 2004
2. ENGINEERING ECONOMICS, PHI Learning, By R. PANNEERSELVAM · 2013

SUBJECT (PR): 6ETC06 COMMUNICATION NETWORK LAB

- **Minimum Eight** Experiments based on syllabus of 6ETC01 **Communication Network** must be conducted.
- Course Objectives and Course Outcomes shall be specified based on the experiments conducted

6ETC07- ELECTRONIC CIRCUIT DESIGN LAB (HARDWARE/SOFTWARE)

Expt. No.	Name of Experiment
1	Layout, physical verification, placement & route for design, static timing analysis, Parametric analysis of CMOS Inverter on silicon using appropriate ASIC design tool.
2	Layout, physical verification, placement & route for design, static timing analysis of two input NAND and NOR logic gates on silicon using appropriate ASIC design tool.
3	Layout, physical verification, placement & route for design, static timing analysis, Parametric analysis of D Flip-flop on silicon using appropriate ASIC design tool.
4	Layout, physical verification, placement & route for design, static timing analysis, Parametric analysis of f=(A.B+C.D) on silicon using appropriate ASIC design tool.
5	To write Verilog code for BCD Counter and simulate with test bench.
6	To write Verilog code for 2-to-4 decoder and simulate with test bench, synthesis, implement on PLD.
7	To write Verilog code for 8-to-1 Multiplexer and simulate with test bench, synthesis, implement on PLD.
8	To write Verilog code for D flip-flop with reset and simulate with test bench, synthesis, implement on PLD.
9	log code for 4 Bit Full Adder in Module instantiation simulate with test bench, synthesis, implement on PLD.
10	To write Verilog code for sequence detector-1111 and simulate with test bench, synthesis, implement on PLD.

Subject (Pr): 6ETC08 Python Programming Lab

- **Minimum Eight** Experiments based on syllabus of 6ETC04 OE-II Introduction to Pythonmust be conducted.
- Course Objectives and Course Outcomes shall be specified based on the experiments conducted

6ETC09: MINI PROJECT

Course Name	Course Code	Examination Scheme					
		Theory		Practical			
		Internal Assessment	University Assessment	Internal Assessment			University Assessment
Mini Project	6ETC09			Term work	Presentation & Demo	Total	
		--	--	25	25	50	--

Course Objectives:

1. To acquaint with the process of identifying the needs and converting it into the problem.
2. To familiarize the process of solving the problem in a group.
3. To acquaint with the process of applying engineering fundamentals to attempt solutions to the problems.
4. To inculcate the process of self-learning and research.

Course Outcomes:

Upon completion of this course, students will demonstrate the ability to :

1. Identify problems based on societal /research needs.
2. Apply Knowledge and skill to solve societal problems in a group.
3. Develop interpersonal skills to work as member of a group or leader.
4. Analyze the impact of solutions in societal and environmental context for sustainable development.
5. Excel in written and oral communication.
6. Demonstrate project management principles during project work.

Guidelines for Mini Project

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three ormore than four students, as it is a group activity.
- Students should do survey and identify needs, which shall be converted into problem statement for miniproject in consultation with faculty supervisor/head of department.
- Students shall submit implementation plan, which will cover weekly activity of mini project.
- A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record comments.
- Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
- Students in a group shall understand problem effectively, propose multiple solution and select best possiblesolution in consultation with guide/ supervisor.
- Students shall convert the best solution into working model using various components of their domain areasand demonstrate.
- The solution to be validated with proper justification and report to be compiled in standard format.
- With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality to be carried out by all the groups of the students.

Guidelines for Assessment of Mini Project:

Term Work:

- The review/ progress monitoring committee shall be constituted by head of departments of each institute.The progress of mini project to be evaluated on continuous basis, minimum two reviews in the semester.
- In continuous assessment focus shall also be on each individual student, assessment based on individual'scontribution in group activity, their understanding and response to questions.
- Distribution of Term work marks for both semesters shall be as below;
-

Marks awarded by guide/supervisor based on log book:	**10**
Marks awarded by review committee:	**10**
Quality of Project report:	**5**

Guidelines for Assessment of Mini Project Practical/Oral Examination:

- Report should be prepared as per the guidelines issued by the College.
- Mini Project shall be assessed through a presentation and demonstration of working model by the studentproject group to a panel of Internal and External Examiners
- Students shall be motivated to publish a paper based on the work in Conferences/students competitions.

Assessment criteria of Mini Project

Mini Project shall be assessed based on following criteria;

1. Quality of survey/ need identification
2. Clarity of Problem definition based on need.
3. Innovativeness in solutions
4. Feasibility of proposed problem solutions and selection of best solution
5. Cost effectiveness
6. Societal impact
7. Full functioning of working model as per stated requirements

8. Contribution of an individual's as member or leader
9. Clarity in written and oral communication

Note:

An orientation program of 15 hours duration / MOOC to be offered to the students during

(a) Vth semester : Indian Constitution

(b) VIth semester : Indian Traditional Knowledge

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2. Academic Calendar of University

SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE

Official Publication of Sant Gadge Baba Amravati University

PART- TWO

(असाधारण)

शनिवार, दिनांक ७ ऑगस्ट, २०२१

अधिसूचना

क्रमांक : ७९/२०२१ दिनांक: ०७/८/२०२१

विषय : शैक्षणिक नियामिका .... शैक्षणिक वर्ष २०२१-२०२२

Subject: Academic Calendar.... Academic Year 2021-2022

सर्व संबंधितांच्या माहिती करीता अधिसूचित करण्यात येते की, शैक्षणिक वर्ष २०२१-२०२२ ची शैक्षणिक नियामिका खालील प्रमाणे राहील.

It is notified for all concerned that, the Academic Calendar for the Academic Session 2021-2022 shall be as under:

तक्ता -१

(Table-1)

(विद्यापीठ शैक्षणिक विभाग आणि अभियांत्रिकी व भेषजी सोडून इतर सर्व प्रोग्राम्स करीता)

(For University Teaching Departments and all other programmes excluding Engineering & Pharmacy)

अ. क्र. (S. N)	कृती/कार्यक्रम (Activity)	प्रारंभ (Commencement)	समाप्ती (Cessation)	एकूण दिवस (Total Days)
१.	शैक्षणिक सत्र (प्रथम सत्र) Academic Session (First Session)	सोमवार, दि. ३० ऑगस्ट, २०२१ Monday, 30 August, 2021	शनिवार, दि. १५ जानेवारी, २०२२ Saturday, 15th January, 2022	105
२.	प्रवेश प्रक्रीया % Admission Process	बुधवार, दि. १ सप्टेंबर, २०२१ Wednesday, 1st September, 2021	शनिवार, दि. १८ सप्टेंबर, २०२१ Saturday, 18th September, 2021	14
३.	शैक्षणिक दिवस (विषम सत्र) Teaching Days (Odd Semesters)	सोमवार, दि. २७ सप्टेंबर, २०२१ Monday, 27th September, 2021	शनिवार, दि. १५ जानेवारी, २०२२ Saturday, 15th January, 2022	83
४.	अभिक्रम प्रक्रिया (प्रथम वर्ष प्रवेशित विद्यार्थ्याकरिता) Induction Programme (For 1st Year Students)	सोमवार, दि. २० सप्टेंबर, २०२१ Monday, 20th September, 2021	शनिवार, दि. २५ सप्टेंबर, २०२१ Saturday, 25th September, 2021	6
५.	प्रथम सत्र अवकाश (First Term Vacation)	सोमवार, दि. १ नोव्हेंबर, २०२१ Monday, 1st November, 2021	शनिवार, दि. ६ नोव्हेंबर, २०२१ Saturday, 6th November, 2021	6

६.	विषम सत्रांची विद्यापीठीय परीक्षा/ अशैक्षणिक दिवस Odd Semesters University Examinations/ Non-instructional days	All U.G. and P.G. Programmes	सोमवार, दि. १७ जानेवारी, २०२२ Monday, 17th January, 2022	शनिवार, दि. ५ फेब्रुवारी, २०२२ Saturday, 5th February, 2022	19 *
७.	शैक्षणिक सत्र (द्वितीय सत्र) Academic Session (Second Session)		सोमवार, दि. १७ जानेवारी, २०२२ Monday, 17th January, 2022	मंगळवार, दि. ३१ मे, २०२२ Tuesday, 31st May, 2022	109
८.	शैक्षणिक दिवस (सम सत्र) Teaching Days (Even Semesters)		सोमवार, दि. ७ फेब्रुवारी, २०२२ Monday, 7th February, 2022	मंगळवार, दि. ३१ मे, २०२२ Tuesday, 31st May, 2022	90
९.	द्वितीय सत्र अवकाश (Second Term Vacation)		बुधवार, दि. १ जून, २०२२ Wednesday, 1st June, 2022	गुरूवार, दि. ३० जून, २०२२ Thursday, 30th June, 2022	26
१०.	सम सत्रांची विद्यापीठीय परीक्षा Even Semesters University Examination		बुधवार, दि. १ जून, २०२२ Wednesday, 1st June, 2022	गुरूवार, दि. ३० जून, २०२२ Thursday, 30th June, 2022	30 *
११.	पुढील शैक्षणिक सत्राचा २०२२-२०२३ चा प्रारंभ Commencement of Next Academic Session 2022-2023		शुक्रवार, दि. १ जूलै, २०२२ Friday, 1 July, 2022		

* **Including Sundays.**

तक्ता -२

(Table-2)

अभियांत्रिकी व भेषजी प्रोग्राम्स

Engineering & Pharmacy Programmes

 # तृतिय वर्ष व पुढील वर्ष

 # (Third Year Onwards)

$ प्रथम व द्वितीय वर्ष

$ (First & Second Year)

S.N.	कृती/कार्यक्रम (Activity)		प्रारंभ (Commencement)	समाप्ती (Cessation)	एकूण दिवस (Total Days)
1.	प्रथम सत्र First Session		सोमवार, दि. ५ जुलै, २०२१ Monday, 5th July, 2021	शनिवार, दि. १५ जानेवारी, २०२२ Saturday, 15th January, 2022	150

2.	अशैक्षणिक दिवस Non Instructional Days		सोमवार, दि. ५ जुलै, २०२१ Monday, 5th July, 2021	शनिवार, दि. २४ जुलै, २०२१ Saturday, 24th July, 2021	18
3.	प्रवेश प्रक्रीया % Admission Process		सोमवार, दि. २६ जुलै, २०२१ Monday, 26th July, 2021	शनिवार, दि. १८ सप्टेंबर, २०२१ Saturday, 18th September, 2021	46
4.	शैक्षणिक दिवस (विषम सत्र) Teaching Days (Odd Semester)	#	बुधवार, दि. ११ ऑगस्ट, २०२१ Wednesday, 11th August, 2021	शनिवार, दि. ११ डिसेंबर, २०२१ Saturday, 11th December, 2021	93
		$	सोमवार, दि. २० सप्टेंबर, २०२१ Monday, 20th September, 2021	शनिवार, दि. १५ जानेवारी, २०२२ Saturday, 15th January, 2022	90
5.	हिवाळी अवकाश Winter Vacation		सोमवार, दि. १ नोव्हेंबर, २०२१ Monday, 1st November 2021	शनिवार, दि. ६ नोव्हेंबर, २०२१ Saturday, 6th November 2021	6
6.	परीक्षा हिवाळी २०२१ Examination * Winter 2021		सोमवार, दि. १३ डिसेंबर, २०२१ Monday,13th December 2021	शनिवार, दि. ५ फेब्रुवारी, २०२२ Saturday, 5th February 2022	52
7.	द्वितीय सत्र Second Session		सोमवार, दि. १७ जानेवारी, २०२२ Monday, 17th January, 2022	मंगळवार, दि. ३१ मे, २०२२ Tuesday, 31st May 2022	109
8.	शैक्षणिक दिवस (सम सत्र) Teaching Days (Even Semester)	#	सोमवार, दि. १७ जानेवारी, २०२२ Monday, 17th January, 2022	शनिवार, दि. ७ मे, २०२२ Saturday, 7th May 2022	90
		$	सोमवार, दि. ७ फेब्रुवारी, २०२२ Monday, 7th February 2022	मंगळवार, दि. ३१ मे, २०२२ Tuesday, 31st May 2022	90
9.	परीक्षा उन्हाळी २०२२ Examination Summer 2022		सोमवार, दि. ९ मे, २०२२ Monday, 9th May 2022	गुरूवार, दि. ३० जून, २०२२ Thursday, 30th June 2022	54
10.	उन्हाळी अवकाश Summer Vacation		बुधवार, दि. १ जून, २०२२ Wednesday, 1st June, 2022	गुरूवार, दि. ३० जून, २०२२ Thursday, 30th June, 2022	26
11.	पुढील शैक्षणिक सत्राचा २०२२-२०२३ चा प्रारंभ Commencement of Next Academic Session 2022-2023		शुक्रवार, दि. १ जूलै, २०२२ Friday, 1st July, 2022		

* **Including Sundays.**

% सर्व विद्याशाखांच्या पदवी आणि पदव्युत्तर अभ्यासक्रमांसाठी विद्यापीठ अनुदान आयोग/ए.आय.सी.टी.ई./शिखर संस्था, महाराष्ट्र शासन आणि विद्यापीठाने वेळोवेळी निर्गमित केलेल्या निर्देशानुसार प्रवेश प्रक्रिया राबविण्यात यावी.
(% Admission Procedure should be continued as per the directions issued by UGC/AICTE/Appenx Bodies, Government of Maharashtra and University from time to time for all degrees and post graduate programmes of all faculties.)

कोवीड-१९ संबंधित विहित मार्गदर्शक तत्त्वांचे अनुसरण करुन वर्गकक्ष ऑनलाईन / ऑफलाईन (वर्गकक्ष) किंवा मिश्रित स्वरुपात (ऑनलाईन + ऑफलाईन) सुरु केले जाऊ शकतात.
(The classes may be started in online/ offline (class room) or blended mode (online+offline) following the prescribed protocols /guidelines related to COVID-19.)

दिलेल्या कालावधीत परीक्षा पूर्ण करण्यासाठी विद्यापीठ सर्व अभ्यासक्रमांच्या विषम (सेमिस्टरसाठी) सत्रांसाठी परीक्षा विकेंद्रीकरणाची पध्दती अवलंबू शकेल.
(The University may adopt practice of decentralization of Examinations for the odd semesters of all programmes so as to complete examinations in the stated duration.)

<u>विशेष सुचनाः (Special Note):</u>

विद्यापीठाचा दीक्षांत समारंभ सोमवार, दि. २० डिसेंबर, २०२१ रोजी आयोजित करण्यात येईल.
University Convocation will be organized on Monday, 20th December, 2021.

१. ही शैक्षणिक नियामिका विद्यापीठाचे शैक्षणिक विभाग/ घटक महाविद्यालये/ संलग्नित महाविद्यालये (व्यावसायिक महाविद्यालयांसहीत) यांना लागू राहील.
(This Academic Calendar shall be applicable to all University Teaching Departments/ University Constituent Colleges/Affiliated Colleges (including Professional Colleges) of Sant Gadge Baba Amravati University.)

२. विद्यापीठाच्या शैक्षणिक विभागांतील / घटक महाविद्यालयातील/ संलग्नित महाविद्यालयांतील शिक्षक व शैक्षणिक कर्मचा-यांना तक्ता-३ मध्ये दर्शविण्यात आलेल्या सुट्यांव्यतिरिक्त राज्य शासनाने जाहीर केलेल्या इतर सुट्या अथवा जिल्हाधिका-यांनी जाहीर केलेल्या सुट्या उपभोगता येणार नाहीत. तथापि, यासंदर्भात अनुषंगिक निर्णय घेण्याचे अधिकार मा. कुलगुरू यांना राहतील.
(The Teaching Departments of the University/ University Constituent Colleges/ Affiliated Colleges of the University shall have holidays as per Table-2 and shall not avail the holidays declared by the State Government or the District Collector. However, the Hon'ble Vice-Chancellor shall have the power to take decision in this regard.)

३. परीक्षा कालावधी कमी करण्यात यावा, ज्यामुळे मूल्यांकनाला पुरेसा वेळ देता येईल व निकाल वेळेवर जाहीर करता येतील, तथा प्रवेश प्रक्रियेला गती देवून प्रवेश वेळेत पूर्ण करता येतील. जेणेकरुन विद्यार्थी महाविद्यालय/ विद्यापीठ परिसरात शैक्षणिक कार्यासाठी नियोजित कार्यक्रमानुसार उपस्थित राहू शकेल. याकरीता परीक्षा विभागाने परीक्षेकरिता निर्धारीत केलेल्या कालावधीचे कटाक्षाने पालन करावे.
(Span of Examination be curtailed to have enough time for evaluation and the publication of results in time so that the admission process could be speed up and completed in time, to have students' presence in the campus for teaching as per schedule. For this, the time span allotted for examinations shall be strictly followed by Examination Section.)

४. अभिक्रम प्रक्रिया : शिखर संस्थांच्या (ए.आय.सी.टी.ई., यु.जी.सी. इत्यादी) मार्गदर्शक तत्त्वांनुसार विद्यापीठाच्या शैक्षणिक विभागाद्वारे/ घटक महाविद्यालयाद्वारे/ संलग्नित महाविद्यालयांद्वारे अभिक्रम प्रक्रिया अंतर्गत विविध उपक्रम राबविण्यात यावेत.
Induction Programme: Activities shall be performed as per guidelines of the apex bodies (A.I.C.T.E., U.G.C. etc.) by the University teaching departments/ constituent / affiliated colleges.

तक्ता -३
(Table – 3)

अ. क्र. (Sr.No.)	सण/सुट्या (Festivals/Holidays)	दिवस व दिनांक (Day & Date)
१.	गणेश चतुर्थी Ganesh Chaturthi	शुक्रवार, दि. १० सप्टेंबर, २०२१ Friday, 10th September, 2021
२.	गौरीपूजन Gouri Poojan	सोमवार, दि. १३ सप्टेंबर, २०२१ Monday, 13th September, 2021
३.	महात्मा गांधी जयंती Mahatma Gandhi Jayanti	शनिवार, दि. २ ऑक्टोबर, २०२१ Saturday, 2nd October, 2021
४.	सर्वपित्री अमावास्या Sarvapitri Amawasyya	बुधवार, दि. ६ ऑक्टोबर, २०२१ Wednesday, 6th October, 2021
५.	दसरा Dasara	शुक्रवार , दि. १५ ऑक्टोबर, २०२१ Friday, 15th October, 2021
६.	ईद-ए-मिलाद Id-E-Milad	मंगळवार , दि. १९ ऑक्टोबर, २०२१ Tuesday, 19th October, 2021
७.	गुरूनानक जयंती Gurunanak Jayanti	शुक्रवार , दि. १९ नोव्हेंबर, २०२१ Friday, 19th November, 2021
८.	ख्रिसमस Christmas	शनिवार , दि. २५ डिसेंबर, २०२१ Saturday, 25th December, 2021
९.	मकरसंक्रांती Makarsankranti	शुक्रवार , दि. १४ जानेवारी, २०२२ Friday, 14th January, 2022
१०.	प्रजासत्ताक दिन Republic Day	बुधवार , दि. २६ जानेवारी, २०२२ Wednesday, 26th January, 2022
११.	छत्रपती शिवाजी महाराज जयंती Chhatrapati Shivaji Maharaj Jayanti	शनिवार, दि. १९ फेब्रुवारी, २०२२ Saturday, 19th February, 2022
१२.	महाशिवरात्री Mahashivratri	मंगळवार, दि. १ मार्च, २०२२ Tuesday, 1st March, 2022
१३.	होळी (दुसरा दिवस) Holi (Second Day)	शुक्रवार, दि. १८ मार्च, २०२२ Friday, 18th March, 2022
१४.	गुढीपाडवा Gudhi Padwa	शनिवार, दि. २ एप्रिल, २०२२ Saturday, 2nd April, 2022
१५.	डॉ.बाबासाहेब आंबेडकर जयंती / महावीर जयंती Dr.Babasaheb Ambedkar Jayanti / Mahavir Jayanti	गुरूवार, दि. १४ एप्रिल, २०२२ Thursday, 14th April, 2022
१६.	गुड फ़ायडे Good Friday	शुक्रवार, दि. १५ एप्रिल, २०२२ Friday, 15th April, 2022
१७.	रमझान ईद (ईद-उल-फितर) Ramzan Id (Id-Ul-Fitar)	मंगळवार, दि. ३ मे, २०२२ Tuesday, 3rd May, 2022
१८.	बुध्द पौर्णिमा Buddha Pournima	सोमवार, दि. १६ मे, २०२२ Monday, 16th May, 2022

स्वा/-
(डॉ.टी.आर.देशमुख)
कुलसचिव,
संत गाडगे बाबा अमरावती विद्यापीठ

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3. Academic Time-Table (Spring Semester) 2021-22

DAY: MONDAY

CLASS	11.00-12.00	12.00-1.00	1.00-1.15	1.15-2.15	2.15-3.15	3.15-3.45	3.45-4.45	4.45-5.45	ROOM
2S	EMI(C)/CS(D)/ADC(A)/ETL(B) (MRC/RZF/SSJ/VSK)		BREAK	EMF (AUJ)	CS (RZF)	RECESS	NMOT (BSR)	EMI (UAJ)	A2
3S	ACS (AUJ)	CAEMD (PRB)		PE(C)/EEDU(D)/CAEMD(A)/CTLab(B) (VSK/AKD/PRB/GNB)			PE (VSK)	S_Devel. Program	A3
4S	PSS (GNB)	DSP (PRD)		PQ/EDC (SSJ/RKM)	HVE (RSK)		DSP(A) (PRD)		A4
2R	DCN(A)/OS(B)/M&ALP(C)/C SKILL(D) (KPS/(PKB/PVD/HMD)		BREAK	OS (DRD)B1	TOC (NMK)B1	RECESS	AI (CMM)B1	- TEC -	B3
3R	DAA (DRD)	SE (CMM)		BDA/Cry (RAZ/VSM)	SP&G (SBP)		ET LAB(BDA(E)/CRY(F) (RAZ/VSM)		B1
4R	SE (JMP)B1	NS (VSM)B1		AI (PKB)B5	ES (PVD)B5		PROJECT		B3
2N	DS (AKS)B2	SSEE (SVB)B2	BREAK	DCN(A)/OS(B)/DS(C)/C.S.LAB-II(D) (ASM/PVK/AKS/PPB)		RECESS	COA (T*) (FIK)B2	TEC	B4/B2
3N	CD(A)/DAA(B)/BDA(C) (SDP/AGS/FIK)			BDA (FIK)B4	AI (KJS)B4		CD (SDP)B4	TEC	B4
4N	SE (KJS)B4	NAS (PPB)B4		DWC (AGS)B2	WC (SDP)B2		NAS(A)/SE(B)/C.LAB-V(C) (PPB/KJS/AKS)		B2
2U1	AC (SBP)	SS (MNT)	BREAK	ADC (KTK)	V&E (RSD)	RECESS	AC(A)/SS(B)/NT(C) ADC(D) (SGN/VKB/BPH/KTK)		A1
3U1	CA (DDN)	CN (AND)		CN(A)/ECD(B)/PP(C)/Mini.Project(D) (AAD/SPB/TPM/DDN)			SC (PDK)	S_D_Lab	C1
4U1	UHF(A)/SDL-VI (B) (PDK/LS)			UHF (VVR)	SDL-VI (AND)		DCN (KMT)	WC (DPT)	C3
2U2	AC(A)/SS(B)/NT(C)/ADC(D) (PRW/VKB/BPH/VNB)			AC (PRW)C1	SS (VKB)C1		NT (SPB)C4	V&E (RSD)C4	C3/C1
3U2	CN (VSI)	CA (KBK)		EE (LS)	SC (SGN)		Skill Dev.	S_D_Lab	C2
4U2	UHF (VVR)	BME (VMU)		DCN (DLB)	WC (DPT)		UHF(A)/SDL-VI (B) (VVR/AND)		C4
2M	EC-I (SQS)	HPS (MBB)	BREAK	MS (NHK)	MT (SPT)	RECESS	EVS (RMK)	EVS (RMK)	E2
3M	CSE (KRG)	DOM (RVR)		DME(B)/DOM(C)/CADS(D)/RS(A) (ASB/NBB/CVP/MBB)			DME (ASB)	--	E3
4M	ORT (ASB)	RAC (KDG)		ICE (KVC)	AE (JGK)		RAC(A)/ICE(B)/ORT(C) (KDG/SQS/KRG)		E4
DAY WISE TIME-TABLE (Autumn SEMESTER) 2021-22									
A1 (1U1)	BEE (RSK)D1	EG (JGK)D1	BREAK	CHE (ASA)D1	M-II (PSD)D1	RECESS	CHE (X)/ EG(Y)/CS(Z) (ASA/JGK/HSP)		D1
A2 (1U2)	CHE(X)EG(Y)CS(Z) (ASA/NBB/HSP)			BEE (UAJ)D2	CHE (AVP)D2		EG (NBB)D2	M-II (PSD)D2	D2
A3 (1M)	CHE (RMK)D2	M-II (NAP)D2		CHE(X)EG(Y)CS(Z) (RMK/RVR/SVB)			EG (RVR)D1	BEE (RZF)D1	
B1 (1R)	CP (PHG)D3	M-I (NST)D3	BREAK	EM (SBS)D4	PHY (AST)D4	RECESS	EM (X)/ CP(Y)/PHY (Z) (KVC/PHG/AST)		D3/D4
B2 (1N)	M-I (NST)D4	PHY (RGR)D4		EM (X)/CP(Y)/PHY(Z) (NGM/JMP/RGR)			CP (JMP)D4	EM (CVP)D4	D4
B3 (1S)	PHY(X)EM(Y)CP(Z) (AST/CVP/SBP)			CP (SBP) D3	M-I (NAP)D3		EM (NGM)D3	PHY (RGR)D3	D3

(T)* , *, T* - Tutorial, ** - Additional,

DAY: TUESDAY

CLASS	11.00-12.00	12.00-1.00	1.00-1.15	1.15-2.15	2.15-3.15	3.15-3.45	3.45-4.45	4.45-5.45	ROOM
2S	EMI (UAJ)	EMF (AUJ)	BREAK	CS (RZF)	NMOT (BSR)	RECESS	ADC (SSJ)	EVS (RMK)	A2
3S	CAEMD (PRB)	EEDU (SRP)		PE(D)/EEDU(A)/CAEMD(B)/CTLab(C) (AUJ/SRP/PRB/GNB)			Open Elective-II	ACS (AUJ)	A3
4S	PSS (GNB)	DSP (PRD)		PQ/EDC (SSJ/RKM)	HVE (RSK)		DSP(B) (PRD)		A4
2R	M&ALP (PVD)B3	DCN (KPS) B3	BREAK	DCN(B)/OS(C)/M&ALP(D)/C SKILL(A) (KPS/PKB/PVD/HMD)		RECESS	TOC (NMK)B1	OS (DRD)B1	B1/B3
3R	DAA(A /SE(B)/C-SKILL(C) (DRD/CMM/NMK			BDA/Cry (RAZ/VSM)	DAA (DRD)		OE - II	-- TEC --	B1
4R	AI (A)/ES(B) (PKB)/(HMD)			PROJECT			AI (PKB)B5	ES (PVD)B5	B3
2N	DS (AKS)B2	SSEE (SVB)B2	BREAK	**DCN(B)/OS(C)/DS(D)/C.S.LAB-II(A)** (ASM/PVK/AKS/PPB)		RECESS	COA (FIK)B2	OS (PVK)B2	B4/B2
3N	CD(B)/DAA(C)/BDA(D)/C.S. LAB-IV(A) (SDP/AGS/FIK/PHG)			BDA (FIK)B4	CD (SDP)B4		OE-II	TEC	B4
4N	SE (KJS)B4	NAS (PPB)B4		DWC (AGS)B2	TEC		NAS(D)/SE(C)/ C.LAB-V(A) (PPB/KJS/AKS)		B2
2U1	NT (BPH)	SS (MNT)	BREAK	ADC (KTK)	V&E (RSD)	RECESS	AC(B)/SS(C)/NT(D)/ADC(A) SGN/AND/BPH/KTK		A1
3U1	CA (DDN)	EE (AAD)		CN(B)/ECD(C)/PP(D)/ Mini.Project(A) (AAD/SPB/TPM/DDN)			OE(ITP) (DDN/TPM)	S_D_Lab	C1
4U1	UHF(B)/SDL-VI (A) (PDK/LS)			UHF (VVR)	BME (VMU)		DCN (KMT)	WC (DPT)	C3
2U2	AC(B)/SS(C)/NT(D)/ADC(A) (PRW/VKB/SPB/VNB)			ADC (VNB)C1	SS (VKB)C1		NT (SPB)C4	V&E (RSD)C4	C3/C1
3U2	CN (VSI)	CA (KBK)		EE (LS)	SC (SGN)		OE(ITP) (DDN/TPM)	S_D_Lab	C2
4U2	UHF (VVR)	BME (VMU)		DCN (DLB)	WC (DPT)		UHF(B)/SDL-VI(A) (VVR/ DLB)		C4
2M	BEDC(A)/MS(B)/MT(C)/ HPS(D) (BSR/NHK/SPT/MBB)		BREAK	EC-I (SQS)	MT (SPT)	RECESS	HPS (MBB)	BEDC (BSR)	E2
3M	CSE (KRG)	CADS (CVP)		DME(D)/DOM(A)/CADS(B)/RS(C) (ASB/KDG/CVP/MBB)			OE-II	--	E3
4M	ORT (ASB)	RAC (KDG)		ICE (KVC)	ANE (JGK)		RAC(B)/ICE(C)/ORT(D) (KDG/SQS/KRG)		E4
DAY WISE TIME-TABLE (Autumn SEMESTER) 2021-22									
A1 (1U1)	BEE (RSK)D1	EG (JGK)D1	BREAK	CHE (ASA)D1	M-II (PSD)D1	RECESS	CS(X)/ BEE (Y)/CHE(Z) (HSP/RSK/ASA)		D1
A2 (1U2)	CS(X)/ BEE(Y)/CHE(Z) (HSP/RSP/ASA)			BEE (UAJ)D2	CHE (AVP)D2		EG (NBB)D2	M-II (PSD)D2	D2
A3 (1M)	CHE (RMK)D2	M-II (NAP)D2		CS(X)BEE(Y)CHE(Z) (SVB/MRC/RMK)			EG (RVR)D1	BEE (RZF)D1	D2/D1
B1 (1R)	PHY (AST)D3	M-I (NST)D3	BREAK	EM (SBS)D4	CP (PHG)D4	RECESS	--WS— **PTP)**		D3/D4
B2 (1N)	M-I (NST)D4	PHY (RGR)D4		PHY (X)EM(Y)CP(Z) (RGR/NGM/JMP)			CP (JMP)D4	EM (CVP)D4	D4
B3 (1S)	-WS- (PTP)			CP (SBP)D3	M-I (NAP)D3		EM (NGM)D3	PHY (RGR)D3	D3

(T)* , *, T* - Tutorial, ** - Additional,

DAY: WEDNESDAY

CLASS	11.00-12.00	12.00-1.00	1.00-1.15	1.15-2.15	2.15-3.15	3.15-3.45	3.45-4.45	4.45-5.45	ROOM
2S	EMI(D)/CS(A)/ADC(B)/ETL(C) (MRC/RZF/SSJ/VSK)		BREAK	EMF (AUJ)	NMOT (BSR)	RECESS	EMI (UAJ)	ADC (SSJ)	A2
3S	CAEMD (PRB)	EEDU (SRP)		PE(A)/EEDU(B)/CAEMD(C)/CTLab(D) (VSK/SRP/PRB/GNB)			OE-II	PE (VSK)	A3
4S	PSS (GNB)	DSP (PRD)		PQ/EDC (SSJ/RKM)	HVE (RSK)		DSP(C) (PRD)		A4
2R	DCN (KPS) B3	ENVS (ASA) B3	BREAK	DCN(C)/OS(D)/M&ALP(A)/C SKILL(B) (KPS/VSM/PVD/HMD)		RECESS	AI (CMM)B1	TOC (NMK)B1	B1/B3
3R	DAA(B)/SE(C)/C-SKILL(D) (DRD/CMM/NMK)			SP&G (SBP)	SE (CMM)		OE - II	-- TEC --	B1
4R	AI (B)/ES(C) (PKB)/(RAZ)			AI (PKB)B1	SE (JMP)B1		ES (PVD)B5	NS (VSM)B5	B3
2N	DS (AKS)B2	DCN (ASM)B2	BREAK	DCN(C)/OS(D)/DS(A)/C.S.LAB-II(B) (ASM/PVK/AKS/SSM)		RECESS	COA (FIK)B2	ENVS (ASA)B2	B4/B2
3N	CD(C)/DAA(D)/BDA(A) (SDP/AGS/FIK)			AI (KJS)B4	DAA (AGS)B4		OE-II	TEC	B4
4N	SE (KJS)B4	NAS (PPB)B4		WC (SDP)B2	TEC		NAS(C)/SE(D)/C.LAB-V(B) (PPB/KJS/PVK)		B2
2U1	AC (SBP)	V&E (RSD)	BREAK	ADC (KTK)	NT (BPH)	RECESS	AC(C)/SS(D)/NT(A)/ADC(B) SBP/MNT/BPH/KTK		A1
3U1	SC (PDK)	CN (AND)		Skill Develop.			OE(ITP) (DDN/TPM)	S_D_Lab	C1
4U1	UHF(C)/SDL-VI (D) (DPT/LS)			UHF (VVR)	BME (VMU)		DCN (KMT)	WC (DPT)	C3
2U2	AC(C)/SS(D)/NT(A)/ADC(B) (PRW/VKB/SPB/VNB)			AC (PRW)C2	ADC (VNB)C2		NT (SPB)C4	V&E (RSD)C4	C3/C2
3U2	CN (VSI)	CA (KBK)		CN(A) / ECD(B) /PP(C)/M.Project(D) (KMT/KBK/VSI/RSD)			OE(ITP) (DDN/TPM)	S_D_Lab	C2
4U2	UHF (VVR)	BME (VMU)		DCN (DLB)	WC (DPT)		UHF(C)/SDL-VI (D) (PDK/AND)		C4
2M	BEDC(D)/MS(A)/MT(B)/ HPS(C) (BSR/NHK/SPT/SQS)		BREAK	MS (NHK)	MT (SPT)	RECESS	HPS (MBB)	BEDC (BSR)	E2
3M	DOM (RVR)	CSE (KRG)		CADS (CVP)	DME (ASB)		OE-II	--	E3
4M	ORT (ASB)	RAC (KDG)		RAC(C)/ICE(D)/ORT(A) (KDG/SQS/KRG)			PROJECT		E4

DAY WISE TIME-TABLE (Autumn SEMESTER) 2021-22

A1 (1U1)	BEE (RSK)D1	EG (JGK)D1	BREAK	CHE (ASA)D1	M-II (PSD)D1	RECESS	BEE(X)/CS(Y)/EG(Z) (RSK/HSP/JGK)		D1
A2 (1U2)	BEE(X)/CS(Y)/EG(Z) (RKM/HSP/NBB)			BEE (UAJ)D2	CHE (AVP)D2		EG (NBB)D2	M-II (PSD)D2	D2
A3 (1M)	CHE (RMK)D2	M-II (NAP)D2		BEE(X)CS(Y) EG(Z) (RSP/SVB/RVR)			EG (RVR)D1	BEE (RZF)D1	D2/D1
B1 (1R)	CP(X)/PHY(Y)/EM(Z) PHG/AST/KVC		BREAK	EM (SBS)D4	CP (PHG)D4	RECESS	M-I (NST) (D5)	PHY (AST) (D5)	D4/D5
B2 (1N)	M-I (NST)D4	PHY (RGR)D4		---WS-- (PTP)			CP (JMP)D4	EM (CVP)D4	D4
B3 (1S)	-WS- (PTP)			EM (NGM) D3	M-I (NAP)D3		CP (SBP)D3	PHY (RGR)D3	D3

(T)* , *, T* - Tutorial, ** - Additional,

DAY: THURSDAY

CLASS	11.00-12.00	12.00-1.00	1.00-1.15	1.15-2.15	2.15-3.15	3.15-3.45	3.45-4.45	4.45-5.45	ROOM
2S	EMI(A)/CS(B)/ADC(C)/ETL(D) (UAJ/PRD/GNB/VSK)		BREAK	CS (RZF)	NMOT (BSR)	RECESS	ADC (SSJ)	EMI (UAJ)	A2
3S	ACS (AUJ)	EEDU (SRP)		PE(B)/EEDU(C)/CAEMD(D)/CTLab(A) (AUJ/AKD/PRB/RKM)			OE-II	PE (VSK)	A3
4S	PQ/EDC (SSJ/RKM)	HVE (RSK)		DSP (PRD)	PSS (GNB)		DSP(D) (PRD)		A4
2R	M&ALP (PVD)B3	DCN (KPS) B3	BREAK	DCN(D)/OS(A)/M&ALP(B)/C SKILL(C) (KPS/VSM/PVD/HMD)		RECESS	OS (DRD)B1	-- TEC -	B1/B3
3R	DAA(C)/SE(D)/C-SKILL(A) (DRD/CMM/NMK)			SE (CMM)	DAA (DRD)		OE - II	--TEC--	B1
4R	SE (JMP)B1	NS (VSM)B1		PROJECT			- TEC -		B3
2N	OS (PVK)B2	DCN (ASM)B2	BREAK	DCN(D)/OS(A)/DS(B)/C.S.LAB-II(C) (ASM/PVK/AKS/SSM)		RECESS	COA (FIK)B2	SSEE (SVB)B2	B4/B2
3N	AI (KJS)	BDA (FIK)		CD (SDP)B4	DAA (AGS)B4		OE-II	TEC	B4
4N	WC (SDP)B4	DWC (AGS)B4		PROJECT			NAS(B)/SE(A)/C.LAB-V(D) (PB/KJS/PVK)		B2
2U1	AC (SBP)	SS (MNT)	BREAK	ADC (KTK)	NT (BPH)	RECESS	AC(D)/SS(A)/NT(B)/ADC(C) SBP/MNT/BPH/KTK		A1
3U1	CA (DDN)	CN (AND)		EE (AAD)	SC (PDK)		S_D_Lab	Skill Dev.	C1
4U1	UHF(D)/SDL-VI (C) (DPT/DLB)			UHF (VVR)	BME (VMU)		DCN (KMT)	WC (DPT)	C3
2U2	AC(D)/SS(A)/NT(B)/ADC(C) PRW/VKB/SPB/VNB			AC (PRW)C2	ADC (VNB)C2		SS (VKB)C4	Skill Dev.	C3/C2
3U2	EE (LS)	SC (SGN)		CN(B) / ECD(C) /PP(D)/M.Project(A) (KMT/KBK/VSI/RSD)			OE(ITP) (DDN/TPM)	S_D_Lab	C2
4U2	UHF (VVR)	BME (VMU)		DCN (DLB)	SDL-VI (LS)		UHF(D)/SDL-VI (C) (VVR/AND)		C4
2M	BEDC(C)/MS(D)/MT(A) / HPS(B) (BSR/NHK/SPT/MBB)		BREAK	MS (NHK)	MT (SPT)	RECESS	EC-I (SQS)	BEDC (BSR)	E2
3M	DOM (RVR)	CSE (KRG)		DME(A)0/DOM(B)/CADS(C)/RS(D) (ASB/NBB/CVP/NGM)			OE-II	–	E3
4M	ORT (ASB)	RAC (KDG)		ICE (KVC)	ANE (JGK)		PROJECT		E4

DAY WISE TIME-TABLE (Autumn SEMESTER) 2021-22

A1 (1U1)	BEE (RSK)D1	EG (JGK)D1	BREAK	CHE (ASA)(D 1)	M-II (PSD)D1	RECESS	CS(X)/CHE(Y)/CS(Z) (HSP/RMK/HSP)		D1
A2 (1U2)	CS(X)/CHE(Y)/CS(Z) (SVB/ASA/SVB)			BEE (UAJ)D2	CHE (AVP)D2		EG (NBB)D2	M-II (PSD)D2	D2
A3 (1M)	CHE (RMK)D2	M-II (NAP)D2		CS(X)CHE(Y)/CS(Z) (SVB/RMK/SVB)			EG (RVR)D1	BEE (RZF)D1	D2/D1
B1 (1R)	CP (PHG)D3	M-I (NST)D3	BREAK	EM (SBS)D4	PHY (AST)D4	RECESS	---WS--- (PTP)		D3/D4
B2 (1N)	M-I (NST)D4	PHY (RGR)D4		CP(X)PHY(Y)EM(Z) ((JMP/RGR/KRG)			CP (JMP)D4	EM (CVP)D4	D4
B3 (1S)	EM(X)CP(Y)PHY(Z) CVP/SBP/AST			CP (SBP)D3	M-I (NAP)D3		EM (NGM)D3	PHY (RGR)D3	3D

(T)* , *, T* - Tutorial, ** - Additional,

DAY: FRIDAY

CLASS	11.00-12.00	12.00-1.00	1.00-1.15	1.15-2.15	2.15-3.15	3.15-3.45	3.45-4.45	4.45-5.45	ROOM
2S	EMI(B)/CS(C)/ADC(D)/ETL(A) (MRC/PRD/GNB/VSK)		BREAK	EMF (AUJ)	CS (RZF)	RECESS	ADC (SSJ)	EVS (RMK)	A2
3S	ACS (AUJ)	EEDU (SRP)		CAEMD (PRB)	PE (VSK)		S_Devel. Program	S_Devel. Program	A3
4S	Project			Project			Project		A4
2R	M&ALP (PVD)B1	ENVS (ASA)B1	BREAK	AI (CMM)B1	TOC (NMK)B1	RECESS	---- TEC ---		B1/B3
3R	DAA(D)/SE(A)/C-SKILL(B) (DRD/CMM/NMK)			BDA/Cry (RAZ/VSM)	DAA (DRD)		SP&G (SBP)	- TEC -	B1
4R	NS (VSM)B5	SE (JMP)B5		ES (PVD)B5	AI (PKB)B5		AI (D)/ES(A) (PKB)/(HMD)		B3
2N	OS (PVK)B2	DCN (ASM)B2	BREAK	TEC	ENVS (ASA)B2	RECESS	TEC	TEC	B2
3N	CD(D)/DAA(A)/BDA(B) (SDP/AGS/FIK)			CD (SDP)B4	DAA (AGS)B4		C.S. LAB-IV(B/C/D) (AGS/FIK/SDP)		B4
4N	PROJECT			PROJECT			TEC	TEC	B2
2U1	AC (SBP)	SS (MNT)	BREAK	NT (BPH)	EVS (RMK)	RECESS	EVS (RMK)	Skill Development	A1
3U1	CA (DDN)	SC (PDK)		EE (AAD)	CN (AND)		CN(C)/ECD(D)/PP(A)/Mini.Proj (B) (AAD/KBK/TPM/DDN)		C1
4U1	BME (VMU)	SDL-VI (AND)		PROJECT			PROJECT		C3
2U2	AC (PRW)E1	SS (VKB)E1		ADC (VNB)C2	NT (SPB)C2		EVS (ASA)C1	EVS (ASA)C1	E1/C2/C1
3U2	CN (VSI)	CA (KBK)		CN(C)/ECD(D) /PP(A)/M.Pro.(B) (KMT/KBK/VSI/KTK)			SC (SGN)	S_D_Lab	C2
4U2	WC (DPT)	SDL-VI (LS)		-- PROJECT --			-- PROJECT --		C4
2M	BEDC(B)/MS(C)/MT(D)/ HPS(A) (BSR/NHK/KVC/MBB)		BREAK	MS (NHK)	HPS (MBB)	RECESS	EC-I (SQS)	BEDC (BSR)	E2
3M	DOM (RVR)	CADS (CVP)		DME(C)/DOM(D)/CADS(A)/RS(B) (ASB/KDG/CVP/NGM)			DME (ASB)	DME (ASB)	E3
4M	RAC(D)/ICE(A)/ORT(B) (KDG/SQS/KRG)			ICE (KVC)	ANE (JGK)		PROJECT		E4

DAY WISE TIME-TABLE (Autumn SEMESTER) 2021-22

A1 (1U1)	BEE (RSK)D1	EG (JGK)D1	BREAK	CHE (ASA)D1	M-II (PSD)D1	RECESS	EG(X)/CS(Y)/BEE(Z) (JGK/HSP/RSK)		D1
1U2	EG(X)/CS(Y)/BEE(Z) NBB/SVB/UAJ			EG (NBB)D2	CHE (AVP)D2		BEE (UAJ)D2	M-II (PSD)D2	D2
A3 (1M)	CHE (RMK)D2	M-II (NAP)D2		EG(X)CS(Y)BEE(Z) (RVR/SVB/RKM)			EG (RVR)D1	BEE (RZF)D1	D2/D1
B1 (1R)	CP (PHG)D3	M-I (NST)D3	BREAK	EM (SBS)D4	PHY (AST)D4	RECESS	PHY(X)/EM(Y)/CP(Z) (AST/KRG/PHG)		D3/D4
B2 (1N)	M-I (NST)D4	PHY (RGR)D4		--WS-- (PTP)			CP (JMP)D4	EM (CVP)D4	D4
B3 (1S)	CP(X) PHY(Y) EM(Z) (SBP/AST/NGM)			CP (SBP)D3	M-I (NAP)D3		EM (NGM)D3	PHY (RGR)D3	D3

(T)* , *, T* - Tutorial, ** - Additional,

DAY: SATURDAY

CLASS	8:30-9:30	9:30-10:30	10:30-10:45	10:45-11:45	11:45-12:45	ROOM
2S	Skill Development Programme		BREAK	Skill Development Programme		A2
3S	Skill Development Programme			Skill Development Programme		A3
4S	Skill Development Programme			Skill Development Programme		A4
2R	Skill Development Program		BREAK	Skill Development Program		B3
3R	ET LAB(BDA(G)/CRYP(H) (RAZ)/(VSM)			Skill Development Program		B1
4R	Skill Development Program			AI (C)/ES(D) (PKB/RAZ)		B3
2N	Skill Development Program		BREAK	Skill Development Program		B2
3N	Skill Development Program			Skill Development Program		B4
4N	Skill Development Program			Skill Development Program		B2
2U1	Skill Development		BREAK	Skill Development		A1
3U1	CN(D)/ECD(A)/PP(B)/ Mini.Proj(C) (AAD/DPT/TPM/RSD)			S_D_Lab	S_D_Lab	C1
4U1	-- PROJECT --			S_ D_Lab		C3
2U2	Skill Development			Skill Development		C1/C2
3U2	S_D_Lab			CN(D)/ECD(A)/PP(B)/M.Project(C) (KMT/KBK/VSI/RSD)		C2
4U2	-- PROJECT --			-- PROJECT --		C4
2M	Skill Development/ Professional Training/ Tech Talk/Webinar		BREAK	Skill Development/ Professional Training/ Tech Talk/Webinar		E2
3M	Skill Development/ Professional Training/ Tech Talk/Webinar			Skill Development/ Professional Training/ Tech Talk/Webinar		E3
4M	Skill Development/ Professional Training/ Tech Talk/Webinar			Skill Development/ Professional Training/ Tech Talk/Webinar		E4
DAY WISE TIME-TABLE (Autumn SEMESTER) 2021-22						
A1 (1U1)	--	--	BREAK	--	--	D1
A2 (1U2)	--	--		--	--	D2
A3 (1M)	--	--		--	--	D2/D1
B1 (1R)	--	--	BREAK	--	--	D3/D4
B2 (1N)	--	--		--	--	D3
B3 (1S)						

(T)* , *, T* - Tutorial, ** - Additional

4. Teaching Load of the Faculty

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON
LOAD ALLOCATION
Session 2021-22 (Spring Semester)
Department: COMPUTER SCIENCE & ENGINEERING

Sr No	Name of the Faculty	Semester	Subject Allotted		Teaching Load			Other Activity Contribution	
			Code	Abbr.	Theory	Practical	Total Load	Dept Level	Institutional Level
1.	Dr. S. B. Patil	--	--	--	--	--	--	• HOD-Overall Administration	• **Head-SGIARC**
2.	Dr. N. M. Kandoi	IV	4KS05	TOC	4	--	**12**	• Dept SGBAU Exam Coordinator	--
		VI	6KS09	C SKILL IV	--	8			
3.	Dr. D. R. Dhotre	IV	4KS03	OS	3	--	**15**	• Project Coordinator. • R& D Coordinator. • AMC Committee Member.	--
		VI	6KS02/6KS06	DAA	4	8			
4.	Prof. C. M. Mankar	IV	4KS01	AI	3	--	**16**	• AMC Committee Member. • ISO Cell Member. • Purchasing Committee Member • Industry Institute Interaction Cell Member. • Class Consoler-4R	• **ICT Coordinator**
		VI	6KS03/6KS07	SE	3	8			
		ME	**1KMEF7**	**OSD**	**--**	**2**			
5.	Prof. V. S. Mahalle	IV	4KS07	OS	--	4	**15**	• AMC Committee Member. • NBA Coordinator. • M. E. Coordinator • Purchasing Committee Member. • Disciplinary/ Redressal Committee.	--
		VI	6KS04	PE – II CRYPTOGRAPHY	3	--			
		VI	6KS08	ET LAB II	--	4			
		VIII	8KS04	NS	4	--			
6.	Prof. P. K. Bharne	IV	4KS07	OS	--	4	**20**	• Seminar Incharge. • Deptt.Library Committee Member. • Practical Coordinator. • Class Consoler-2R	--
		VIII	8KS01/8KS05	AI	4	8			
		ME	**1KMEF3**	**OSD**	**4**	**--**			
7.	Prof. Ms. K. P. Sable	IV	4KS02/4KS06	DCN	3	8	**13**	• ISTE Dept(Student Coordinator) • Virtual Lab. • NPTEL, MOOC etc. courses	• **NPTEL, MOOC etc. courses Incharge**

		ME	**1KMEF6**	**ALGO**	**--**	**2**		Incharge. • Disciplinary/Redressal Committee Member. • Skill Courses/ Continuing Education Coordinator(Staff) • T&P Coordinator	
8.	Prof. J. M. Patil	I	1B3/1B7	CP	5	6	**15**	• Secretary-Staff Council. • Visiting Professors/Guest Lecturer In-charge. • AMC Committee Member. • NBA Coordinator. • Purchasing Committee Member.	--
		VIII	8KS03	SE	4	--			
9.	Prof. Ms. P. V. Deshmukh	IV	4KS04/4KS08	M&ALP	3	8	**19**	• CSESA Coordinator • Cultural Activity Coordinator • Web Site Coordinator • Time Table Coordinator. • Result Analysis Coordinator. • Skill Courses/ Continuing Education Coordinator (Student). • Dept Students & Faculty information system coordinator	• **Music, Art & Cultural Cell (Club) Member**
		VIII	8KS02	ES	4	--			
		ME	**1KMEF2**	**ALGO**	**4**	--			
10.	Prof. S. B. Pagrut	I	1B3/1B7	CP	5	6	**18**	• Remote Center (IIT Bombay) Coordinator. • Carrier Guidance Cell Member. • Students Internship Co-Ordinator.	--
		VI	6KS01	SP&G	3	--			
		ME	**1KMEF1**	**ACA**	**4**	--			
11.	Prof. Ms. R. A. Zamare	VI	6KS04	PE – II BDA	3	--	**14**	• Class Test Coordinator • Scholarship Committee Member. • Admission Committee Member. • ISTE (Staff Coordinator). • Deptt.Library Committee Member. • Class Consoler-3R	--
		VI	6KS08	ET LAB II	--	4			
		VI	6KS05	OE - II	3	--			
		ME	**1KMEF4**	**OOS**	**4**	--			

12	Prof. H. M. Deshmukh	VIII	8KS06	ES	--	8	**16**	• Student's Competition Coordinator(Hackton etc.) • E-Cell Coordinator. • Idea Lab Coordinator. • CSI Students Chapter Coordinator.	--
		IV	4KS09	C SKILL II	--	8			

Prof. Ms. P. V. Deshmukh
TTC, CSE

Dr. S. B. Patil
HOD, CSE & SGIARC

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON
DEPT. OF ELECTRICAL ENGINEERING
Spring Semester : 2021-22
Date : 6/1/2022
Load Allocation (Revised)

Sr. No.	Faculty Name	Semester	Subject Allotted		Teaching Load			Other Activity Contribution	
								Dept Level	Institution Level
			Code	Abbr.	Th	Pr	Total Load		
1	Dr. S.R. Paraskar	VI SEM BE	6EP02	EEDU	04	04	08	Chairman-Academic Monitoring Committee	-------
		II SEM ME (EPS)	EP2205	APEPS	04	----			
2	Prof. U.A. Jawadekar	I SEM BE	1B3	BEE	05	02	13	Member-Academic Monitoring Committee	Coordinator - Music, Art & Cultural cell (Club)
		IV SEM BE	4EP02	EMI	04	02		Class Counsellor (2S)	
								Dept Member, IQAC & ISO Cell	
								Dept- Alumni Coordinator	
									Member– Feedback form Revision Committee
									Chief Coordinator- ISO
									Member-Student Profile Committee
3	Dr. Mrs.A.U. Jawadekar	IV SEM BE	4EP01	EMF	04	---	12	Member Secretary-Academic Monitoring Committee	Member Secretary-Woman development Cell
		VI SEM BE	6EP04	ACS	04	---		Mentor (4S)	
		VI SEM BE	6 EP06	PE LAB	----	04		Dept Member, Library Committee	
								Dept Member, 1st Year B.E. & M.E. Admission Cell	
									Chief Coordinator –IQAC Cell
									Member – Institutional International Journal Committee
4	Prof. R. Z. Fulare	I SEM BE	1B3	BEE	05	02	15	Class Counsellor (3S)	------
		IV SEM BE	4EP03	CS	04	04		Lab In-charge (Project)	
								Dept member-Institute Level Scholarship Committee	
								Departmental Display, Publicity &Ambience Coordinator	
5	Prof. P.R. Bharambe	VI SEM BE	6EP03	CAEMD	04	08	12	Member -Academic Monitoring Committee	In-charge - Electrical Maintenance & Power House
		II SEM ME (EPS)	EP 2203	PQIT	04	----		NBA–Coordinator	
								Lab In-charge (Electrical Machines)	
								Mentor (2S)	
								Faculty Advisor– Institution of Engineers (I) Chapter	
									Member-Information & Communication Cell

6	Prof. R. S. Kankale	I SEM BE	1B3	BEE	05	06	15	Member-Academic Monitoring Committee	Chief Coordinator - Community Development & Extension Service Cell Coordinator-
		VIII SEM BE	8EP02	HVE	04	----		Lab In-charge (SGP & High Voltage)	
								Project &Seminar Coordinator	
								Mentor (3S)	
								R&D Cell Coordinator	
7	Dr. S. S. Jadhao	IV SEM BE	4EP05	ADC	04	04	12	Mentor (4S)	Chief Coordinator -R&D Activities & Ph.D
		VIII SEM BE	8EP04	PQ	04	----		Lab In-charge Electrical Power Research Lab (SGIARC)	
									Member -Alumni Association
									Member - Governing Body (SGIARC)
									Member– IDEA/ Fabrication Lab
8	Prof. M. R. Chavan	VI SEM BE (OE)	6EP05	EAM	03	-----	11	Mentor (3S)	-----
		II SEM ME (EPS)	EP 2202	EMAC	04	----		T&P Dept Coordinator	
		IV SEM BE	4EP06	EMI LAB	---	06			
		I SEM BE	1B7	BEE LAB	----	02			
9	Prof. R. K. Mankar	VIII SEM BE	8EP04	EDC	04	-----	11	Mentor (2S)	-----
		VI SEM BE (OE)	6EP05	EAM	03	----		Lab In-charge (Basic Elect .Engg)	
		II SEM ME (EPS)	EP 2201	PSDC	04	----		Time–Table Coordinator	
		II SEM ME (EPS)	EP2216	PS Lab-II	----	04		CDES Coordinator	
								M.E. (EPS) Course Coordinator	
10	Prof. G. N. Bonde	VIII SEM BE	8EP01	PSS	04	----	16	Class Counsellor (4S)	Assistant Programme Officer -NSS
		VI SEM BE	6EP09	Comp Tech Lab	----	08		Lab In-charge (C.S.& Elect.Measurement)	
								Departmental Information Cell Coordinator	
		IV SEM BE	4EP07	CS	-----	04			
11	Prof. V. S. Karale	VI SEM BE	6 EP01	PE	04	04	16	Lab In-charge (PLC& Factory Automation) & (Power Quality)	Member– IDEA/ Fabrication Lab
		IV SEM BE	4EP09	Electronics Tech Lab	-----	08		Coordinator - Univ. (Practical) Exam	
12	Prof.B.S. Rakhonde	IV SEM BE Mechanical	4ME01	BEDC	04	08	16	Lab In-charge Computer& Microprocessor)	Member - Alumni Association
		IV SEM BE	4EP04	NMOT	04	----		Class Test Coordinator	
								Dept-Alumni Coordinator	
								Dept Member-1st Year BE Admission Cell	
									Coordinator – Alumni Meet
								Dept Coordinator - University (Theory) Exam	Member-Brand Revamp Exercise Cell
								Coordinator -Result Analysis	
13	Prof. P. R. Dhabe	VIII SEM BE	8EP03	DSP	04	08	16	Seminar Hall In-charge	--------
		II SEM ME (EPS)	EP 2204	HVDCT	04	---		Faculty Advisor– Institution of Engineers (I) Chapter	
								In charge - Departmental Library	

		IV SEM BE	4EP08	ADC LAB	----	04			
14	Dr. R. S. Pote	I SEM BE	1B7	BEE LAB	-----	06	06	Dept Member- ISTE Faculty Chapter	In-charge - Electrical Installation
									In-charge -Solar Production Centre
15	Prof. A K. Damral	VI SEM BE	6EP07	EEDU LAB	------	04	04	----------	In-charge -Solar Research Centre (SGIARC)
									Consultant – Renewable Energy Sources
	Total Teaching Load (in Hours/week)				**81**	**102**	**183**		

R. K.Mankar
TTC

Dr. S. R. Paraskar
HOD

Department of ELECTRONICS & TELE.COMM. ENGINEERING
LOAD ALLOCATION Session 2021-22 (Spring Semester)

Sr. No.	Name of the faculty	Semester	Code	Subject Allotted		Teaching Load			Other Activity Contribution	
				Class	Abbr.	Theory	Practical	Total Load	Dept. Level	Institution Level
1	DR.M.N.TOBDEWAL	IV		2U1	SS DIP (TH+PR) (Over & above)	4 ---	4 ----	08	1. Overall Coordination 2. Chairman-AMC, DCC, DAC, etc. 3. Chairman: ESSA, Purchase committee, Discipline committee, etc.	Secretary ISTE Faculty chapter
2	DR. K. B. KHANCHANDANI	VI		3U1	CA ECD	4	10	14	Coordinator CEP	--
3	DR. r.s. dhekekar	IV		2U1&2U2	V&E Mini Project	4+4 ---	--- 6	14	1. Member-DCC 2. Coordinator-B.E. Final Year Project & Seminar 3. Coordinator-Dept. R&D and Ph.D. 4. In-charge: ME Lab-II+IOT	--
4	DR.S.B.PATIL	IV		2U1	AC	04	04	8	--	HOD, CSE
5	Prof. V. M.UMALE	VIII		4U1&4U2	BME	04	04	08	Coordinator - Discipline Committee	1. Dean Exam 2. Chief coordinator-NBA
6	Prof. V. N. BHONGE	IV II		2U1 ME	ADC ADC LAB HSDSD (Over & above)	04 ---- -----	8 -----	12	1. Member-AMC 2. Member-Purchase Committee 3. Class counselor:2U2	1. Member-Alumni Association 2. Secretary, Student Consumer Society
7	Prof. D. L. BHOMBE	VIII		4U1	DCN SDL-VI	04 --	--- 04	08	--	1. Dean-Academics 2. Chief Coordinator NBA 3. In-charge-NCC
8	Dr. D. D. nawgaje	VI II		3U2 ME	CA Mini Project AIS(TH) (Over & above)	4 ----	---- 8	12	1. Member-AMC and DCC 2. PG(ME) Coordinator 3. Lab.In-charge: ME Lab-I	1. Coordinator-Alumni Association 2. Member- Fab Lab
9	prof. mS. b.p. hARNE	IV II		2U1 ME	NT PC(TH) (Over & above)	04 --- --- ---	10	14	1. Lab. In-charge: EWS 2. Class counselor: 2U1 3. Member Scholarship	--

									committee and Discipline committee	
10	PROF. D. P. TULASKAR	VIII		4U1&4U2	WC UHF ECD	4+ 4 ---- ---	----- 04 02	14	1. Member Secretary-DCC 2. Coordinator-Dept. website up-gradation 3. Member-Syllabus Restructuring	Program officer NSS
11	PROF. P. R. WANKHEDE	IV		2U2	AC	4	8	12	1. Coordinator NBA 2. Member-DCC	1. Branch counselor, IEEE 2. Member, Fab Lab. 3. Chairman SC/ST Cell 4. Coordinator, Institutional Journal 5. Faculty Advisor Robotics & Automation Chapter
12	PROF. A. N. DOLAS	VI VIII		3U1 4U1	CN SDL-VI SS Lab	4 2 --	---- 6 2	14	1. Class counselor: 4U1 2. Lab. In-charge- ADC Lab. 3. Member-Discipline and Purchase Committee 4.	In-charge EPABX
13	pROF. V. V. RATNAPARKHI	VIII		4U1&4U2	UHF	4+ 4	6	14	1. In-charge-CE Lab. and Dept. Library 2. Member-Syllabus Restructuring	1. Chief Coordinator Proposal development 2. Member-Fab Lab. 3. Coordinator-Institutional Journal
14	prof. v.k. bhangdiya	IV II		2U2 ME	SS VLSI (TH+PR) (Over & above)	04 ---	10 ---	14	1. Member-DCC 2. Lab. In-charge: DSP Lab. 3. Dept. Coordinator-SGBAU Practical Exam. 4. Member, Admission Committee	--
15	PROF. K.T. KAHAR	IV		2U2	ADC Mini Project	04 ----	8 2	14	1. Lab. In-charge PE Lab. 2. Coordinator-B.E. Final Year Project & Seminar	Member, ISO Cell
16	PROF. P.D. KALE	VI		3U1	Sat.COM UHF Lab	04 ---	6	10	Coordinator, T&P and	--

						----			Career Guidance cell	
17	Prof. Ms. K. M. Thanvi	VIII		4U2	DCN CN Lab	4 ---	--- 8	12	Faculty Advisor-ESSA Coordinator-CDES	Faculty In-charge: IEEE WE Member: WD Cell
18	Prof. S.P. BaDAR	IV		2U2	NT ECD Lab	4 ----	6 4	14	1. Coordinator-NBA 2. Member-DCC	Chief Coordinator-Pursuit-2021-22
19	prof. t.p. marode	VI		3U,R,N, M,S	ITP	3+ 3	4	10	Member-Result Analysis	In-charge SIS Development system Coordination E-cell and Hackathon Member- Student Consumer Society
20	PROF.LOPAMUDRA SAMAL	VI VIII		3U1 4U2	EE SDL-VI	04 02	06	12	Class counselor-4U2	Member-Admission committee
21	PROF. V.S.INGOLE	VI		3U2	CN ITP Lab	4 8		12	Class counselor-3U2 Dept. Alumni Coordinator	Member- Fab. Lab.
22	PROF. S.G.NEMANE	VI		3U2	Sat.Com AC Lab ITP Lab	04 04 04		12	1. Coordinator Time Table 2. Coordinator Class Test 3. Dept. Coordinator: SIS Development system 4. Dept. Coordinator V-Lab 5. Dept. Coordinator-SGBAU Theory Exam	--
23	Mrs.A.A.deshmukh	VI		3U2	EE CN Lab	4 ---	------ 8	12	1. Class counselor, 3U1 2. In-charge Class Test 3. Coordinator-ISTE Student and Faculty Chapter	Member-Admission Committee

Head of the Department

DEPARTMENT OF INFORMATION TECHNOLOGY
SPRING SEMESTER, 2021-2022

Table II **Date: 10.01.2022**

SR. NO.	Name of the faculty	Semester	Subject Allotted		Teaching Load			Other Activity Contribution	
			Code	Abbr.	Theory	Practical	Total Load	Dept. Level	Institution Level
1.	Prof.A.S.Manekar	IV IV	4IT02 4IT06	DCN DCN Lab	03 --	-- 08	11	1)General Administration 2) Department Purchasing 3) Lesson Plan 4) Academic Research 5) Department academic monitoring Committee 6)Discipline Committee 7) Incubation & Consultancy	
2.	Prof.Ms.P.V.Kale	IV IV VIII	4IT03 4IT08 8IT07	OS OS Lab CLAB-V	03 -- --	-- 08 04	15	1) Department academic monitoring Committee 2) NBA Coordinator 3) Discipline Committee	1) Student Council-Faculty Advisor 2) Scholarship Committee-Chief Coordinator
3.	Prof.A.K.Shahade	IV IV VIII M.E	4IT04 4IT08 8IT07 ME	DS DS CLAB-V ME	03 -- -- 04	-- 08 04 --	19	1) Department academic monitoring Committee 2) Time Table Coordinator 3) Discipline Committee 4) Project Coordinator 5) Vlab, IITB, Dept. Coordinator	1) Officer In-charge – University Theory Exam 2)VLAB, IITB, Nodal Centre Co-ordinator
4.	Prof.A.G.Sharma	VI VI VI VIII	6IT02 6IT07 6IT09 8IT01	DAA DAA LAB C.Skill Lab IV DWC	03 -- -- 03	- 08 02 --	16	1) Class Test Coordinator 2) Lab In-charge –WT 3) ISO & QIP Cell 4) Class Counsellor – 3N	1)Smart India Hackathon, Ecell - Coordinator
5.	Prof.F.I.Khandwani	IV VI VI VI	4IT01 6IT04 6IT08 6IT09	COA BDA (PE-II) BDA LAB C.Skill Lab IV	04 03 -- --	-- -- 08 02	17	1) SCOT 2) Cultural coordinator 3) Class Counsellor- 2N 4) ICC In-charge	1) ISTE Student Chapter-Faculty Advisor
6.	Prof.S.D.Padiya	VI VI VI VIII	6IT01 6IT06 6IT09 8IT04	CD CD LAB C.Skill Lab IV WC	04 -- -- 03	-- 08 02 --	17	1) IPR & Proposal Cell Coordinator 2) Student Competition Coord. 3) ACM Faculty In-charge	
7.	Prof.S.S.Muddalkar	II II IV	1A4 1A8 4IT09	CP CP Lab C.Skill Lab II	05 -- --	-- 06 04	15	1) Dept. T&P Coordinator 2) Lab In-charge-DMC	1)Guest Visit to campus - Coordinator
8.	Prof.Ms.P.P.Bute	VIII VIII IV	8IT02 8IT05 4IT09	NAS NAS Lab C.Skill Lab II	03 -- --	- 08 04	15	1) Community Development 2) Scholarship 3) Alumni & Parents Coord. 4) Department Coordinator-University practical Exam 5) ISTE faculty Chapter 6) Class Counsellor-4N	
9.	Prof. P.H.Gohatre	II II VI VI	1A4 1A8 6IT05 6IT09	CP CP Lab IPR (OE-II) C.Skill Lab IV	05 -- 03 --	-- 06 -- 02	16	1) ITSA Faculty Advisor 2)Lab In-charge OS 3)Visiting Professor & Guest Lecture 4)Dept. Library 5) R&D & MOU Activities	

10.	Prof. Ms. K.J.Sapkal	VI VIII VIII	6IT03 8IT03 8IT06	AI SE SE Lab	03 03 --	-- -- 08	14	--	1) NSS Programme Asst
					55	100	155		

DEPT. OF MECHANICAL ENGINEERING
Spring Semester (2021 - 2022)
Date: 03/01/2022
LOAD ALLOCATION

S.N.	Faculty Name	Sem.	Subject Allotted		Teaching Load			Other Activity	
			Code	Abbr.	Theory	Practical	Total	Dept. Level	Institution Level
01	Dr. S. P. Trikal	IV	4ME04	MT	4	6	10	1) Academic Monitoring Committee 2) Purchase Committee	--
02	Dr. V. K. Thute	--	--	--	--	--	--	--	--
03	Prof. M. B. Bhambere	IV VI	4ME05 6ME09	HPS RS	4 -	6 4	14	1) Academic Monitoring Committee 2) SAE Chapter (Advisor - Baja) 3) R & D	--
04	Prof. C. V. Patil	II VI	1A3 6ME04	EM CADS	5 3	- 8	16	1) Academic Monitoring Committee 2) Projects	Uni. Practical Exam Coordinator
05	Dr. J. G. Khan	II VIII	1A4 8ME01	EG AE	5 4	6 -	15	1) Theory Exam Coordinator 2) Student's Dashboard Committee	--
06	Prof. A. S. Bharule	VI VIII	6ME01 8ME04	DME ORT	4 4	8 -	16	1) IQAC Coordinator 2) Time Table Coordinator 3) PG Coordinator	--
07	Prof. N. B. Borkar	II VI	1A4 6ME02	EG DOM	5 -	6 4	15	1) ISTE Chapter Coordinator 2) Scholarship Committee	1) Final Year Project 2) Theory Univ. Exam
08	Dr. N. H. Khandare	IV VI	4ME01 6FEME05	MS OE-II (AE)	4 3	8 -	15	Dept. T&P Activity	CII Communicator
09	Prof. S. Q. Syed	IV VIII VI	4ME02 8ME03 4ME05	EC-I ICE HPS	4 - -	- 8 2	14	1) Class Test Coordinator 2) Renewable Energy Club 3) MESA	
10	Prof. P. T. Patokar	II	1A5	WP	-	36	36	1) Community Development and Extension Service Cell (CDES) 2) Member - IQAC	Banner Preparation
11	Prof. K. R. Gandhare	VI VIII II	6ME03 8ME04 1A3	CSE ORT EM	4 - -	- 8 4	16	1) SAE Chapter (Advisor - Tifan) 2) E.D. Cell 3) I. C. Cell 4) Seminars 5) Result Analysis	Feedback Form Revision Committee
12	Prof. R. V. Rajkolhe	II VI	1A4 6ME02	EG DOM	5 4	6 -	15	1) Cultural Activity	Spiritual Discourses

S.N.	Faculty Name	Sem.	Subject Allotted		Teaching Load			Other Activity	
			Code	Abbr.	Theory	Practical	Total	Dept. Level	Institution Level
								Coordinator 2) Guest Lecture Coordinator	
13	Prof. N. G. More	II VI	1A3 6ME09	EM RS	5 -	6 4	15	1) Renewable Energy Club 2) IDEA/FAB Lab.	Solar Production Centre
14	Prof. K. D. Gadgil	VIII VI	8ME02 6ME02	RAC DOM	4 -	8 4	16	1) N.B.A. Coordinator 2) Departmental Library 3) GATE Test Series 4) Virtual Lab.	--
15	Prof. K. V. Chandan	VIII II IV	8ME03 1A3 4ME04	ICE EM MT	4 - -	- 8 2	14	1) Carrier Guidance Cell 2) IEI Student Chapter 3) GATE Test Series	--
16	Prof. P. A. Dalke	--	--	--	--	--	--	--	--
TOTAL LOAD (with load taken by other Dept.)					**75**	**152**	**227**		

(Prof. A. S. Bharule) **(Dr. S. P. Trikal)**

Time Table Coordinator

Head of Department

5. Internal Continuous Evaluation System and place

Internal Continuous Evaluation System**: In our college, we have divided the twenty internal marks for every subject as given below**

- **10 marks - Two tests**
- **05 marks - Attendance**
- **05 marks - Assignment (TEC).**

Internal marks evaluation scheme is shown in Figure

Sessional Marks Evaluations scheme for UG /PG: Session 2019-2020 & onward

It is notified to all concern students, faculty, and staff members that the theory internal marks for each course will be evaluate as per the table shown below:

UG: B. E. 1st, 2nd, 3rd, and 4th Year: Two Class Tests and TEC (All Branches)

S N	Item(s)	Duration for Conduction	Evaluation Scale: Marks and Syllabus		Weightage (Out of 20 Marks)
01	Class Test I and Class Test II	One hour for each Class Test	**30** 02Units for each Class Test		**60/6 = 10**
02	Teacher Evaluation Component (TEC) **Any one TEC to each student/subject**	Throughout the semester	**30**		**30/6 = 05**
03	Attendance	Throughout the semester	95 – 100% 90 – 94.99 % 85 – 89-99 % 80 – 84.99 % 75 – 79.99 % Below 75%	05 04 03 02 01 00	**05**

PG: M. E. (EPS/ Digital Electronics /Computer Engg. /AM&MSD)

S.N.	Items/Syllabus:	Duration for Conduction	Evaluation Scale (Marks)	Weightage (Out of 20 Marks)
01	Class Test I (50 % of syllabus)	One & half hour for Each Class Test	**40**	**80/8 = 10**
02	Class Test-II / (Remaining 50 % of syllabus)		**40**	
03	Teacher Evaluation Component (TEC) **Any one TEC to each student/subject**	Throughout the semester	**40**	**40/4 = 10**

Please Note: **Attendance in UG & PG should be min. 75% for the term grant. Subject Teacher will identify and open min. two & max. four TEC per subject.**

List of Teacher Evaluation Components (TECs):

1. Tutorials/**Assignments** on Syllabus points
2. Presentation/Seminar on extension of the course
3. Mini/Term/Short Projects (Design/Fabrication/ Simulation/ Software / Hardware Development / Survey / Case Studies etc.)
4. New Experiment development and testing
5. Open book test
6. Surprise test
7. Quiz / Group Discussion
8. Field/Industrial work
9. Industrial visit and report writing

Note: If any student missed either CT1 or CT2 due to off Campus college activities approved by concern HOD, then it is mandatory for them to appear for retest.

Assignments Details

Assignments have its own importance in engineering education. Assignments in the form of various components (TEC) such as mini/term/short projects (Design/Fabrication/ Simulation/ Software / Hardware Development) / Survey / Case Studies, New Experiment development and testing, Presentation/Seminar on extension of the course, Quiz / Group Discussion, Industrial visit and report writing, Tutorials on Syllabus points are given to students for each course, to check and evaluate their understanding and to enhance their subject knowledge.

Every teacher decides the assignment components in the beginning of each semester and gets it approved by HOD and then conveys it to the Dean (Academics) and students. Students work on these components throughout the semester which helps them to attain the course outcomes. The continuous monitoring and evaluation is done by the teacher for assuring the quality. .

Various components of assignment

Component	**Assessment Process**
Mini / Term / Short Projects (Design / Fabrication/ Simulation / Software / Hardware Development)	This component helps students to gain expertise in their subject. Students collect and extract the information related with the topic from different online and offline sources. Students demonstrate their presentations skills by presenting the information. They learn to communicate effectively and express their ideas and opinion about the project work. Students form a group of 2 or 3 and based on their interest select a mini project either hardware or software based. They access information through various resources and summarize the main idea. Evaluation is done by the course teacher after completion of the work based on the specified rubrics.
Survey / Case studies	Case studies help to increase students' critical thinking and problem-solving skills and motivate them towards learning attitude. Case study is found to be beneficial for students in terms of actively engaging them and allowing them to learn the applications of engineering techniques to solve real world problems. Thus, use of case studies is a pedagogical technique that allows students to apply their theoretical knowledge to practical situations. Students are asked to work upon a case study and evaluation is done by the faculty using specified rubrics.
Industrial visit/field work and report writing	Industry visit/ field work means sending the students to certain workplaces, Industries for doing some practical work. Main objectives of field work are : • To provide opportunities to the the students for practical experience in the organization. • To make them aware about the recent technologies used by industries • To remove the fear of project work • To enable students to understand professional duties and responsibilities of the personnel in the field. • To get good practical knowledge/exposure Assessment is done on the basis of viva and reports using the rubrics designed for the same.
New Experiment development and testing	Main objective of introducing this component as assignment is that it helps the students to acquire practical knowledge and increases the utilization of departmental facilities (Software, Interfacing/Computing/Laboratory Equipment's).It helps to develop logical skills and technical manuscript writing skills in students. Students design new experiment which is not included in their experimental list. They identify the experiment, develop outline of experiment (circuit diagram, flowchart, algorithm, etc), perform the experiment and then analyze the results. Evaluation is done on the basis of rubrics.
Tutorial	Tutorial is an important teaching-learning tool. It helps learners enhance their intellectual, communication and social skills. Tutorials provide an interactive learning environment where students can clarify and extend, through readings, discussions and other activities, what they learn from the lectures. Tutorial is given to the students based on the topics covered in theory lecture and evaluation is done by the faculty based on the solution of the problem.

Quiz	Quizzes helps to expand students' knowledge and helps to explore new skills. Quizzes are designed in such a manner that to solve that, it requires critical thinking and extensive research. Quiz is based on complete course and quiz scores are calculated based on the number of points assigned to each quiz question. Quiz in the form of MCQ are also assigned to students. MCQs are found to be flexible to various levels of learning outcomes from simple recall of content to more complex level such as students' ability to examine facts, understanding concepts and principles. MCQs are designed to test quickly and effectively students'knowledge about a particular idea or concept. Assessment tool used here is direct and marks are awarded to students on the basis of correct answers.
Group discussion (GD)	Group discussion on study topics plays a vital role in understanding the topic. Discussing the topic among classmates helps in learning a topic with perfection. Various benefits of GD for students are: • It enhances the subject knowledge. • It helps in exploring more ideas about the topic. • It helps students to realize their mistakes and weakness • It builds self confidence and improves communication skills. • Evaluation of students is done by the faculty on the basis of Rubrics
Open book test	Open book test is an assessment method that allows students to refer their notes, text books or other approved material while answering the questions. Questions devised in open book test are such that helps to assess the interpretation of knowledge, comprehension skills and critical thinking skills. Assessment of open book test is done on the basis of Rubrics.
Presentation /seminar	Presentations of topics in classroom are most valuable to students to share their knowledge, improve their communication skills and to boost their self-confidence. These skills play an important role in their engineering course and also help them in their career advancement. Students give presentation on technical topic of their interest which is relevant to their course. Faculty evaluates students on various aspects and marks are awarded based on rubrics.

All the components of assignments cover the entire syllabus

Continuous assessment in the laboratory

As per university scheme, subjects having practical sessions are conducted in respective laboratories. Practical sessions are evaluated for 50 marks (25-internal evaluation and 25-external evaluation).25 internal marks are divided as given below

- Continuous Evaluation Marks: 20
- Laboratory test Marks: 05

Continuous assessment system is implemented for assessment of laboratory work. After the completion of the experiment, assessment is done on the basis of submission of laboratory records on regular basis, understanding of the experiment through oral viva voce questions and participation in performing the experiment. Neatness of the laboratory record book is also given due weightage in the assessment. After the completion of all the experiments, laboratory test is also conducted.

6. Student's assessment of Faculty, System in place

Student's assessment of faculty mechanism is well organized system in the college for all courses. During every semester, three student feedbacks are taken. These feedbacks are taken by:

(i) Deans and the HOD

(ii) External agency, S and K Associates.

(iii) Computerized feedback (online feedback)

- Lectures are monitored by Deans and HOD. They give constructive comments to improve the quality of teaching and the teaching- learning process. Academic monitoring committee is looking after the teaching learning process.
- Counseling is provided by the respective HOD for those faculty members who have secured low scores and negative comments, if any, in the feedback. This motivates them to improve their skills and abilities.
- If required, training / orientation programs are conducted by professional experts to master the skills of the faculty members in the nuances of teaching, thus improving the efficiency of teaching-learning process.
- External agency, S and K Associates conducts the independent feedback process. They submit their reports to the authority and accordingly the steps are taken to improve the quality of teaching as well as the teaching-learning process.
- Around twenty days before the end of the semester, all the students are required to fill a computerized feedback for apprising the faculty using a scale of 5 (high) to 0 (low).Teachers performance appraisal analysis sheet is prepared for both the theory as well as practical subjects.
- Theory appraisal sheet consists of total fifteen questions whereas the practical appraisal sheet consists of ten questions.
- The hard copy of the theory and practical performance appraisal analysis sheets duly signed and approved by the HOD and the Dean (Academics) is given to the concerned faculty members.
- All the courses mentioned in the feedback form will be analyzed as given in Table

Feedback assessment process

Step-1	Collection of feedback forms for all the subjects from the students based on parameters specified in questionnaire.
Step-2	Estimation of average for all the parameters and calculation of average performance rating

Step-3	Preparation of teachers performance appraisal analysis sheet
Step-4	Performance appraisal analysis sheet approved by Dean (academics) and HOD
Step-5	Distribution of performance appraisal analysis sheets to the respective teachers. If he / she receives average or below average performance, he / she gets counselling and allows them to get correct their performances.

Questionnaire for computerized feedback is shown in Table

Questionnaire for computerized feedback

Que. No.	**Questions** (Ranking on the scale of five)
1	Whether the lectures were well prepared, organized and course material is well structured?
2	Was the Blackboard writing / audio visual aids are clear and organized?
3	Were the lectures delivered with emphasis on fundamental concepts and with illustrative examples?
4	Whether the Teacher engages classes regularly & maintains the discipline.
5	Whether difficult topics were taught with adequate attention and ease?
6	Did the Faculty provide you new knowledge and has command over the subject?
7	Was the instructor enthusiastic about teaching?
8	Was the teacher able to deliver lectures with good communication skills?
9	Were you encouraged to ask Questions, to make lectures interactive and lively?
10	Did the course improve your understanding of concepts, principles in this field and motivated you to think and learn?
11	Whether the teacher was effective in preparing students for exams?
12	Was the unit tests were challenging?
13	Was the evaluation fair and Impartial? And did it help you to improve?
14	Did teacher give additional technical / non-technical inputs by referring to INTERNET / additional books?
15	Whether teacher was always accessible to the students for counselling, guidance and solving queries off the classroom hours?

Corrective Measures

The institute conducts oral feedback and written feedback once a semester for all faculties and all subjects. In the same, weak points or poor performance of the faculty is taken under consideration by Dean Academics. The report of the same is sent to Head of Department and the Principal by Dean Academics. Head of the Department does counseling of the faculty and discuss on the measures with the faculty. The faculty is asked for improvement. Lectures are monitored by HOD and academic

monitoring committee of the department; they give constructive comments to improve the quality of teaching and learning process. Faculty is promoted and encouraged to attend the faculty development programmer (FDPs) related to effective teaching methodologies. Principal seeks explanation from concerned HOD.

- The faculty is asked for Explanation in case of inappropriate result
- Counseling is given to the concerned faculty by HOD
- Promoting and encouraging faculty to attend the faculty development programs (FDP) related to effective teaching methodologies.
- Lectures are monitored by HOD and academic monitoring committee of the department.
- They give constructive comments to improve the quality of teaching and learning process.
- Principal seeks explanation from concerned HOD and advice for further improvement.