5KS01 Database Management Systems

Course Code:5KS01	Course Title: **Database Management Systems**	LTPC:L-4, C-4
Course Prerequisite:	Discrete Mathematics, Data Structures and Algorithm	
Course Objectives:	• 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. To learn 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. This course meets the following student outcomes: 1. Design E-R Model for given requirements and convert the same into database tables. 2. Use database techniques such as SQL. 3. Explain transaction Management in relational database System. 4. Use advanced database Programming concepts	
Unit I:	Unit Title: : 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		
Unit II:	Unit Title: 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 DatabaseOperations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database,Join expressions, Views		
Unit III:	Unit Title: 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 multivalued dependencies, More Normal Forms, Database Design Process.		
Unit IV:	Unit title :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:	Unit Title: 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:	Unit Title: Concurrency Control and recovery system	Hours:8
Lock-Based Protocols, Deadlock Handling, Multiple Granularities, Timestamp- Based Protocols, Validation-Based Protocols, Multiversion 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)		
Evaluation: Continuous Assessment (30 %) and Assignments / Quizzes / Projects (20%) Term End Examination (50%)-suggested		

Compiler Design

5KS02	Compiler Design	Lecture – 03 Hours/Week Tutorial – 00 Credit – 03
Course Prerequisite:	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: 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 (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:		**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:		**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:		**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:		**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:		**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 Books:

[1] 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).

Evaluation:

Continuous Assessment (30 %), Assignments/Quizzes/Projects (20%), Term End Examination (50%) **(Suggested)**

COMPUTER ARCHITECTURE & ORGANIZATION

5KS03	**Computer Architecture & Organization**	**L-3, T-0, C-3**
Course Prerequisite:	**Microprocessor & Assembly Language Programming**	
Objectives:	Students will be expected to demonstrate their understanding of Computer Architecture & Organization by being able to do each of the following: 1. To familiarize the basic concepts and structure of computers. 2. To Understand concepts of arithmetic operations. 3. To help students in understanding of addressing modes and memory organization. 4. To understand Conceptualize multitasking ability of a computer and pipelining 5. To facilitate students in learning IO communication	
Course Outcomes (Expected Outcome):	On completion of the course, the students will be able to 1. Understand 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. Understand the concepts of number representation and their operation. 5. Understand 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 Books:	[1] 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. [2] John P. Hayes, ―Computer Architecture and Organization‖, McGraw Hill Publication. [3] DA Patterson and JLHennessy, Computer Organization and Design, Morgan Kaufmann Publisher, 2nd edition [4] A.S. Tanenbaum, "Structured Computer Organization", PHI Publication.	
Evaluation: Continuous Assessment (30 %), Assignments/Quizzes/Projects (20%), Term End Examination (50%) (Suggested)		

Cognitive Technology

5KS04	**Cognitive Technology**	**L-3, T-0, C-3**
Course Prerequisite:		
Objectives:	1. To study the basic concepts and approaches in the field of cognitive science 2. To apply the concepts of planning, reasoning and learning models in cognitive applications 3. To analyze language and semantic models of cognitive process.	
Course Outcomes (Expected Outcome):	On completion of the course, the students will be able to 1. Students will be able to understand the basic concept of cognitive science 2. Learn and understand the learning model and apply the same to appropriate real world applications 3. Apply reasoning methodology to real world applications 4. Students will understand and apply declarative and logic models 5. Envisage the concept of cognitive learning 6. Acquire knowledge in language processing and understanding	
Unit I:	**Introduction to Cognitive Science**	**Hours: 7**
Fundamental Concepts of cognitive science – Computers in Cognitive Science – Applied Cognitive Science – The Interdisciplinary Nature of Cognitive Science – Artificial Intelligence: Knowledge representation, semantic networks, frames, conceptual dependency, scripts, Ontology-Understanding Common Sense Reasoning.		
Unit II:	**Planning and Learning Methods**	**Hours: 7**
Planning – Situation Logic- Learning in Cognitive Systems- Rote Learning – Learning by Examples - Incremental Concept Learning – Inductive Learning - Classification Techniques – Statistical Reasoning- Bayesian Classification- Bayesian Networks- Concept Learning- Version Spaces - Discrimination Trees.		
Unit III:	**Reasoning methods**	**Hours: 8**
Reasoning by analogy – Explanation based reasoning – Case based reasoning- Constraint Satisfaction- Constraint Propagation- Temporal reasoning – Temporal Constraint Networks- Spatial reasoning- Visual Spatial reasoning- Meta reasoning – Learning by correcting mistakes- AI ethics		
Unit IV:	**Cognitive Modeling**	**Hours:6**
Declarative/ logic-based computational cognitive modelling - connectionist models of cognition - Bayesian models of cognition - Cognitive Models of Memory and Language - Computational models of episodic and semantic memory - modelling psycholinguistics (with emphasis on lexical semantics) - towards deep understanding - modelling the interaction of language, memory and learning.		
Unit V:	**Cognitive Development**	**Hours: 7**
Modelling Select Aspects of Cognition Classical models of rationality - symbolic reasoning and decision making under uncertainty - Formal models of inductive generalization causality - Categorization and similarity analysis.		

Unit VI:	Language and Semantic Processing:	Hours: 7
Knowledge Acquisition – Semantics in Cognitive Science – Meaning and Entailment – Cognitive and Computational Models of Semantic Processing – Information Processing Models of the Mind- Physical symbol systems and language of thought- Applying the Symbolic Paradigm- Neural networks and distributed information processing- Neural network models of Cognitive Processes- Dynamical systems and situated cognition		
Text Books:	1. José Luis Bermúdez, ―Cognitive Science: An Introduction to the Science of the Mind‖, Cambridge University Press, New York, 2014. 2. Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing‖, IGI Global Publishers, 2019. 3. Elaine Rich, Kevin Knight, Shivashankar B. Nair, ―Artificial Intelligence‖, Third Edition, Tata McGraw-Hill Education, 2012.	
Reference Books:	1. Stuart J. Russell, Peter Norvig, ―Artificial Intelligence - A Modern Approach‖, Third Edition, Pearson Publishers, 2015. 2. Paul Miller, ―An Introductory Course in Computational Neuroscience‖, MIT Press, 2018. 3. Jerome R. Busemeyer, Zheng Wang, James T. Townsend, Ami Eidels(Ed), ―The Oxford Handbook of Computational and Mathematical Psychology‖,Oxford University Press (2015). 4. Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein, ―Cognitive Science: An Introduction‖, Second Edition, MIT press,1995.	
Evaluation: Continuous Assessment (30 %), Assignments/Quizzes/Projects (20%), Term End Examination (50%) (Suggested)		

Proposed Syllabus for Data Science and Statistics

5KS04	Data Science and Statistics	(L-3, T-0, C-3)
Course Prerequisite:	Discrete Structures & Graph Theory	
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: 1. To understand the need of data science and Statistics 2. To understand the computational statistics in data science. 3. To understand and apply the different data modeling strategies. 4. To learn data analytics using python programming. 5. To be conversant with advances in analytics. 6. To apply principles of Data Science to the analysis of business problems.	
Course Outcomes (Expected Outcome):	On completion of the course, the students will be able to 1. Explain basics and need of data science 2. Demonstrate proficiency with statistical analysis of data. 3. Perform linear and multiple linear regression analysis. 4. Develop the ability to build and assess classification-based models 5. Evaluate outcomes and make decisions based on data. 6. Compare machine learning techniques to solve data science business problems	
Unit I:	**Introduction to Data Science**	**Hours: 6**
Basics and need of data science, Applications of data science, Exploratory Data Analysis, the Data Science Process, Stages of a Data Science Project, Data Science life cycle, Data: Data types, Data Collection, Need of data wrangling, Methods: Data Cleaning, Data Integration, Data reduction, Data transformation, data discretization.		
Unit II:	**Statistical Inference**	**Hours: 6**
Need of Statistics in Data Science, Measures of central tendency: Mean, Median, Mode, Mid-range. Measures of Dispersion: Range, variance, Mean deviation, standard deviation, Bays theorem Basics and need of hypothesis and hypothesis testing, Pearson correlation, sample hypothesis testing, chi-square tests, t-test.		
Unit III:	**Regression and its techniques**	**Hours: 6**
Basics of regression, simple and multiple regression, Ridge regression, Lasso regression, Selecting the Tuning Parameter, Tradeoff Between Prediction Accuracy and Model Interpretability,		
Unit IV:	**Classification**	**Hours: 6**
Classification: An Overview of Classification, why not Linear Regression? Naïve based decision trees, Regression vs Classification Problems, Logical Regression: The Logistic Model, Regression Coefficients, Making Predictions, Multiple Logistic Regression, Classification Problems, The Bootstrap		
Unit V:	**Tree Based Methods**	**Hours: 6**

Tree-Based Methods: Decision, Regression and Classification Trees, Trees Versus Linear Models, Advantages and Disadvantages, Bagging, Random Forests, Boosting, Generalized Additive Models: Regression Problems and Classification Problems.

Versus Linear Models, Advantages and Disadvantages, Bagging, Random Forests, Boosting

Unit VI:	Supervised and Unsupervised Learning	Hours: 6

Supervised learning methods overview, challenges, random forest algorithm, Unsupervised Learning: The Challenge of Unsupervised Learning: Principal Components Analysis, Clustering Methods: K-Means Clustering, Hierarchical Clustering, Practical Issues in Clustering.

Text Books:

Chirag Shah," A Hands-on Introduction to Data Science ", Cambridge University Press (2020) ISBN:978-1-108-47244-9.

Reference Books:

1. [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.

Evaluation:

Continuous Assessment (30 %), Assignments/Quizzes/Projects (20%), Term End Examination (50%) **(Suggested)**

INTERNET OF THINGS

Subject Code 5KS04	INTERNET OF THINGS	**L-3, T-0, C-0**
Course Prerequisite:	Participants will be expected to have a good background in Internet.	
Course Objectives:		
Course Outcomes (Expected Outcome):	On completion of the course, the students will be able to:	
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 Books:

1. 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

"Introduction to Cyber Security"

Subject Code 5KS04	Introduction to Cyber Security	L-3, T-0, C-0
Course Prerequisite:	Participants will be expected to have a good background in Cyber Security.	
Course Objectives:	1. Understand basics of Cyber Security. 2. To be able to secure a message over network. 3. To understand overall network working mechanism for secure data flow. 4. To understand network security protocols and attack prevention.	
Course Outcomes (Expected Outcome):	On completion of the course, the students will be able to: 1. Understanding the basics concepts of Cyber Security 2. Discussing the concepts of cryptography and its implementation in secure network data flow. 3. Provide security of the data over the network. 4. A good knowledge of some commonly used cryptographic primitives and protocols.	
Unit I:		**Hours: 6**
Introduction to Information Security, Data and Network Security, Cryptographic Techniques, Computer-based Symmetric and Asymmetric Key, Need for Security, Security Attacks, Services and Mechanisms, Network Security, Model		
Unit II:		**Hours: 7**
Cryptographic Techniques, Cryptographic Algorithms: Substitution &Transposition Techniques, Block Cipher, Stream Ciphers, RC4, DES, AES, Triple DES, Digital Signature – Properties of Digital Signature, Public Key Protocol; Certificates; Certificate Authorities, Internet Security Protocols.		
Unit III:		**Hours: 7**
Authentication: Requirements, Message Authentication Codes, Algorithms: Hashes, MD5 & SHA, Authentication Techniques: JSON web token (JWT), Password, Certificate based & Biometric Authentication, Kerberos, Authentication Services: Auth0, Identity Server		
Unit IV:		**Hours: 7**
Introduction: Virtual Private Network (VPN), Virtual Private Cloud (VPC), Subnet, VPC Routing, Private & public VPN, Domain Name System (DNS), Firewalls, Internet gateways, VPC endpoints, VPC peering, Security: Secure Socket Layer (SSL), Transport Layer Security (TLS), Web Security Requirements, Secure Electronic Transaction (SET)		
Unit V:		**Hours: 7**
Network Threads, Security Control Mechanisms: Encryption, Content Integrity (Hash Technique), Authentication (JWT bearer token), Access Controls, Data Flow Security, Firewall: Types of Firewalls, Personal Firewalls, Advantages & disadvantages, Intruders, Viruses and related threats. Intrusion Detection Systems, Denial of service attacks.		
Unit VI:		**Hours: 7**
Defining Intrusion, Intrusion Detection, Strategies for Intrusion Detection, Vulnerability		

Analysis, Credentialed approaches, Planning Security Policies; Risk Analysis; Security Policies for an Organization; External Security. Intrusion Detection Systems, Response, Scanning, Threat Management.

Text Books:

2. William Stallings, –Cryptography & Network Security‖, PHI.
3. Forouzan, –Cryptography & Network Security‖, PHI 4.
4. Cryptography And Network Security Principles and Practice Fourth Edition, William Stallings, Pearson Education
5. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall PTR
6. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall
7. Cryptography: Theory and Practice by Douglas R. Stinson, CRC press.

Reference Books:

4. Cryptography And Network Security, Principles and Practice Sixth Edition, William Stallings, Pearson
5. Information Security Principles and Practice By Mark Stamp, Willy India Edition
6. Cryptography & Network Security, Forouzan, Mukhopadhyay, McGrawHill
7. Cryptography and Network Security Atul Kahate, TMH
8. Cryptography and Security, C K Shyamala, N Harini, T R Padmanabhan, Wiley-India
9. Information Systems Security, Godbole, Wiley-India
10. Information Security Principles and Practice, Deven Shah, Wiley-India
11. Security in Computing by Pfleeger and Pfleeger, PHI
12. Build Your Own Security Lab : A Field Guide for network testing, Michael Gregg, Wiley India

Principles of e-Marketing for Engineering

5KS05	Principles of e-Marketing for Engineering	L-3, T-0, C-3
Course Prerequisite:		
Objectives:	6. To provide students with the knowledge about business advantages of the digital marketing and its importance for marketing success; 7. To develop a digital marketing plan; to make SWOT analysis; 8. To define a target group; to introduced to various digital channels, their advantages and ways of integration; 9. 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 6. To identify the importance of the digital marketing for marketing success, 7. To manage customer relationships across all digital channels and build better customer relationships, 8. To create a digital marketing plan, starting from the SWOT analysis and defining a target group, 9. To identifying 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 & socia l 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 Books:	[1] 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. .	
Evaluation: Continuous Assessment (30 %), Assignments/Quizzes/Projects (20%), Term End Examination (50%) (Suggested)		

Fundamentals of Finance & Accounting

5KS05	**Fundamentals of Finance & Accounting**	**L-3, T-0, C-3**
Course Prerequisite:		
Objectives:	Students will be expected to demonstrate their understanding of the following: 10. Know and apply accounting and finance theory 11. Critically evaluate financial statement information 12. Evaluate and compare different investments	
Course Outcomes (Expected Outcome):	On completion of the course, the students will be able to 11. Define bookkeeping and accounting 12. Explain the general purposes and functions of accounting 13. Explain the differences between management and financial accounting 14. Describe the main elements of financial accounting information – assets, liabilities, revenue and expenses 15. 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.	
Evaluation: Continuous Assessment (30 %), Assignments/Quizzes/Projects (20%), Term End Examination (50%) (Suggested)		

Entrepreneurship

5KS05	**Entrepreneurship**	L-3, T-0, C-3
Course Prerequisite:		
Objectives:	13. To explore and experience the joy of creating unique solutions to market opportunities 14. To create and exploit innovative business ideas and market opportunities 15. To turn market opportunities into a business plan 16. To build a mindset focusing on developing novel and unique approaches to market opportunities	
Course Outcomes (Expected Outcome):	On completion of the course, the students will be able to 16. Develop awareness about entrepreneurship and successful entrepreneurs. 17. Develop an entrepreneurial mind-set by learning key skills such as design, personal selling, and communication. 18. Understand the DNA of an entrepreneur and assess their strengths and weaknesses from an entrepreneurial perspective	
Unit I:	**Spirit of Entrepreneurship**	**Hours: 7**
Entrepreneurship **process, ecosystem, Economic relevance of** Entrepreneurship, Societal & Personal Entrepreneurship Ecosystem, The Entrepreneurship Mind, Success factors to be an Entrepreneurship, Components of an Entrepreneurial Mind-set, Innovation, Innovation and Imitation, Entrepreneurs in Innovation Process, Commercialization of Innovations.		
Unit II:	**Entrepreneurship Reconsidered**	**Hours: 7**
Importance of Team and Special role of the CEO, Team Building, Collaboration, Cooperation Networking, Diagnosing the Internal Capabilities, analysis, Understanding - the Market & Custome access, Industry dynamics & competitive environment, Classical Competitive analysis.		
Unit III:	**Building a New Business**	**Hours: 8**
Exploring the Innovation Funnel, Generation & Pre-Field Assessment of the Business Idea, Important Components of Concepts, Sales function in Business Building Process, The New Business Model.		
Unit IV:	**Entrepreneurial Strategies**	**Hours:6**
Strategic Thrust of the Entrepreneurial Company, Entrepreneurial Perspective, OSA Process, Key Performance Indicators, Market Segmentation, Strategic Options for Entrepreneurs – Entrepreneurial, Complementary and Competitive, Customer Understanding, Developing the Entrepreneurial Strategy.		
Unit V:	**Formulating the Business Plan**	**Hours: 7**
Pre-Field Work to the Business Plan, Business Plan as Road Map & Key Document, Contents of Business Plan, Projected Economics, Risk Management, Identification & Evaluation of Risk, Risk Controlling, Lesson Learned and Recommendations for Entrepreneurs.		

Unit VI:	Entrepreneurial Growth	Hours: 7
Making transition from start-up to growth, A model of driving forces, Growth Process, Opportunity Domain. Social Entrepreneurship – Overview, New form of Organization, Identifying Opportunity Forming Organization, Securing Resources, Going to Scale.		
Text Books:	**1. Entrepreneurship for Engineers,** Helmut Kohlert, Dawud Fadai & Hans-Ulrich Sachs, 2nd Editiion, Oldenbourg Verlag Munchen **2. Entrepreneurship,** William Bygrave, Andrew Zacharakis, 2nd Edition, John Wiley & Sons, Inc.	
Reference Books:	1. **Entrepreneurship for Engineers,** Kenji Uchino, Taylor & Francis Group, CRC Press. 2. **Entrepreneurship: Theory, Process, Practice,** Howard Frederick, Allan O'Connor, Donald Kuratko, 4th Edition, Cengage Learning. 3. **Entrepreneurship: Owing Your Future,** Steve Mariotti, 11th Edition, Prentice Hall.	
Evaluation: Continuous Assessment (30 %), Assignments/Quizzes/Projects (20%), Term End Examination (50%) (Suggested)		

5KS06 Database Management Systems Lab

Course Code: 5KS06	Course Title: **Database Management Systems Lab**	LTPC: P-2, C-1
Course Prerequisite:	Basic concept of programming, Basic concepts of data structures	
Course Objectives:	1. 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. 2. To study the primary data model (relational model) for commercial data processing applications. 3. To study the standard structured query language and retrieve the information from the database in various ways. 4. To study the integrity and security constraints of the database by enforcing constraints.	
Course Outcomes(Expected Outcome):	1. To design ER model for any kind of application. 2. To design and develop database. 3. To apply normalization. 4. To query the database. 5. To apply various integrity constraints 6. To build indices, views 7. To implement triggers, assertions	

List of Experiments : Preferably 25 Experiments out of 25 20 may be based on syllabi and at least 05 should be beyond syllabi based on learning of syllabi (Apply)

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.

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

Evaluation: Continuous Assessment (50 %) Term End Examination (50%)-suggested

5KS07 Proposed Syllabus for Compiler Design – Lab

5KS07	Compiler Design – Lab	Practical – 02 Hour/Week Credit – 01
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: 1. Know the basic components of a Compiler. 2. To implement Lexical Analyzer using Lex tool and Syntax Analyzer using Yaac Tool. 3. To implement various parsing methods. 4. 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:	Preferably **25** Experiments. **20** may be based on syllabi and at least **05** 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.
E → E+E / E*E / a / b
[23] Implement a symbol table containing functions create(), modify(), search(), display() and delete().
[24] Implement three address Code for the input a=b*c.
[25] Implement Recursive Decent Parser for the given 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 Books:

[1] 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.

Evaluation:

Continuous Assessment (50 %), Term End Examination (50%) **(Suggested)**

Security Policy & Governance

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.

Design and Analysis of Algorithms

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 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

Software Engineering

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, 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: **06**
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:**06**
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: **06**
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: **06**
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.
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)

Natural Language Processing

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:0**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:0**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: **06**
Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar, Dependency Grammar, Syntactic Parsing, Ambiguity, Probabilistic CFG, Probabilistic Lexicalized CFGs		
Unit IV:	**Semantic Analysis**	Hours:**06**
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: **06**
Supervised classification, Further examples of Supervised classification, Evaluation, Decision Trees, Naïve Bayes classifiers, Modelling Linguistic Patterns.		
Unit VI:	**Extraction Information from Text**	Hours: **06**
Information Extraction, Chunking, Developing and Evaluating Chunks, Recursion in Linguistic Structure, Named Entity Recognition, Relation Extraction		
Text Book: 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 Edition , Prentice Hall,2008.
7. Charu C.Aggarwal - Machine Learning for Text, Springer,2018 edition

Big Data Analytics

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.

Sensors and Actuators

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.

Cryptography

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 Cryptogrphy 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: 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.

Computational Biology

6KSO5	Computational Biology	L-3,T-0,C-3
Course Prerequisite:		
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 Sequeces 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 Book:

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.

Cyber Laws & Ethics

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, InformationTechnology, 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: 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.

Augastine, Paul T., "Cyber Crimes and Legal Issues", Crecent Publishing Corporation, 2007.

Intellectual Property Rights

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.

Design and Analysis of Algorithms Lab

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.

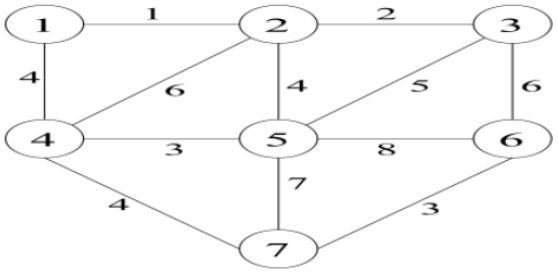
[5]Study and Implement the Divide and Conquer strategy using the Merge sort Algorithm and determine the complexity of an algorithm.

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.

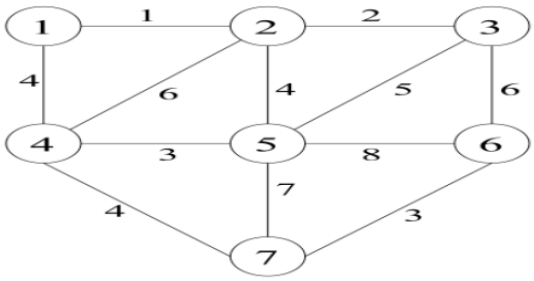
[7] Explain the knapsack algorithm to find an optimal solution of getting maximum profit and implement using the program.

[8] Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm and implement using C.



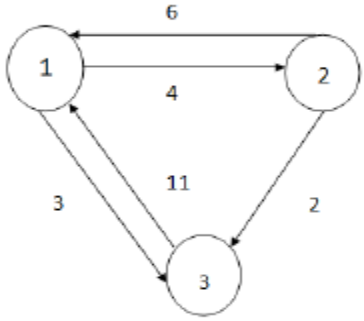
[9] Implement programs to find minimum cost spanning trees from a given graph using Prim's algorithm.

[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

Software Engineering Lab

6KS07	**Software Engineering Lab**	**P-2, C-1**
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 Statechart Diagram , State , Transition , Action , Guidelines for drawing Statechart 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)

C Skill Lab IV (DevOps)

6KS09	C Skill Lab IV– LAB	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 is Jenkins, continuous integration 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, 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 Books:

[1] 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