



AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

(Approved by A.I.C.T.E., New Delhi & Permanently Affiliated to JNTU-GV, Vizianagaram)

NAAC “A+” Accredited Institute

Cherukupally (Village), Near Tagarapuvalasa Bridge, Vizianagaram (Dist), AP, Pin-531162.

www.aietta.ac.in, principal@aietta.ac.in

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Institute Vision:

To develop highly skilled professionals with strong ethical and human values.

Institute Mission:

M1: To impart quality education through effective teaching–learning practices, industrial exposure, and professional training.

M2: To produce competent and highly knowledgeable graduates with a positive attitude and problem-solving ability.

M3: To instill self-confidence, leadership qualities, and social responsibility to face professional and societal challenges.

Department Vision:

To emerge as a center of excellence in Computer Science and Engineering education and research, producing competent, industry-ready professionals with innovation, ethical values, and social responsibility.

Department Mission:

M1: To impart strong foundational knowledge in computer science, programming, and emerging technologies through effective teaching–learning practices.

M2: To develop problem-solving, analytical, and research skills by encouraging innovation, projects, and industry interaction.

M3: To produce industry-ready professionals with proficiency in modern tools, teamwork, and professional communication.

M4: To inculcate ethical values, social responsibility, and lifelong learning skills to meet professional and societal challenges.

Program Educational Objectives (PEOs):

PEO1: Graduates will apply strong foundations in computer science, mathematics, and engineering principles to analyze and solve real-world problems.

PEO2: Graduates will design, develop, and deploy software systems and applications using modern Engineering tools, technologies, and industry-standard practices.



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PEO3: Graduates will pursue successful careers in industry, entrepreneurship, higher education, or research through continuous learning and skill enhancement.

PEO4: Graduates will demonstrate professional ethics, effective communication, teamwork, and leadership while contributing responsibly to society.

Program Specific Outcomes (PSOs):

PSO1: Apply core computing concepts to design efficient software and systems.

PSO2: Use modern tools and emerging technologies to solve real-world problems ethically.

Program Outcomes (POs):

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)



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PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8).



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III B. Tech – I Semester						
S.No	Course Code	Courses	Hours per week			Credits
			L	T	P	C
1	PC	Computer Networks	3	0	0	3
2	PC	Design and Analysis of Algorithms	3	0	0	3
3	PC	Data Warehousing and Data Mining	3	0	0	3
4	Open Elective / Job Oriented	Open Elective-I Open Electives offered by other departments/ Optimization in Operations Research (Job oriented course)	3	0	0	3
5	PE	Professional Elective-I Artificial Intelligence Software Project Management Distributed Systems Advanced Unix Programming	3	0	0	3
6	PC	Data Warehousing and Data Mining Lab	0	0	3	1.5
7	PC	Computer Networks Lab	0	0	3	1.5
8	SO	Skill Oriented Course – III 1. Animation course: Animation Design OR 2. Continuous Integration and Continuous Delivery using DevOps	0	0	4	2
9	MC	Employability Skills-I	2	0	0	0
10	PR	Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester	0	0	0	1.5
Total credits						21.5
11	Minor	Database Management Systems ^{\$}	3	0	2	3+1
12	Honors	Any course from the Pool, as per the opted track	4	0	0	4

^{\$}- Integrated Course



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III B. Tech – II Semester						
S.No	Course Code	Courses	Hours per week			Credits
			L	T	P	C
1	PC	Machine Learning	3	0	0	3
2	PC	Compiler Design	3	0	0	3
3	PC	Cryptography and Network Security	3	0	0	3
4	PE	Professional Elective-II 1.Mobile Computing 2.Big Data Analytics 3.Object Oriented Analysis and Design 4.Network Programming	3	0	0	3
5	Open Elective /Job Oriented	Open Elective-II Open Electives offered by other departments/ MEAN Stack Development (<i>Job Oriented</i>)	3	0	0	3
6	PC	Machine Learning using Python Lab	0	0	3	1.5
7	PC	Compiler Design Lab	0	0	3	1.5
8	PC	Cryptography and Network Security Lab	0	0	3	1.5
9	SO	Skill Oriented Course - IV 1.Big Data:Spark OR 2.MEAN Stack Technologies-Module I (HTML 5, JavaScript, Node.js, Express.js and TypeScript)	0	0	4	2
10	MC	Employability skills-II	2	0	0	0
Total credits						21.5
Industrial/Research Internship(Mandatory) 2 Months during summer vacation						
11	Minor	Data Structures and Algorithms ^{\$}	3	0	2	3+1
12	Honors	Any course from the Pool, as per the opted track	4	0	0	4
Minor course through SWAYAM			-	-	-	2

\$- Integrated Course



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year – I Semester		L	T	P	C
		3	0	0	3
COMPUTER NETWORKS					

Course Objectives:

- To provide insight about networks, topologies, and the key concepts.
- To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
- To understand the principles, key protocols, design issues, and significance of each layers in ISO and TCP/IP.
- To know the basic concepts of network services and various network applications.

Course Outcomes:

By the end of the course, the student will be able to

- Demonstrate different network models for networking links OSI, TCP/IP, B-ISDN, N-BISDN and get knowledge about various communication techniques, methods and protocol standards.
- Discuss different transmission media and different switching networks.
- Analyze data link layer services, functions and protocols like HDLC and PPP.
- Compare and Classify medium access control protocols like ALOHA, CSMA, CSMA/CD, CSMA/CA, Polling, Token passing, FDMA, TDMA, CDMA protocols
- Determine application layer services and client server protocols working with the client server paradigms like WWW, HTTP, FTP, e-mail and SNMP etc.

UNIT I:

Introduction: Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP, Lack of OSI models success, Internet History.

Physical Layer –Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and unguided media: Wireless-Radio waves, microwaves, infrared.

UNIT II:

Data link layer: Design issues, **Framing:** fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, **Elementary Data Link Layer protocols:** simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel.

Sliding window protocol: One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC: configuration and transfer modes, frames, control field, point to point protocol (PPP): framing transition phase, multiplexing, multi link PPP.

UNIT – III:

Media Access Control: Random Access: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA).

Wired LANs: Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.



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UNIT – IV:

The Network Layer Design Issues – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention policies, Approaches to Congestion Control-Traffic Aware Routing- Admission Control-Traffic Throttling-Load Shedding. Traffic Control Algorithm-Leaky bucket & Token bucket.

Internet Working: How networks differ- How networks can be connected- Tunnelling, internetwork routing-, Fragmentation, network layer in the internet – IP protocols-IP Version 4 protocol-IPV4 Header Format, IP addresses, Class full Addressing, CIDR, NAT-, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4 to IPV6, Comparison of IPV4 & IPV6- Internet control protocols- ICMP-ARP-DHCP

UNIT –V:

The Transport Layer: Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services-TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control, Congestion control in TCP.

Application Layer — World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System: Name Space, DNS in Internet , - Resolution-Caching- Resource Records- DNS messages- Registrars-security of DNS Name Servers, SNMP.

Text Books:

1. Computer Networks — Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2. Data Communications and Networks – Behrouz A. Forouzan, Fifth Edition TMH.

References Books:

1. Data Communications and Networks- Achut S Godbole, Atul Kahate
2. Computer Networks, Mayank Dave, CENGAGE



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III Year – I Semester				
	L	T	P	C
	3	0	0	3
DESIGN AND ANALYSIS OF ALGORITHMS				

Course Objectives:

Upon completion of this course, students will be able to do the following:

- Ability to understand, analyze and denote time complexities of algorithms
- To introduce the different algorithmic approaches for problem solving through numerous example problems
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.
- To provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness

Course Outcomes: After the completion of the course, student will be able to

- Analyze the performance of a given algorithm, denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms
- List and describe various algorithmic approaches and Solve problems using divide and conquer & greedy Method
- Synthesize efficient algorithms dynamic programming approaches to solve in common engineering design situations.
- Organize important algorithmic design paradigms and methods of analysis: backtracking, branch and bound algorithmic approaches
- Demonstrate NP- Completeness theory ,lower bound theory and String Matching

UNIT I:

Introduction: Algorithm Definition, Algorithm Specification, performance Analysis, Performance measurement, asymptotic notation, Randomized Algorithms.

UNIT II:

Divide and Conquer: General Method, Defective chessboard, Binary Search, finding the maximum and minimum, Merge sort, Quick sort.

The Greedy Method: The general Method, knapsack problem, minimum-cost spanning Trees, Optimal Merge Patterns, Single Source Shortest Paths.

UNIT III:

Dynamic Programming: The general method, multistage graphs, All pairs-shortest paths, optimal Binary search trees, 0/1 knapsack, The traveling salesperson problem.

UNIT IV:

Backtracking: The General Method, The 8-Queens problem, sum of subsets, Graph coloring, Hamiltonian cycles, knapsack problem.

UNIT V:

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem.



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Text Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, 2nd Edition, Universities Press.
2. Introduction to Algorithms Thomas H. Cormen, PHI Learning
3. Harsh Bhasin, “Algorithms Design & Analysis”, Oxford University Press.

Reference Books:

1. Horowitz E. Sahani S: “Fundamentals of Computer Algorithms”, 2nd Edition, Galgotia Publications, 2008.
2. S. Sridhar, “Design and Analysis of Algorithms”, Oxford University Press.



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III Year – I Semester				
	L	T	P	C
	3	0	0	3
DATA WAREHOUSING AND DATA MINING				

Course Objectives:

The main objective of the course is to

- Introduce basic concepts and techniques of data warehousing and data mining
- Examine the types of the data to be mined and apply pre-processing methods on raw data
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

Course Outcomes:

By the end of the course student will be able to

- Illustrate the importance of Data Warehousing, Data Mining and its functionalities and Design schema for real time data warehousing applications.
- Demonstrate on various Data Preprocessing Techniques viz. data cleaning, data integration, data transformation and data reduction and Process raw data to make it suitable for various data mining algorithms.
- Choose appropriate classification technique to perform classification, model building and evaluation.
- Make use of association rule mining techniques viz. Apriori and FP Growth algorithms and analyze on frequent itemsets generation.
- Identify and apply various clustering algorithm (with open source tools), interpret, evaluate and report the result.

UNIT I:

Data Warehousing and Online Analytical Processing: Data Warehouse: Basic concepts, Data Warehouse Modelling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Introduction: Why and What is data mining, What kinds of data need to be mined and patterns can be mined, Which technologies are used, Which kinds of applications are targeted.

UNIT II:

Data Pre-processing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT III:

Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Scalability and Decision Tree Induction, Visual Mining for Decision Tree Induction.

UNIT IV:

Association Analysis: Problem Definition, Frequent Item set Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP-Growth Algorithm.

UNIT V:

Cluster Analysis: Overview, Basics and Importance of Cluster Analysis, Clustering techniques, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bi-secting K Means,



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Text Books:

1. Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier, 2011.
2. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.

Reference Books:

1. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
2. Data Mining: Vikram Pudi and P. Radha Krishna, Oxford Publisher.
3. Data Mining and Analysis - Fundamental Concepts and Algorithms; Mohammed J. Zaki, Wagner Meira, Jr, Oxford
4. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.
http://onlinecourses.nptel.ac.in/noc18_cs14/preview
5. (NPTEL course by Prof. Pabitra Mitra)
http://onlinecourses.nptel.ac.in/noc17_mg24/preview
6. (NPTEL course by Dr. Nandan Sudarshanam & Dr. Balaraman Ravindran)
http://www.saedsayad.com/data_mining_map.htm



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III Year – I Semester		L	T	P	C
		3	0	0	3
OPTIMIZATION IN OPERATIONS RESEARCH (Job Oriented Course)					

Course Objectives:

- To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
- To state single variable and multi variable optimization problems, without and with constraints.
- To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
- To state transportation and assignment problem as a linear programming problem to determine Simplex method.
- To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.

Course Outcomes: At the end of the course, student will be able to

- State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.
- Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.
- Apply and Solve transportation and assignment problem by using Linear programming Simplex method.
- Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions
- Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.

UNIT I:

Introduction and Classical Optimization Techniques: Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems.

Classical Optimization Techniques: Single variable Optimization, multi variable Optimization without constraints, necessary and sufficient conditions for minimum/maximum, multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers, multivariable Optimization with inequality constraints, Kuhn – Tucker conditions

UNIT II: Linear Programming : Standard form of a linear programming problem, geometry of linear programming problems, definitions and theorems, solution of a system of linear simultaneous equations, pivotal reduction of a general system of equations, motivation to the simplex method, simplex algorithm, Duality in Linear Programming, Dual Simplex method.

UNIT III: Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method, testing for optimality of balanced transportation problems, Special cases in transportation problem.

UNIT IV: Nonlinear Programming: Unconstrained cases, One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method, Univariate method, Powell's method and steepest descent method.

Constrained cases– Characteristics of a constrained problem, Classification, Basic approach of Penalty



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Function method; Basic approaches of Interior and Exterior penalty function methods, Introduction to convex Programming Problem.

UNIT V: Dynamic Programming: Dynamic programming multistage decision processes, types, concept of sub optimization and the principle of optimality, computational procedure in dynamic programming, examples illustrating the calculus method of solution, examples illustrating the tabular method of solution.

Text Books:

1. “Engineering optimization: Theory and practice”, S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. “Introductory Operations Research”, H.S. Kasene & K.D. Kumar, Springer (India), Pvt. LTd.

Reference Books:

1. “Optimization Methods in Operations Research and systems Analysis”, by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Operations Research, Dr. S.D.Sharma, Kedarnath, Ramnath & Co



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III Year – I Semester		L	T	P	C
		3	0	0	3
ARTIFICIAL INTELLIGENCE (Professional Elective –I)					

Course Objectives: The student will be able to

- Know the methodology of Problem solving
- Implement basic AI algorithms
- Design and carry out an empirical evolution of different algorithms on a problem formalization

Course Outcomes (COs): At the end of the course, student will be able to

- Understand the fundamental concepts in Artificial Intelligence
- Analyze the applications of search strategies and problem reductions
- Apply the mathematical logic concepts.
- Develop the Knowledge representations in Artificial Intelligence.
- Explain the Fuzzy logic systems.

UNIT I:

Introduction to artificial intelligence: Introduction ,history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI.

UNIT II:

Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem

Search Strategies: exhaustive searches, heuristic search techniques, iterative-deepening A*, constraint satisfaction

UNIT III:

Logic concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in propositional logic, predicate logic

UNIT IV:

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR

Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure.

UNIT V:

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools.

Text Books:

1. Artificial Intelligence, Saroj Kaushik, CENGAGE Learning,
2. Artificial intelligence, A modern Approach , 2nd ed, Stuart Russel, Peter Norvig, PEA
3. Artificial Intelligence, Rich, Kevin Knight, Shiv Shankar B Nair, 3rd ed, TMH
4. Introduction to Artificial Intelligence, Patterson, PHI



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Reference Books:

1. Artificial intelligence, structures and Strategies for Complex problem solving, -George F Luger, 5th ed, PEA
2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
3. Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier



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III Year – I Semester				
	L	T	P	C
	3	0	0	3
SOFTWARE PROJECT MANAGEMENT (Professional Elective –I)				

Course Objectives:

At the end of the course, the student shall be able to:

- To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
- To compare and differentiate organization structures and project structures
- To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

Course outcomes:

Upon the completion of the course students will be able to:-

- Apply the process to be followed in the software development life-cycle models
- Apply the concepts of project management & planning
- Implement the project plans through managing people, communications and change
- Conduct activities necessary to successfully complete and close the Software projects
- Implement communication, modeling, and construction & deployment practices in software development

UNIT-I:

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

UNIT-II:

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT- III:

Model based software architectures: A Management perspective and technical perspective.

Work Flows of the process: Software process workflows, Iteration workflows.

Checkpoints of the process: Major mile stones, Minor Milestones, Periodic status assessments.

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

UNIT- IV:

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Process Automation: Automation Building blocks, The Project Environment.

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.



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UNIT-V:

Agile Methodology, ADAPTING to Scrum, Patterns for Adopting Scrum, Iterating towards Agility.

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

Text Books:

1. Software Project Management, Walker Royce, PEA, 2005.
2. Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
3. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.

Reference Books:

1. Software Project Management, Bob Hughes,3/e, Mike Cotterell, TMH
2. Software Project Management, Joel Henry, PEA
3. Software Project Management in practice, Pankaj Jalote, PEA, 2005,
4. Effective Software Project Management, Robert K.Wysocki, Wiley,2006
5. Project Management in IT, Kathy Schwalbe, Cengage



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III Year – I Semester		L	T	P	C
		3	0	0	3
DISTRIBUTED SYSTEMS (Professional Elective –I)					

Course Objectives:

- To understand the foundations of distributed systems.
- To learn issues related to clock Synchronization and the need for global state in distributed systems
- To learn distributed mutual exclusion and deadlock detection algorithms
- To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems
- To learn the characteristics of peer-to-peer and distributed shared memory systems

Course Outcomes:

At the end of the course, the students will be able to:

- Elucidate the foundations and issues of distributed systems
- Illustrate the various synchronization issues and global state for distributed systems
- Illustrate the Mutual Exclusion and Deadlock detection algorithms in distributed systems
- Describe the agreement protocols and fault tolerance mechanisms in distributed systems
- Describe the features of peer-to-peer and distributed shared memory systems

UNIT I:

Distributed Systems: Definition, Relation to computer system components, Motivation, Relation to parallel systems, Message-passing systems versus shared memory systems, Primitives for distributed communication, Synchronous versus asynchronous executions, Design issues and challenges.

A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state, Cuts, Past and future cones of an event, Models of process communications.

Logical Time: A framework for a system of logical clocks, Scalar time, Vector time, Physical clock synchronization: NTP.

UNIT II:

Message Ordering & Snapshots: Message ordering and group communication: Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order. Global state and snapshot recording algorithms: Introduction, System model and definitions, Snapshot algorithms for FIFO channels.

UNIT III:

Distributed Mutex & Deadlock: Distributed mutual exclusion algorithms: Introduction, Preliminaries, Lamport's algorithm, Ricart-Agrawala algorithm, Maekawa's algorithm, Suzuki-Kasami's broadcast algorithm. Deadlock detection in distributed systems: Introduction, System model, Preliminaries, Models of deadlocks, Knapp's classification, Algorithms for the single resource model, the AND model and the OR model.

UNIT IV:

Recovery & Consensus: Check pointing and rollback recovery: Introduction, Background and definitions, Issues in failure recovery, Checkpoint-based recovery, Log-based rollback recovery, Coordinated check pointing algorithm, Algorithm for asynchronous check pointing and recovery. Consensus and agreement algorithms: Problem definition, Overview of results, Agreement in a failure, free system, Agreement in synchronous systems with failures.



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UNIT V:

Peer-to-peer computing and overlay graphs: Introduction, Data indexing and overlays, Chord –Content addressable networks, Tapestry.

Distributed shared memory: Abstraction and advantages, Memory consistency models, Sharedmemory Mutual Exclusion.

Text Books:

1. Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore and Tim Kindberg, Fifth Edition, Pearson Education, 2012.
2. Distributed computing: Principles, algorithms, and systems, Ajay Kshemkalyani and Mukesh Singhal, Cambridge University Press, 2011.

Reference Books:

1. Distributed Operating Systems: Concepts and Design, Pradeep K Sinha, Prentice Hall of India, 2007.
2. Advanced concepts in operating systems. Mukesh Singhal and Niranjana G. Shivaratri, McGraw-Hill, 1994.
3. Distributed Systems: Principles and Paradigms, Tanenbaum A.S., Van Steen M., Pearson Education, 2007.

e-Resources:

- 1) <https://nptel.ac.in/courses/106/106/106106168/>



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year – I Semester		L	T	P	C
		3	0	0	3
ADVANCED UNIX PROGRAMMING (Professional Elective –I)					

Course Objectives:

Understanding the shell commands, shell programming, system calls of files and processes, signals, inter-process communication concepts and programming, TCP and UDP.

Course Outcomes: After finishing this course student will be able to:

- Gain good knowledge on Unix commands and awareness of shell programming
- Know about different system calls for files and directories
- Ability to know the working of processes and signals
- Application of client server program for IPC
- Knowledge about socket programming

UNIT-I:

Introduction, Architecture of unix, Responsibilities of shell, unix file system, vi editor. **Unix commands:** Some Basic Commands, file utilities, process utilities, text processing utilities, network utilities, disk utilities, backup utilities, Security by file permissions.

UNIT-II:

Shell Programming: shell variables, The Export command, The Profile File a Script Run During starting, The First Shell Script, The read command, Positional Parameters, The \$? Variable, Knowing the exit Status- More about the Set Command, The Exit command, Branching Control Structures, Loop Control Structures, The Continue and Break Statement- The Expr Command, Performing Integer Arithmetic- Real Arithmetic in Shell Programs- The here Document(<<), The Sleep Command, Debugging Scripts, The Script command, The Eval command, The Exec Command, Sample programs. **Files** - Introduction, file descriptors, open, creat, read, write, close, lseek, dup2, file status information-stat family, file and record locking- fcntl function, file permissions - chmod, fchmod, file ownership-chown, lchown, links-soft and hard links-symlink, link, unlink.

UNIT-III:

Directories-Creating, removing and changing Directories-mkdir, rmdir, chdir, obtaining current working directory-getcwd, Directory contents, Scanning Directories-opendir, readdir, closedir, rewinddir functions. **Process Control:** process identifiers, fork function, vfork function, exit function, wait and waitpid functions, exec functions, user identification. **Signals:** signal handling using signal function, kill and raise, alarm, pause, abort and sleep functions.

UNIT-IV:

IPC: introduction, pipes, FIFO's, client –server examples for pipes and FIFO's **message queues:** message queue structure in kernel, system calls of message queue, client-server example for message queue. **Semaphores:** definition, system calls of semaphores, semaphores structure in kernel, file locking using semaphores

UNIT-V:

Shared memory-system calls of shared memory, semaphore structure in kernel, client server example. **Sockets:** Introduction, overview, elementary socket system calls, TCP Echo program, UDP Echo program



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Text Books:

1. Unix the ultimate guide, 3rd edition, Sumitabha Das, TMH.
2. Advanced programming in the Unix environment by W. Richard Stevens.
3. Unix network programming by W. Richard Stevens.

Reference Books:

1. Introduction to Unix and shell programming, Venkateshmurthy
2. Unix and shell programming by B.M. Harwani, OXFORD university press.



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III Year – I Semester		L	T	P	C
		0	0	3	1.5
DATA WAREHOUSING AND DATA MINING LAB					

Course Objectives: The main objective of the course is to

- Inculcate Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment
- Design a data warehouse or data mart to present information needed by management in a form that is usable
- Emphasize hands-on experience working with all real data sets.
- Test real data sets using popular data mining tools such as WEKA, Python Libraries
- Develop ability to design various algorithms based on data mining tools.

Course Outcomes: By the end of the course student will be able to

- Design a data mart or data warehouse for any organization
- Extract knowledge using data mining techniques and enlist various algorithms used in information analysis of Data Mining Techniques
- Demonstrate the working of algorithms for data mining tasks such as association rule mining, classification for realistic data
- Implement and Analyze on knowledge flow application on data sets and Apply the suitable visualization techniques to output analytical results

Software Requirements: WEKA Tool/Python/R-Tool/Rapid Tool/Oracle Data mining

List of Experiments:

1. Creation of a Data Warehouse.

- Build Data Warehouse/Data Mart (using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics; or other data warehouse tools like Microsoft-SSIS, Informatica, Business Objects, etc.,)
- Design multi-dimensional data models namely Star, Snowflake and Fact Constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, manufacturing, Automobiles, sales etc).
- Write ETL scripts and implement using data warehouse tools.
- Perform Various OLAP operations such slice, dice, roll up, drill up and pivot

2. Explore machine learning tool “WEKA”

- Explore WEKA Data Mining/Machine Learning Toolkit.
- Downloading and/or installation of WEKA data mining toolkit.
- Understand the features of WEKA toolkit such as Explorer, Knowledge Flow interface, Experimenter, command-line interface.
- Navigate the options available in the WEKA (ex. Select attributes panel, Preprocess panel, Classify panel, Cluster panel, Associate panel and Visualize panel)
- Study the arff file format Explore the available data sets in WEKA. Load a data set (ex. Weather dataset, Iris dataset, etc.)
- Load each dataset and observe the following:
 1. List the attribute names and they types
 2. Number of records in each dataset
 3. Identify the class attribute (if any)
 4. Plot Histogram
 5. Determine the number of records for each class.
 6. Visualize the data in various dimensions



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3. Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets
 - Explore various options available in Weka for preprocessing data and apply Unsupervised filters like Discretization, Resample filter, etc. on each dataset
 - Load weather, nominal, Iris, Glass datasets into Weka and run Apriori Algorithm with different support and confidence values.
 - Study the rules generated. Apply different discretization filters on numerical attributes and run the Apriori association rule algorithm. Study the rules generated.
 - Derive interesting insights and observe the effect of discretization in the rule generation process.
4. Demonstrate performing classification on data sets
 - Load each dataset into Weka and run 1d3, J48 classification algorithm. Study the classifier output. Compute entropy values, Kappa statistic.
 - Extract if-then rules from the decision tree generated by the classifier, Observe the confusion matrix.
 - Load each dataset into Weka and perform Naïve-bayes classification and k-Nearest Neighbour classification. Interpret the results obtained.
 - Plot RoC Curves
 - Compare classification results of ID3, J48, Naïve-Bayes and k-NN classifiers for each dataset, and deduce which classifier is performing best and poor for each dataset and justify.
5. Demonstrate performing clustering of data sets
 - Load each dataset into Weka and run simple k-means clustering algorithm with different values of k (number of desired clusters).
 - Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights.
 - Explore other clustering techniques available in Weka.
 - Explore visualization features of Weka to visualize the clusters. Derive interesting insights and explain.
6. Demonstrate knowledge flow application on data sets
 - Develop a knowledge flow layout for finding strong association rules by using Apriori, FP Growth algorithms
 - Set up the knowledge flow to load an ARFF (batch mode) and perform a cross validation using J48 algorithm
 - Demonstrate plotting multiple ROC curves in the same plot window by using j48 and Random forest tree
7. Demonstrate ZeroR technique on Iris dataset (by using necessary preprocessing technique(s)) and share your observations
8. Write a java program to prepare a simulated data set with unique instances.
9. Write a Python program to generate frequent item sets / association rules using Apriori algorithm
10. Write a program to calculate chi-square value using Python. Report your observation.
11. Write a program of Naive Bayesian classification using Python programming language.
12. Implement a Java program to perform Apriori algorithm
13. Write a program to cluster your choice of data using simple k-means algorithm using JDK
14. Write a program of cluster analysis using simple k-means algorithm Python programming language.
15. Write a program to compute/display dissimilarity matrix (for your own dataset containing at least four instances with two attributes) using Python
16. Visualize the datasets using matplotlib in python.(Histogram, Box plot, Bar chart, Pie chart etc.,)



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III Year – I Semester		L	T	P	C
		0	0	3	1.5
COMPUTER NETWORKS LAB					

Course Objectives:

Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work

Course Outcomes:

By the end of the course student will be able to

- Know how reliable data communication is achieved through data link layer.
- Suggest appropriate routing algorithm for the network.
- Provide internet connection to the system and its installation.
- Work on various network management tools

List of Experiments:

1. Study of Network devices in detail and connect the computers in Local Area Network.
2. Write a Program to implement the data link layer framing methods such as
 - i) Character stuffing ii) bit stuffing.
3. Write a Program to implement data link layer framing method checksum.
4. Write a program for Hamming Code generation for error detection and correction.
5. Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
6. Write a Program to implement Sliding window protocol for Goback N.
7. Write a Program to implement Sliding window protocol for Selective repeat.
8. Write a Program to implement Stop and Wait Protocol.
9. Write a program for congestion control using leaky bucket algorithm
10. Write a Program to implement Dijkstra's algorithm to compute the Shortest path through a graph.
11. Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).
12. Write a Program to implement Broadcast tree by taking subnet of hosts.
13. Wireshark
 - i. Packet Capture Using Wire shark
 - ii. Starting Wire shark
 - iii. Viewing Captured Traffic
 - iv. Analysis and Statistics & Filters.
14. How to run Nmap scan
15. Operating System Detection using Nmap
16. Do the following using NS2 Simulator
 - i. NS2 Simulator-Introduction
 - ii. Simulate to Find the Number of Packets Dropped
 - iii. Simulate to Find the Number of Packets Dropped by TCP/UDP
 - iv. Simulate to Find the Number of Packets Dropped due to Congestion
 - v. Simulate to Compare Data Rate& Throughput.



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III Year – I Semester		L	T	P	C
		0	0	4	2
ANIMATION COURSE: ANIMATION DESIGN (Skill Oriented Course)					

Course Objectives:

The main objective of this course is to understand 2-D and 3-D animation using Adobe package

Course Outcomes:

At the end of the Course, Student will be able to:

- learn various tools of digital 2-D animation
- understand production pipeline to create 2-D animation.
- apply the tools to create 2D animation for films and videos
- understand different styles and treatment of content in 3D model creation
- apply tools to create effective 3D modelling texturing and lighting

List of Experiments:

1. Adobe Photoshop:
 - a. Create your visiting card
 - b. Create Title for any forthcoming film
2. Draw Cartoon Animation using reference
3. Creating Frame by Frame animation
4. Create a scene by using Mask layers animation
5. Adobe Illustrator:

Packet Design(Toothpaste packet, Soap cover, any Food product)
6. Create any model of the male or female character
7. Create any Model of Cars or Bike
8. Create any Model of any animal.
9. Create any Model of any birds, fishes, and worms.
10. Create and Convert 2D objects into 3D objects
11. Create an animated 3D titling with sound
12. Create any Model some objects such as chairs, tables, fruits, utensils

List of Augmented Experiments: (Weeks 13 – Week 16)

(Any two of the following experiments can be performed)

1. Animate day and night scene of a street with the help of lighting
2. Create a human character using Character studio and animate the same
3. Create a natural outdoor or indoor scene.
4. Apply texture on various objects and characters

Reference Books:

1. Flash MX 2004, Thyagarajan Anbumani, TMH.
2. Brian Underdahl, The Complete Reference – Macromedia Flash Mx2004, 2nd edition – TMH.

Web Links:

1. https://onlinecourses.swayam2.ac.in/cec21_cs07/preview
2. https://onlinecourses.swayam2.ac.in/ugc19_cs09/preview
3. https://onlinecourses.swayam2.ac.in/ntr20_ed15/preview
4. https://youtube.com/playlist?list=PLfFk8y2fd3FjeE_CrFASNvDLBp3yF1Hwi



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III Year – I Semester		L	T	P	C
		0	0	4	2
CONTINUOUS INTEGRATION AND CONTINUOUS DELIVERY USING DevOps (Skill Oriented Course)					

Course Outcomes:

At the end of the Course, Student will be able to:

- Understand the why, what and how of DevOps adoption
- Attain literacy on Devops
- Align capabilities required in the team
- Create an automated CICD pipeline using a stack of tools

List of Exercises:

Note: There are online courses indicated in the reference links section. Learners need to go through the contents in order to perform the given exercises

Exercise 1:

Reference course name : Software engineering and Agile software development
Get an understanding of the stages in software development lifecycle, the process models, values and principles of agility and the need for agile software development. This will enable you to work in projects following an agile approach to software development.
Solve the questions given in the reference course name to gauge your understanding of the topic

Exercise 2:

Reference course name: Development & Testing with Agile: Extreme Programming
Get a working knowledge of using extreme automation through XP programming practices of test first development, refactoring and automating test case writing.
Solve the questions in the “Take test” module given in the reference course name to gauge your understanding of the topic

Exercise 3:

Module name : DevOps adoption in projects
It is important to comprehend the need to automate the software development lifecycle stages through DevOps. Gain an understanding of the capabilities required to implement DevOps, continuous integration and continuous delivery practices.
Solve the questions given in Quiz1, Quiz2, Quiz 3

Exercise 4:

Module name :Implementation of CICD with Java and open source stack
Configure the web application and Version control using Git using Git commands and version control operations.

Exercise 5:

Module Name: Implementation of CICD with Java and open source stack
Configure a static code analyzer which will perform static analysis of the web application code and identify the coding practices that are not appropriate. Configure the profiles and dashboard of the static code analysis tool.



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Exercise 6:

Module Name: Implementation of CICD with Java and open source stack

Write a build script to build the application using a build automation tool like Maven. Create a folder structure that will run the build script and invoke the various software development build stages. This script should invoke the static analysis tool and unit test cases and deploy the application to a web application server like Tomcat.

Exercise 7:

Module Name: Implementation of CICD with Java and open source stack

Configure the Jenkins tool with the required paths, path variables, users and pipeline views.

Exercise 8:

Module name: Implementation of CICD with Java and open source stack

Configure the Jenkins pipeline to call the build script jobs and configure to run it whenever there is a change made to an application in the version control system. Make a change to the background color of the landing page of the web application and check if the configured pipeline runs.

Exercise 9:

Module name: Implementation of CICD with Java and open source stack

Create a pipeline view of the Jenkins pipeline used in Exercise 8. Configure it with user defined messages.

Exercise 10 :

Module name: Implementation of CICD with Java and open source stack

In the configured Jenkins pipeline created in Exercise 8 and 9, implement quality gates for static analysis of code.

Exercise 11:

Module name :Implementation of CICD with Java and open source stack

In the configured Jenkins pipeline created in Exercise 8 and 9, implement quality gates for static unit testing.

Exercise 12:

Module name :Course end assessment

In the configured Jenkins pipeline created in Exercise 8 and 9, implement quality gates for code coverage.

Reference Books:

1. Learning Continuous Integration with Jenkins: A beginner's guide to implementing Continuous Integration and Continuous Delivery using Jenkins - Nikhil Pathania ,Packt publication
[<https://www.amazon.in/Learning-Continuous-Integration-Jenkins-Pathania/dp/1785284835>]
2. Jenkins 2 – Up and Running: Evolve Your Deployment Pipeline for Next Generation Automation - Brent Laster, O'Reilly publication
[<https://www.amazon.in/Jenkins-2-Running-Brent-Laster/dp/1491979593>]

Hardware and software configuration:

1. Git [GitHub or Gitlab]
2. Sonarqube
3. Jenkins
4. JUnit
5. Eclipse



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6. Tomcat server
7. Maven
8. Cobertura or JaCoCo
9. Java SDK
10. All necessary drivers and jar files for connecting the software
11. Windows machine with 16GB RAM

Web Links: (Courses mapped to Infosys Springboard platform)

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_013382690411003904735_shared/overview [Software Engineering and Agile software development]
2. https://infyspringboard.onwingspan.com/en/viewer/html/lex_auth_01350157819497676810467 [Development & Testing with Agile: Extreme Programming]
3. https://infyspringboard.onwingspan.com/en/viewer/html/lex_auth_01353898917192499226_shared [DevOps CICD]



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III Year – I Semester		L	T	P	C
		2	0	0	0
EMPLOYABILITY SKILLS-I					

Course Objectives:

The main objective of this course is to assist students in developing employability skills and personal qualities related to gaining and sustaining employment.

Course Outcomes: The end of the course student will be able to

- Understand the corporate etiquette.
- Make presentations effectively with appropriate body language
- Be composed with positive attitude
- Understand the core competencies to succeed in professional and personal life

UNIT I:

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT II:

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT III:

Standard Operation Methods: Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

Verbal Ability: Synonyms, Antonyms, One Word Substitutes-Correction of Sentences-Analogies, Spotting Errors, Sentence Completion, Course of Action -Sentences Assumptions, Sentence Arguments, Reading Comprehension, Practice work

UNIT IV:

Job-Oriented Skills –I: Group Discussion, Mock Group Discussions

UNIT V:

Job-Oriented Skills –II: Resume Preparation, Interview Skills, Mock Interviews

Text Books and Reference Books:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.
3. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand & Company Ltd., 2018.
4. Raman, Meenakshi & Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

e-resources:

1. www.Indiabix.com
2. www.freshersworld.com



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year – I Semester	Minor Course	L	T	P	C
		3	0	2	4
DATABASE MANAGEMENT SYSTEMS					

Course Objectives:

This Course will enable students to

- introduce about database management systems
- give a good formal foundation on the relational model of data and usage of Relational Algebra
- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers
- introduce the concepts of basic SQL as a universal Database language
- demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization

Course Outcomes:

By the end of the course, the student will be able to

- Describe a relational database and object-oriented database
- Create, maintain and manipulate a relational database using SQL
- Describe ER model and normalization for database design
- Examine issues in data storage and query processing and can formulate appropriate solutions
- Outline the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage
- Examine integrity constraints to build efficient databases
- Apply Queries using Advanced Concepts of SQL
- Build PL/SQL programs including stored procedures, functions, cursors and triggers

UNIT I

Introduction: Database system, Characteristics (Database Vs File System), Database Users(Actors on Scene, Workers behind the scene), Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

UNIT II

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).

UNIT III

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams. operations.



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UNIT IV

SQL: Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(uptable and non-uptable), relational set

UNIT V

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF), Fifth Normal Form (5NF).

List of Exercises:

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5.
 - i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
 - ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION ERROR.
8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

Text Books:

- 1) Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, TMH
- 2) Database System Concepts, 5/e, Silberschatz, Korth, TMH
- 3) Oracle: The Complete Reference by Oracle Press
- 4) Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
- 5) Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007



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Reference Books:

- 1) Introduction to Database Systems, 8/e C J Date, PEA.
- 2) Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA
- 3) Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

e-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105175/>
- 2) <https://www.geeksforgeeks.org/introduction-to-nosql/>



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year – II Semester				
	L	T	P	C
	3	0	0	3
MACHINE LEARNING				

Course Objectives:

- Identify problems that are amenable to solution by ANN methods, and which ML methods may be suited to solving a given problem.
- Formalize a given problem in the language/framework of different ANN methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).

Course Outcomes: After the completion of the course, student will be able to

- Explain the fundamental usage of the concept Machine Learning system
- Demonstrate on various regression Technique
- Analyze the Ensemble Learning Methods
- Illustrate the Clustering Techniques and Dimensionality Reduction Models in Machine Learning.
- Discuss the Neural Network Models and Fundamentals concepts of Deep Learning

Unit I:

Introduction- Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Main Challenges of Machine Learning.

Statistical Learning: Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization.

Unit II:

Supervised Learning(Regression/Classification):Basic Methods: Distance based Methods, Nearest Neighbours, Decision Trees, Naive Bayes, **Linear Models:** Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, **Binary Classification:** Multiclass/Structured outputs, MNIST, Ranking.

Unit III:

Ensemble Learning and Random Forests: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking.

Support Vector Machine: Linear SVM Classification, Nonlinear SVM Classification SVM Regression, Naïve Bayes Classifiers.

Unit IV:

Unsupervised Learning Techniques: Clustering, K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures.

Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Using Scikit-Learn, Randomized PCA, Kernel PCA.

Unit V:

Neural Networks and Deep Learning: Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, Installing TensorFlow 2, Loading and Preprocessing Data with TensorFlow.



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Text Books:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Publications, 2019
2. Data Science and Machine Learning Mathematical and Statistical Methods, Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman, 25th November 2020

Reference Books:

1. Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year – II Semester		L	T	P	C
		3	0	0	3
COMPILER DESIGN					

Course Objectives:

Understand the basic concept of compiler design, and its different phases which will be helpful to construct new tools like LEX, YACC, etc.

Course Outcomes: At the end of the course, student will be able to

- Demonstrate phases in the design of compiler
- Organize Syntax Analysis, Top Down and LL(1) grammars
- Design Bottom Up Parsing and Construction of LR parsers
- Analyze synthesized, inherited attributes and syntax directed translation schemes
- Determine algorithms to generate code for a target machine

UNIT I: Lexical Analysis: Language Processors, Structure of a Compiler, Lexical Analysis, The Role of the Lexical Analyzer, Bootstrapping, Input Buffering, Specification of Tokens, Recognition of Tokens, Lexical Analyzer Generator-LEX, Finite Automata, Regular Expressions and Finite Automata, Design of a Lexical Analyzer Generator.

UNIT II: Syntax Analysis: The Role of the Parser, Context-Free Grammars, Derivations, Parse Trees, Ambiguity, Left Recursion, Left Factoring, **Top Down Parsing:** Pre Processing Steps of Top Down Parsing, Backtracking, Recursive Descent Parsing, LL (1) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing.

UNIT III: Bottom Up Parsing: Introduction, Difference between LR and LL Parsers, Types of LR Parsers, Shift Reduce Parsing, SLR Parsers, Construction of SLR Parsing Tables, More Powerful LR Parsers, Construction of CLR (1) and LALR Parsing Tables, Dangling Else Ambiguity, Error Recovery in LR Parsing, Handling Ambiguity Grammar with LR Parsers.

UNIT III: Syntax Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. **Intermediate Code Generation:** Variants of Syntax Trees, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Backpatching, Intermediate Code for Procedures.

UNIT IV: Run Time Environments: Storage Organization, Run Time Storage Allocation, Activation Records, Procedure Calls, Displays, **Code Optimization:** The Principle Sources of Optimization, Basic Blocks, Optimization of Basic Blocks, Structure Preserving Transformations, Flow Graphs, Loop Optimization, Data-Flow Analysis, Peephole Optimization

UNIT V: Code Generation: Issues in the Design of a Code Generator, Object Code Forms, Code Generation Algorithm, Register Allocation and Assignment.

Text Books:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Pearson Publishers, 2007.



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Reference Books:

1. Compiler Construction, Principles and Practice, Kenneth C Louden, Cengage Learning, 2006
2. Modern compiler implementation in C, Andrew W Appel, Revised edition, Cambridge University Press.
3. Optimizing Compilers for Modern Architectures, Randy Allen, Ken Kennedy, Morgan Kaufmann, 2001.
4. Levine, J.R., T. Mason and D. Brown, Lex and Yacc, edition, O'Reilly & Associates, 1990



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III Year – II Semester		L	T	P	C
		3	0	0	3
CRYPTOGRAPHY AND NETWORK SECURITY					

Course Objectives:

The main objectives of this course are to explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, public key algorithms, design issues and working principles of various authentication protocols and various secure communication standards including Kerberos, IPsec, and SSL/TLS.

Course Outcomes : At the end of the course, student will be able to

- Explain different security threats and countermeasures and foundation course of cryptography mathematics.
- Classify the basic principles of symmetric key algorithms and operations of some symmetric key algorithms and asymmetric key cryptography
- Revise the basic principles of Public key algorithms and Working operations of some Asymmetric key algorithms such as RSA, ECC and some more
- Design applications of hash algorithms, digital signatures and key management techniques
- Determine the knowledge of Application layer, Transport layer and Network layer security Protocols such as PGP, S/MIME, SSL,TSL, and IPsec .

UNIT I:

Basic Principles : Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography.

UNIT II:

Symmetric Encryption: Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard.

UNIT III:

Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography, Asymmetric Key Cryptography

UNIT IV:

Data Integrity, Digital Signature Schemes & Key Management : Message Integrity and Message Authentication, Cryptographic Hash Functions, Digital Signature, Key Management.

UNIT V:

Network Security-I: Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, **Network Security-II :** Security at the Network Layer: IPsec, System Security

Text Books:

1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill,2015
2. Cryptography and Network Security,4th Edition, William Stallings, (6e) Pearson,2006
3. Everyday Cryptography, 1st Edition, Keith M.Martin, Oxford,2016

Reference Books:

1. Network Security and Cryptography, 1st Edition, Bernard Meneges, Cengage Learning,2018



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III Year – II Semester		L	T	P	C
		3	0	0	3
MOBILE COMPUTING (Professional Elective-II)					

Course Objectives:

- To understand the fundamentals of mobile communication
- To understand the architecture of various Wireless Communication Networks
- To understand the significance of different layers in mobile system Course Contents

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

- Develop a strong grounding in the fundamentals of mobile Networks
- Apply knowledge in MAC, Network, and Transport Layer protocols of Wireless Network
- Comprehend, design, and develop a lightweight network stack
- Analyze the Mobile Network Layer system working
- Explain about the WAP Model

UNIT I: Introduction to Wireless Networks: Applications, History, Simplified Reference Model, Wireless transmission, Frequencies, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular Systems: Frequency Management and Channel Assignment, types of hand-off and their characteristics.

UNIT II: MAC – Motivation, SDMA, FDMA, TDMA, CDMA, Telecommunication Systems, GSM: Architecture Location tracking and call setup, Mobility management, Handover, Security, GSM, SMS, International roaming for GSM, call recording functions, subscriber and service data management, DECT, TETRA, UMTS, IMT-2000.

UNIT III: Wireless LAN: Infrared vs. Radio transmission, Infrastructure, Adhoc Network, IEEE 802.11 WLAN Standards, Architecture, Services, HIPERLAN, Bluetooth Architecture & protocols.

UNIT IV: Mobile Network Layer: Mobile IP, Dynamic Host Configuration Protocol, Mobile Transport Layer, Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/Fast recovery, Transmission/Time-out freezing, Selective retransmission, Transaction Oriented TCP.

UNIT V: Support for Mobility: Wireless Application Protocol: Architecture, Wireless Datagram Protocol, Wireless Transport Layer Security, Wireless Transaction Protocol, Wireless Session Protocol, Wireless Application Environment, Wireless Markup Language, WML Scripts, Wireless Telephone Application.

Text Books:

1. Jochen Schiller, “Mobile Communication”, Second Edition, Pearson Education, 2008.

Reference Books:

1. William Stallings, “Wireless Communications and Networks”, Second Edition, Pearson Education, 2004.
2. C. Siva Ram Murthy, B. S. Manoj, “Adhoc Wireless Networks: Architectures and Protocols”, Second Edition, Pearson Education, 2008.



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III Year – II Semester		L	T	P	C
		3	0	0	3
BIG DATA ANALYTICS (Professional Elective II)					

Course Objectives:

- To optimize business decisions and create competitive advantage with Big Data analytics
- To learn to analyze the big data using intelligent techniques
- To introduce programming tools PIG & HIVE in Hadoop ecosystem

Course Outcomes:

At the end of the course, the students will be able to

- Illustrate big data challenges in different domains including social media, transportation, finance and medicine
- Use various techniques for mining data stream
- Design and develop Hadoop
- Identify the characteristics of datasets and compare the trivial data and big data for various applications
- Explore the various search methods and visualization techniques

UNIT I

Introduction: Introduction to big data: Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs Reporting.

UNIT II

Stream Processing: Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies - Real Time Sentiment Analysis - Stock Market Predictions.

UNIT III

Introduction to Hadoop: Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analysing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment.

UNIT IV

Frameworks and Applications: Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and ZooKeeper.

UNIT V

Predictive Analytics and Visualizations: Predictive Analytics, Simple linear regression, Multiple linear regression, Interpretation of regression coefficients, Visualizations, Visual data analysis techniques, interaction techniques, Systems and application



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Text Books:

1. Tom White, “Hadoop: The Definitive Guide”, Third Edition, O’reilly Media, Fourth Edition, 2015.
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012.
3. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, CUP, 2012

Reference Books:

1. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
2. Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, “Harness the Power of Big Data: The IBM Big Data Platform”, Tata McGraw Hill Publications, 2012.
3. Arshdeep Bahga and Vijay Madisetti, “Big Data Science & Analytics: A Hands On Approach”, VPT, 2016.
4. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)”, John Wiley & Sons, 2014.

Software Links:

1. Hadoop: <http://hadoop.apache.org/>
2. Hive: <https://cwiki.apache.org/confluence/display/Hive/Home>
3. Piglatin: <http://pig.apache.org/docs/r0.7.0/tutorial.html>



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year – II Semester		L	T	P	C
		3	0	0	3
OBJECT ORIENTED ANALYSIS AND DESIGN (Professional Elective II)					

Course Objectives: The main objective is the students to

- Become familiar with all phases of OOAD.
- Master the main features of the UML.
- Master the main concepts of Object Technologies and how to apply them at work and develop the ability to analyze and solve challenging problem in various domains.
- Learn the Object design Principles and understand how to apply them towards Implementation.

Course Outcomes: After finishing this course student will be able to:

- Analyze the nature of complex system and its solutions.
- Illustrate & relate the conceptual model of the UML, identify & design the classes and relationships
- Analyze & Design Class and Object Diagrams that represent Static Aspects of a Software System and apply basic and Advanced Structural Modeling Concepts for designing real time applications.
- Analyze & Design behavioral aspects of a Software System using Use Case, Interaction and Activity Diagrams.
- Analyze & Apply techniques of State Chart Diagrams and Implementation Diagrams to model behavioral aspects and Runtime environment of Software Systems.

UNIT I:

Introduction: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. **Case Study:** System Architecture: Satellite-Based Navigation

UNIT II:

Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management.

UNIT III:

Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI: Cryptanalysis.

UNIT IV:

Basic Behavioral Modeling-I: Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study:** Web Application: Vacation Tracking System

UNIT V:

Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams

Case Study: Weather Forecasting



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Text Books:

1. Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston , “Object- Oriented Analysis and Design with Applications”, 3rd edition, 2013, PEARSON.
2. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.

Reference Books:

1. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd.
3. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
4. Applying UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.



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III Year – II Semester		L	T	P	C
		3	0	0	3
NETWORK PROGRAMMING (Professional Elective II)					

Course Objectives:

Having successfully completed this course, the student will be able to:

- Demonstrate mastery of main protocols comprising the Internet.
- Develop skills in network programming techniques.
- Implement network services that communicate through the Internet.
- Apply the client-server model in networking applications.
- Practice networking commands available through the operating system

Course Outcomes: At the end of the course, student will be able to

- Identifying different models and sockets
- Demonstrate different TCP Echo server functions and I/O models
- Rationalize IPV4 and IPV6 Socket options
- Identifying daemon processing and Advanced input and output functions
- Analyze Broadcasting and multicasting

UNIT I:

Introduction to Network Programming: Introduction to Network Programming: OSI model, UNIX standards, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application Elementary Sockets: Sockets introduction, Elementary TCP sockets.

UNIT II:

TCP client server: Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host.I/O Multiplexing: I/O Models, the select and poll functions, Batch input and buffering, shutdown function.

UNIT III:

UDP and Socket options: Elementary UDP sockets: Introduction UDP Echo server functions, lost datagram, summary of UDP example, Lack of flow control with UDP. **Socket options:** getsockopt and setsockopt functions. Socket states, Generic socket options IPV4 socket options, IPV6 socket options, ICMPV6 socket options and TCP socket options, SCTP socket options, fcntl function.

UNIT IV:

Advanced Sockets and Daemon Processes: IPV4 and IPV6 interoperability, introduction, IPV4 client: IPV6 server, IPV6 client: IPV4 Server, IPV6 Address-testing macros. Daemon Processes and inetdSuperserver –Introduction, syslogd Daemon, syslog Function, daemon_init Function, inetd Daemon, daemon_inetd. Advanced I/O functions: Socket timeouts, recv and send functions, ready and writev functions, recvmsg and send msg functions, Ancillary data.

UNIT V:

Broadcasting and Multicasting: Broadcasting introduction, broadcast addresses, unicast versus Broadcast, dg_cli function using broadcasting, race conditions, Multicasting addresses, multicasting versus broadcasting on a LAN, multicasting on a WAN, source-specific multicast, multicast socket options. **Raw Sockets:** Introduction, Raw Socket Creation, Raw Socket Output, Raw Socket Input, Ping Program, Traceroute Program



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Text Books:

1. UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Pearson Education
2. UNIX Network Programming, 1st Edition, W. Richard Stevens. PHI.

Reference Books:

1. UNIX Systems Programming using C++ T CHAN, PHI.
2. UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education
3. Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year – II Semester		L	T	P	C
		3	0	0	3
MEAN STACK DEVELOPMENT (Job Oriented Course)					

Course Outcomes:

At the end of the Course, Student will be able to:

- Build static web pages using HTML 5 elements.
- Apply JavaScript to embed programming interface for web pages and also to perform Client side validations.
- Build a basic web server using Node.js, work with Node Package Manager (NPM) and recognize the need for Express.js.
- Develop JavaScript applications using typescript and work with document database using MongoDB.
- Utilize Angular JS to design dynamic and responsive web pages.

UNIT-I:

HTML 5: Introduction to Web, Overview of Web Technologies, HTML - Introduction, HTML - Need, Case-insensitivity, Platform-independency, DOCTYPE Declaration, Types of Elements, HTML Elements - Attributes, Metadata Element, Sectioning Elements, Paragraph Element, Division and Span Elements, List Element, Link Element, Character Entities, HTML5 Global Attributes, Creating Table Elements, Table Elements : Colspan/ Rowspan Attributes, border, cellpadding and cellspacing attributes, Creating Form Elements, Input Elements - Attributes, Color and Date Pickers, Select and Datalist Elements, Editing Elements, Media, Iframe, Why HTML Security, HTML Injection, Clickjacking, HTML5 Attributes & Events Vulnerabilities, Local Storage Vulnerabilities, HTML5 - Cross-browser support, Best Practices For HTML Web Pages.

UNIT-II:

JavaScript: Why we need JavaScript, What is JavaScript, Environment Setup, Working with Identifiers, Type of Identifiers, Primitive and Non Primitive Data Types, Operators and Types of Operators, Types of Statements, Non - Conditional Statements, Types of Conditional Statements, If and Switch Statements, Types of Loops, Types of Functions, Declaring and Invoking Function, Arrow Function, Function Parameters, Nested Function, Built-in Functions, Variable Scope in Functions, Working With Classes, Creating and Inheriting Classes, In-built Events and Handlers, Working with Objects, Types of Objects, Creating Objects, Combining and cloning Objects using Spread operator, Destructuring Objects, Browser and Document Object Model, Creating Arrays, Destructuring Arrays, Accessing Arrays, Array Methods, Introduction to Asynchronous Programming, Callbacks, Promises, Async and Await, Executing Network Requests using Fetch API, Creating and consuming Modules.

UNIT-III:

Node.js: Why and What Node.js, How to use Node.js, Create a web server in Node.js, Node Package Manager, Modular programming in Node.js, Restarting Node Application, File Operations.

Express.js: Express Development Environment, Defining a route, Handling Routes, Route and Query Parameters, How Middleware works, Chaining of Middlewares, Types of Middlewares, Connecting to MongoDB with Mongoose, Validation Types and Defaults, Models, CRUD Operations, API Development, Why Session management, Cookies, Sessions, Why and What Security, Helmet Middleware, Using a Template Engine Middleware, Stylus CSS Preprocessor.



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UNIT-IV:

Typescript: Installing TypeScript, Basics of TypeScript, Function, Parameter Types and Return Types, Arrow Function, Function Types, Optional and Default Parameters, Rest Parameter, Creating an Interface, Duck Typing, Function Types, Extending Interfaces, Classes, Constructor, Access Modifiers, Properties and Methods, Creating and using Namespaces, Creating and using Modules, Module Formats and Loaders, Module Vs Namespace, What is Generics, What are Type Parameters, Generic Functions, Generic Constraints.

MongoDB: Introduction Module Overview, Document Database Overview, Understanding JSON, MongoDB Structure and Architecture, MongoDB Remote Management, Installing MongoDB on the local computer (Mac or Windows), Introduction to MongoDB Cloud, Create MongoDB Atlas Cluster, GUI tools Overview, Install and Configure MongoDB Compass, Introduction to the MongoDB Shell, MongoDB Shell JavaScript Engine, MongoDB Shell JavaScript Syntax, Introduction to the MongoDB Data Types, Introduction to the CRUD Operations on documents, Create and Delete Databases and Collections, Introduction to MongoDB Queries.

UNIT-V:

What is Angular, Features of Angular, Angular Application Setup, Components and Modules, Executing Angular Application, Elements of Template, Change Detection, Structural Directives - ngIf, ngFor, ngSwitch, Custom Structural Directive, Attribute Directives - ngStyle, ngClass, Custom Attribute Directive, Property Binding, Attribute Binding, Style and Event Binding, Built in Pipes, Passing Parameters to Pipes, Nested Components Basics, Passing data from Container Component to Child Component, Passing data from Child Component to ContainerComponent, Shadow DOM, Component Life Cycle, Template Driven Forms, Model Driven Forms or Reactive Forms, Custom Validators in Reactive Forms, Custom Validators in Template Driven forms, Dependency Injection, Services Basics, RxJS Observables, Server Communication using HttpClient, Communicating with different backend services using Angular HttpClient, Routing Basics, Router Links, Route Guards, Asynchronous Routing, Nested Routes.

Text Books:

1. Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson.
2. Pro Mean Stack Development, 1st Edition, Elad Elrom, Apress O'Reilly.
3. Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition, SitePoint, SitePoint Pty. Ltd., O'Reilly Media.
4. MongoDB – The Definitive Guide, 2nd Edition, Kristina Chodorow, O'Reilly.

Reference Books:

1. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech.
2. An Introduction to Web Design, Programming, 1st Edition, Paul S Wang, Sanda SKatila, Cengage Learning.

Web Links:

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overview (HTML5)
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview (Javascript)
3. https://infyspringboard.onwingspan.com/en/app/toc/lex_32407835671946760000_shared/overview (Node.js & Express.js)
4. https://infyspringboard.onwingspan.com/en/app/toc/lex_9436233116512678000_shared/overview (Typescript)
5. https://infyspringboard.onwingspan.com/en/app/toc/lex_20858515543254600000_shared/overview (Angular JS)
6. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_013177169294712832113_shared/overview (MongoDB)



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year – II Semester		L	T	P	C
		0	0	3	1.5
MACHINE LEARNING USING PYTHON LAB					

Course Objectives:

This course will enable students to learn and understand different Data sets in implementing the machine learning algorithms.

Course Outcomes (Cos): At the end of the course, student will be able to

- Implement procedures for the machine learning algorithms
- Design and Develop Python programs for various Learning algorithms
- Apply appropriate data sets to the Machine Learning algorithms
- Develop Machine Learning algorithms to solve real world problems

Requirements: Develop the following program using Anaconda/ Jupiter/ Spider and evaluate ML models.

Experiment-1:

Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

Experiment-2:

For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

Experiment-3:

Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Experiment-4:

Exercises to solve the real-world problems using the following machine learning methods: a) Linear Regression b) Logistic Regression c) Binary Classifier

Experiment-5: Develop a program for Bias, Variance, Remove duplicates , Cross Validation

Experiment-6: Write a program to implement Categorical Encoding, One-hot Encoding

Experiment-7:

Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

Experiment-8:

Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

Experiment-9: Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.



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Experiment-10:

Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

Experiment-11: Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

Experiment-12: Exploratory Data Analysis for Classification using Pandas or Matplotlib.

Experiment-13:

Write a Python program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set

Experiment-14:

Write a program to Implement Support Vector Machines and Principle Component Analysis

Experiment-15:

Write a program to Implement Principle Component Analysis



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year – II Semester		L	T	P	C
		0	0	3	1.5
COMPILER DESIGN LAB					

Course Objectives:

To enlighten the student with knowledge base in compiler design and its applications

Course Outcomes: The end of the course student will be able to

- Design simple lexical analyzers
- Determine predictive parsing table for a CFG
- Apply Lex and Yacc tools
- Examine LR parser and generating SLR Parsing table
- Relate Intermediate code generation for subset C language

List of Experiments:

1. Write a C program to identify different types of Tokens in a given Program.
2. Write a Lex Program to implement a Lexical Analyzer using Lex tool.
3. Write a C program to Simulate Lexical Analyzer to validating a given input String.
4. Write a C program to implement the Brute force technique of Top down Parsing.
5. Write a C program to implement a Recursive Descent Parser.
6. Write C program to compute the *First* and *Follow* Sets for the given Grammar.
7. Write a C program for eliminating the left recursion and left factoring of a given grammar
8. Write a C program to check the validity of input string using Predictive Parser.
9. Write a C program for implementation of LR parsing algorithm to accept a given input string.
10. Write a C program for implementation of a Shift Reduce Parser using Stack Data Structure to accept a given input string of a given grammar.
11. Simulate the calculator using LEX and YACC tool.
12. Generate YACC specification for a few syntactic categories.
13. Write a C program for generating the three address code of a given expression/statement.
14. Write a C program for implementation of a Code Generation Algorithm of a given expression/statement.

Text Books & Reference Books :

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Pearson Publishers, 2007.
2. John R Levine, Tony Mason, Doug Brown, "Lex and Yacc", Orielly, 2nd Edition, 2009.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year – II Semester		L	T	P	C
		0	0	3	1.5
CRYPTOGRAPHY NETWORK SECURITY LAB					

Course Objectives:

- To learn basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
- To understand and implement encryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher.

Course Outcomes: At the end of the course, student will be able to

- Apply the knowledge of symmetric cryptography to implement encryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher
- Demonstrate the different algorithms like DES, BlowFish, and Rijndael, encrypt the text “Hello world” using Blowfish Algorithm.
- Analyze and implement public key algorithms like RSA, Diffie-Hellman Key Exchange mechanism, the message digest of a text using the SHA-1 algorithm

List of Experiments:

1. Write a C program that contains a string (char pointer) with a value ‘Hello World’. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value ‘Hello World’. The program should AND or and XOR each character in this string with 127 and display the result
3. Write a Java program to perform encryption and decryption using the following algorithms:
 - a) Ceaser Cipher
 - b) Substitution Cipher
 - c) Hill Cipher
4. Write a Java program to implement the DES algorithm logic
5. Write a C/JAVA program to implement the BlowFish algorithm logic
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Using Java Cryptography, encrypt the text “Hello world” using BlowFish. Create your own key using Java key tool.
8. Write a Java program to implement RSA Algorithm
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.



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		0	0	4	2
BIG DATA: SPARK (Skill Oriented Course)					

Course Objectives:

The main objective of the course is to process Big Data with advance architecture like spark and streaming data in Spark

Course Outcomes:

By the end of the course , the student will be able to

- Develop MapReduce Programs to analyze large dataset Using Hadoop and Spark
- Write Hive queries to analyze large dataset Outline the Spark Ecosystem and its components
- Perform the filter, count, distinct, map, flatMap RDD Operations in Spark.
- Build Queries using Spark SQL
- Apply Spark joins on Sample Data Sets
- Make use of sqoop to import and export data from hadoop to database and vice-versa

List of Experiments:

1.

EXPERIMENT-1:
To Study of Big Data Analytics and Hadoop Architecture
(i) know the concept of big data architecture
(ii) know the concept of Hadoop architecture
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01256841991858585686_shared/overview

2. Loading DataSet in to HDFS for Spark Analysis

EXPERIMENT-2:
Installation of Hadoop and cluster management
(i) Installing Hadoop single node cluster in ubuntu environment
(ii) Knowing the differencing between single node clusters and multi-node clusters
(iii) Accessing WEB-UI and the port number
(iv) Installing and accessing the environments such as hive and sqoop
(We can restrict to standalone or if the facilities available can try for pseudo-distribution mode {or} fully distribution mode)
https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_01329503531746099243539_shared?collectionId=lex_auth_01329503580490137643544_shared&collectionType=Collection

EXPERIMENT-3:
File management tasks & Basic linux commands
(i) Creating a directory in HDFS
(ii) Moving forth and back to directories
(iii) Listing directory contents
(iv) Uploading and downloading a file in HDFS
(v) Checking the contents of the file



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(vi) Copying and moving files
(vii) Copying and moving files between local to HDFS environment
(viii) Removing files and paths
(ix) Displaying few lines of a file
(x) Display the aggregate length of a file
(xi) Checking the permissions of a file
(xii) Zipping and unzipping the files with & without permission pasting it to a location
(xiii) Copy, Paste commands
https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_01257430580733542457_shared?collectionId=lex_auth_01256841991858585686_shared&collectionType=Course

EXPERIMENT-4:
Map-reducing
(i) Definition of Map-reduce
(ii) Its stages and terminologies
(iii) Word-count program to understand map-reduce
(Mapper phase, Reducer phase, Driver code)
https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_01257421539761356848_shared?collectionId=lex_auth_01256841991858585686_shared&collectionType=Course

EXPERIMENT-5:
Implementing Matrix-Multiplication with Hadoop Map-reduce

EXPERIMENT-6:
Compute Average Salary and Total Salary by Gender for an Enterprise.

EXPERIMENT-7:
(i) Creating hive tables(External and internal)
(ii) Loading data to external hive tables from sql tables(or)Structured c.s.v using scoop
(iii) Performing operations like filterations and updations
(iv) Performing Join(inner, outer etc)
(v) Writing User defined function on hive tables
https://infyspringboard.onwingspan.com/web/en/viewer/webmodule/lex_auth_01257841711418572848_s_hared?collectionId=lex_auth_01258388119638835242_shared&collectionType=Course

EXPERIMENT-8:
Create a sql table of employees
Employee table with id,designation
Salary table (salary ,dept id)
Create external table in hive with similar schema of above tables,Move data to hive using scoop and load the contents into tables,filter a new table and write a UDF to encrypt the table with AES-algorithm, Decrypt it with key to show contents



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https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012606909641981952143_shared?collectionId=lex_auth_0126052684230082561692_shared&collectionType=Course

EXPERIMENT-9:

(i) Pyspark Definition(Apache Pyspark) and difference between Pyspark, Scala, pandas

(ii) Pyspark files and class methods

(i) get(file name)

(ii) get root directory()

EXPERIMENT-10 :

Pyspark -RDD'S

(i) what is RDD's?

(ii) ways to Create RDD

(i) parallelized collections

(ii) external dataset

(iii) existing RDD's

(iv) Spark RDD's operations

(Count, foreach(), Collect, join,Cache())

https://infyspringboard.onwingspan.com/web/en/app/toc/lex_3509975869549336000_shared/overview

EXPERIMENT-11 :

Perform pyspark transformations

(i) map and flatMap

(ii) to remove the words, which are not necessary to analyze this text.

(iii) groupBy

(iv) What if we want to calculate how many times each word is coming in corpus ?

(v) .How do I perform a task (say count the words 'spark' and 'apache' in rdd3) separatly on each partition and get the output of the task performed in these partition ?

(vi) unions of RDD

(vii) join two pairs of RDD Based upon their key

https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01330150584451891225182_shared/overview

EXPERIMENT-12:

Pyspark sparkconf-Attributes and applications

(i) What is Pyspark spark conf ()

(ii) Using spark conf create a spark session to write a dataframe to read details in a c.s.v and later move that c.s.v to another location



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Hardware and software configuration:

Hardware Configuration for each Node (Suggested)

Operating System:

NAME="Red Hat Enterprise Linux Server", VERSION="7.9 (Maipo)"

CPU Architecture: x86_64

CPU op-mode(s): 32-bit, 64-bit

CPU(s): 32

RAM: 64G

Software Required

Java: openjdk version "1.8.0_202" (installed in all nodes)

For Hive metastore – we have installed MySQL

MySQL: Ver 8.0.19 for Linux on x86_64 (MySQL Community Server - GPL)

Resource Links for installation

- Hadoop Installation steps: [Apache Hadoop 3.3.2 – Hadoop: Setting up a Single Node Cluster.](#) & [Apache Hadoop 3.3.2 – Hadoop Cluster Setup](#)
- Links to download different versions of Hadoop : [Index of /hadoop/ common \(apache.org\)](#) & [Index of /dist/hadoop/core \(apache.org\)](#)

Text Books:

1. Spark in Action, Marko Bonaci and Petar Zecevic, Manning.
2. PySpark SQL Recipes: With HiveQL, Dataframe and Graphframes, Raju Kumar Mishra and Sundar Rajan Raman, Apress Media.

Web Links:	
1.	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01330150584451891225182_shared/overview
2.	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01258388119638835242_shared/overview
3.	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0126052684230082561692_shared/overview



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		0	0	4	2
MEAN STACK TECHNOLOGIES-MODULE I (HTML 5, JAVASCRIPT, EXPRESS.JS, NODE.JS AND TYPESCRIPT) (Skill Oriented Course)					

Course Outcomes:

At the end of the Course, Student will be able to:

- Develop professional web pages of an application using HTML elements like lists, navigations, tables, various form elements, embedded media which includes images, audio, video and CSS Styles.
- Utilize JavaScript for developing interactive HTML web pages and validate form data.
- Build a basic web server using Node.js and also working with Node Package Manager (NPM).
- Build a web server using Express.js
- Make use of Typescript to optimize JavaScript code by using the concept of strict type checking.

List of Exercises

1.a	Course Name: HTML5 - The Language
	Module Name: Case-insensitivity, Platform-independency, DOCTYPE Declaration, Types of Elements, HTML Elements - Attributes, Metadata Element
	Include the Metadata element in Homepage.html for providing description as "IEKart's is an online shopping website that sells goods in retail. This company deals with various categories like Electronics, Clothing, Accessories etc.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28320667711144660000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
1.b	Course Name: HTML5 - The Language
	Module Name: Sectioning Elements
	Enhance the Homepage.html of IEKart's Shopping Application by adding appropriate sectioning elements.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_6372291347110857000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
1.c	Course Name: HTML5 - The Language
	Module Name: Paragraph Element, Division and Span Elements, List Element
	Make use of appropriate grouping elements such as list items to "About Us" page of IEKart's Shopping Application
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_32785192040894940000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
1.d	Course Name: HTML5 - The Language
	Module Name: Link Element
	Link "Login", "SignUp" and "Track order" to "Login.html", "SignUp.html" and "Track.html" page respectively. Bookmark each category to its details of IEKart's Shopping application.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_15515105953273338000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
1.e	Course Name: HTML5 - The Language
	Module Name: Character Entities
	Add the © symbol in the Home page footer of IEKart's Shopping application.



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	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_547667376938096260_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
1.f	Course Name: HTML5 - The Language
	Module Name: HTML5 Global Attributes
	Add the global attributes such as contenteditable, spellcheck, id etc. to enhance the Signup Page functionality of IEKart's Shopping application.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28723566050321920000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
2.a	Course Name: HTML5 - The Language
	Module Name: Creating Table Elements, Table Elements : Colspan/Rowspan Attributes, border, cellpadding, cellspacing attributes
	Enhance the details page of IEKart's Shopping application by adding a table element to display the available mobile/any inventories.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013168035284033536113_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
2.b	Course Name: HTML5 - The Language
	Module Name: Creating Form Elements, Color and Date Pickers, Select and Datalist Elements
	Using the form elements create Signup page for IEKart's Shopping application.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_13975270903118459000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
2.c	Course Name: HTML5 - The Language
	Module Name: Input Elements - Attributes
	Enhance Signup page functionality of IEKart's Shopping application by adding attributes to input elements.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_14048414537062347000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
2.d	Course Name: HTML5 - The Language
	Module Name: Media, Iframe
	Add media content in a frame using audio, video, iframe elements to the Home page of IEKart's Shopping application.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_30738402225794945000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
3.a	Course Name: Javascript
	Module Name: Type of Identifiers
	Write a JavaScript program to find the area of a circle using radius (var and let - reassign and observe the difference with var and let) and PI (const)
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013053264414818304732_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
3.b	Course Name: Javascript
	Module Name: Primitive and Non Primitive Data Types
	Write JavaScript code to display the movie details such as movie name, starring, language, and ratings. Initialize the variables with values of appropriate types. Use template literals wherever necessary.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-



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	module/lex_21528322245232402000_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
3.c	Course Name: Javascript Module Name: Operators and Types of Operators Write JavaScript code to book movie tickets online and calculate the total price, considering the number of tickets and price per ticket as Rs. 150. Also, apply a festive season discount of 10% and calculate the discounted amount. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_13808338384481720000_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
3.d	Course Name: Javascript Module Name: Types of Statements, Non - Conditional Statements, Types of Conditional Statements, if Statements, switch Statements Write a JavaScript code to book movie tickets online and calculate the total price based on the 3 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed. (c) If se https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_16257498471333610000_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
3.e	Course Name: Javascript Module Name: Types of Loops Write a JavaScript code to book movie tickets online and calculate the total price based on the 3 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed. (c) If https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_6238536888292970000_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
4.a	Course Name: Javascript Module Name: Types of Functions, Declaring and Invoking Function, Arrow Function, Function Parameters, Nested Function, Built-in Functions, Variable Scope in Functions Write a JavaScript code to book movie tickets online and calculate the total price based on the 3 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed. (c) If https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_15455199570613326000_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
4.b	Course Name: Javascript Module Name: Working With Classes, Creating and Inheriting Classes Create an Employee class extending from a base class Person. Hints: (i) Create a class Person with name and age as attributes. (ii) Add a constructor to initialize the values (iii) Create a class Employee extending Person with additional attributes role https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012599811117760512458_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
4.c	Course Name: Javascript Module Name: In-built Events and Handlers Write a JavaScript code to book movie tickets online and calculate the total price based on the 3 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed. (c) If se https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_4192188372573027000_shared?collectionId=lex_18109698366332810000



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	0_shared&collectionType=Course
4.d	Course Name: Javascript
	Module Name: Working with Objects, Types of Objects, Creating Objects, Combining and cloning Objects using Spread operator, Destructuring Objects, Browser Object Model, Document Object Model
	If a user clicks on the given link, they should see an empty cone, a different heading, and a different message and a different background color. If user clicks again, they should see a re-filled cone, a different heading, a different message, and a diffe
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_13197025862804100000_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
5.a	Course Name: Javascript
	Module Name: Creating Arrays, Destructuring Arrays, Accessing Arrays, Array Methods
	Create an array of objects having movie details. The object should include the movie name, starring, language, and ratings. Render the details of movies on the page using the array.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013053270191734784711_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
5.b	Course Name: Javascript
	Module Name: Introduction to Asynchronous Programming, Callbacks, Promises, Async and Await, Executing Network Requests using Fetch API
	Simulate a periodic stock price change and display on the console. Hints: (i) Create a method which returns a random number - use Math.random, floor and other methods to return a rounded value. (ii) Invoke the method for every three seconds and stop when
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012599811633905664460_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
5.c	Course Name: Javascript
	Module Name: Creating Modules, Consuming Modules
	Validate the user by creating a login module. Hints: (i) Create a file login.js with a User class. (ii) Create a validate method with username and password as arguments. (iii) If the username and password are equal it will return "Login Successful" else w
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013052857053585408667_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
6.a	Course Name: Node.js
	Module Name: How to use Node.js
	Verify how to execute different functions successfully in the Node.js platform.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_19002830632103186000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
6.b	Course Name: Node.js
	Module Name: Create a web server in Node.js
	Write a program to show the workflow of JavaScript code executable by creating web server in Node.js.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28177338996267815000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course



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6.c	Course Name: Node.js
	Module Name: Modular programming in Node.js
	Write a Node.js module to show the workflow of Modularization of Node application.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28865394191004004000_shared?collectionId=lex_324078356719467600_00_shared&collectionType=Course
6.d	Course Name: Node.js
	Module Name: Restarting Node Application
	Write a program to show the workflow of restarting a Node application.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_9174073856000159000_shared?collectionId=lex_3240783567194676000_0_shared&collectionType=Course
6.e	Course Name: Node.js
	Module Name: File Operations
	Create a text file src.txt and add the following data to it. Mongo, Express, Angular, Node.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_33376440180246100000_shared?collectionId=lex_324078356719467600_00_shared&collectionType=Course
7.a	Course Name: Express.js
	Module Name: Defining a route, Handling Routes, Route Parameters, Query Parameters
	Implement routing for the AdventureTrails application by embedding the necessary code in the routes/route.js file.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_29394215542149950000_shared?collectionId=lex_324078356719467600_00_shared&collectionType=Course
7.b	Course Name: Express.js
	Module Name: How Middleware works, Chaining of Middlewares, Types of Middlewares
	In myNotes application: (i) we want to handle POST submissions. (ii) display customized error messages. (iii) perform logging.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_13930661312009580000_shared?collectionId=lex_324078356719467600_00_shared&collectionType=Course
7.c	Course Name: Express.js
	Module Name: Connecting to MongoDB with Mongoose, Validation Types and Defaults
	Write a Mongoose schema to connect with MongoDB.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035588775485440691_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
7.d	Course Name: Express.js
	Module Name: Models
	Write a program to wrap the Schema into a Model object.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035593896869888662_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
8.a	Course Name: Express.js
	Module Name: CRUD Operations
	Write a program to perform various CRUD (Create-Read-Update-Delete) operations using Mongoose library functions.



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	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035684270129152696_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
8.b	Course Name: Express.js
	Module Name: API Development
	In the myNotes application, include APIs based on the requirements provided. (i) API should fetch the details of the notes based on a notesID which is provided in the URL. Test URL - http://localhost:3000/notes/7555 (ii) API should update the details bas
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035745250975744755_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
8.c	Course Name: Express.js
	Module Name: Why Session management, Cookies
	Write a program to explain session management using cookies.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24299316914857090000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
8.d	Course Name: Express.js
	Module Name: Sessions
	Write a program to explain session management using sessions.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_905413034723449100_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
8.e	Course Name: Express.js
	Module Name: Why and What Security, Helmet Middleware
	Implement security features in myNotes application
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_31677453061177940000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
9.a	Course Name: Typescript
	Module Name: Basics of TypeScript
	On the page, display the price of the mobile-based in three different colors. Instead of using the number in our code, represent them by string values like GoldPlatinum, PinkGold, SilverTitanium.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28910354929502245000_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
9.b	Course Name: Typescript
	Module Name: Function
	Define an arrow function inside the event handler to filter the product array with the selected product object using the productId received by the function. Pass the selected product object to the next screen.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_10783156469383723000_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
9.c	Course Name: Typescript
	Module Name: Parameter Types and Return Types
	Consider that developer needs to declare a function - getMobileByVendor which accepts string as input parameter and returns the list of mobiles.
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712912427057152901_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course



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9.d	Course Name: Typescript
	Module Name: Arrow Function
	Consider that developer needs to declare a manufacturer's array holding 4 objects with id and price as a parameter and needs to implement an arrow function - myfunction to populate the id parameter of manufacturers array whose price is greater than or equ
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712910875500544904_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
9.e	Course Name: Typescript
	Module Name: Optional and Default Parameters
	Declare a function - getMobileByManufacturer with two parameters namely manufacturer and id, where manufacturer value should passed as Samsung and id parameter should be optional while invoking the function, if id is passed as 101 then this function shoul
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712914940641280906_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
10.a	Course Name: Typescript
	Module Name: Rest Parameter
	Implement business logic for adding multiple Product values into a cart variable which is type of string array.
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712921860915200909_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
10.b	Course Name: Typescript
	Module Name: Creating an Interface
	Declare an interface named - Product with two properties like productId and productName with a number and string datatype and need to implement logic to populate the Product details.
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712925244276736910_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
10.c	Course Name: Typescript
	Module Name: Duck Typing
	Declare an interface named - Product with two properties like productId and productName with the number and string datatype and need to implement logic to populate the Product details.
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712925995458560912_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
10.d	Course Name: Typescript
	Module Name: Function Types
	Declare an interface with function type and access its value.
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712948945346560918_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
11.a	Course Name: Typescript
	Module Name: Extending Interfaces
	Declare a productList interface which extends properties from two other declared interfaces like Category,Product as well as implementation to create a variable of this interface type.
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712948945346560918_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course



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	on/lex_auth_012712951652139008920_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
11.b	Course Name: Typescript Module Name: Classes Consider the Mobile Cart application, Create objects of the Product class and place them into the productList array. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_3705824317381604400_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
11.c	Course Name: Typescript Module Name: Constructor Declare a class named - Product with the below-mentioned declarations: (i) productId as number property (ii) Constructor to initialize this value (iii) getProductId method to return the message "Product id is <<id value>>". https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712954616782848927_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
11.d	Course Name: Typescript Module Name: Access Modifiers Create a Product class with 4 properties namely productId, productName, productPrice, productCategory with private, public, static, and protected access modifiers and accessing them through Gadget class and its methods. https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712953517170688931_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
12.a	Course Name: Typescript Module Name: Properties and Methods Create a Product class with 4 properties namely productId and methods to setProductId() and getProductId(). https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_9356738095572543000_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
12.b	Course Name: Typescript Module Name: Creating and using Namespaces Create a namespace called ProductUtility and place the Product class definition in it. Import the Product class inside productList file and use it. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_20787271128051925000_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
12.c	Course Name: Typescript Module Name: Creating and using Modules Consider the Mobile Cart application which is designed as part of the functions in a module to calculate the total price of the product using the quantity and price values and assign it to a totalPrice variable. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24788158187785620000_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
12.d	Course Name: Typescript Module Name: What is Generics, What are Type Parameters, Generic Functions, Generic Constraints Create a generic array and function to sort numbers as well as string values. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24788158187785620000_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course



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module/lex_446287045482942800_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
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Software configuration and installation

1. HTML & Javascript

- Simple editors such as Notepad or go for IDEs like Visual Studio Code(recommended), Eclipse etc. which makes coding easier.
- And, to execute application, you can use any commonly used browser such as Google Chrome(recommended), Mozilla Firefox etc
- Setup details: [Environmental Setup for HTML5 - Viewer Page | Infosys Springboard \(onwingspan.com\)](#)
- [Environment Setup: Internal - Viewer Page | Infosys Springboard \(onwingspan.com\)](#)

2. Node JS

Download **Node.js** from the official site

Setup details : [How to use Node.js - Viewer Page | Infosys Springboard \(onwingspan.com\)](#)

3. Typescript

[Installing TypeScript - Internal - Viewer Page | Infosys Springboard \(onwingspan.com\)](#)

Text Books:

1. Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson.
2. Pro Mean Stack Development, 1st Edition, ELadElrom, Apress O'Reilly.
3. Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition, SitePoint, SitePoint Pty. Ltd., O'Reilly Media.

Reference Books:

1. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech.
2. An Introduction to Web Design, Programming, 1st Edition, Paul S Wang, Sanda S Katila, Cengage Learning.

Web Links:

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overview_w (HTML5)
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview_w (Javascript)
3. https://infyspringboard.onwingspan.com/en/app/toc/lex_32407835671946760000_shared/overview_w (Node.js & Express.js)
4. https://infyspringboard.onwingspan.com/en/app/toc/lex_9436233116512678000_shared/overview (Typescript)



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III Year – II Semester				
	L	T	P	C
	2	0	0	0
EMPLOYABILITY SKILLS-II				

Course Objectives:

The main objective of this course is to assist students in developing employability skills and personal qualities related to gaining and sustaining employment.

Course Outcomes: After completion of this course

- Solve various Basic Mathematics problems by following different methods
- Follow strategies in minimizing time consumption in problem solving Apply shortcut methods to solve problems
- Confidently solve any mathematical problems and utilize these mathematical skills both in their professional as well as personal life.
- Analyze, summarize and present information in quantitative forms including table, graphs and formulas

UNIT I:

Numerical ability I: Number system, HCF & LCM, Average, Simplification, Problems on numbers

Numerical ability II: Ratio & Proportion, Partnership, Percentages, Profit & Loss

UNIT II:

Arithmetical ability I: Problems on ages, Time & Work, Pipes & Cistern, Chain Rule.

Arithmetical ability II: Time & Distance, Problems on boats & Steams, Problems on Trains

UNIT III:

Arithmetical ability III: Allegation, Simple interest and compound interest, Races & Games of skills, Calendar and Clock,

Logical ability: Permutations and Combination and Probability.

UNIT IV:

Mensuration: Geometry, Areas, Volumes

UNIT V:

Data interpretation: Tabulation, Bar graphs, Pie charts, line graphs

Text Books And Reference Books:

1. R. S. Aggarwal “Quantitative Aptitude”, Revised ed., S Chand publication, 2017
ISBN:8121924987

E- resources:

1. https://blog.feedspot.com/aptitude_youtube_channels/
2. https://www.tutorialspoint.com/quantitative_apititude/
3. <https://www.careerbless.com/aptitude/qa/home.php>



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING					
III Year – II Semester	Minor Course	L	T	P	C
		3	0	2	4
DATA STRUCTURES AND ALGORITHMS					

Course Objectives:

The objective of the course is to

- Introduce the fundamental concept of data structures and abstract data types
- Emphasize the importance of data structures in developing and implementing efficient algorithms
- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms
- Demonstrate the different data structures implementation

Course Outcomes:

After completing this course a student will be able to:

- Use basic data structures such as arrays and linked list.
- Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.
- Use various searching and sorting algorithms.

UNIT I:

Data Structures - Definition, Classification of Data Structures, Operations on Data Structures, Abstract Data Type (ADT), Preliminaries of algorithms. Time and Space complexity.

Searching - Linear search, Binary search, Fibonacci search.

Sorting- Insertion sort, Selection sort, Exchange (Bubble sort, quick sort), distribution (radix sort), merging (Merge sort) algorithms.

UNIT II:

Linked List: Introduction, Single linked list, Representation of Linked list in memory, Operations on Single Linked list-Insertion, Deletion, Search and Traversal, Reversing Single Linked list, Applications on Single Linked list- Polynomial Expression Representation, Addition and Multiplication, Sparse Matrix Representation using Linked List, Advantages and Disadvantages of Single Linked list, Double Linked list-Insertion, Deletion, Circular Linked list-Insertion, Deletion.

UNIT III:

Queues: Introduction to Queues, Representation of Queues-using Arrays and using Linked list, Implementation of Queues-using Arrays and using Linked list, Application of Queues- Circular Queues, Deques, Priority Queues, Multiple Queues.

Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on Stacks, Linked list Representation of Stacks, Operations on Linked Stack, Applications-Reversing list, Factorial Calculation, Infix to Postfix Conversion, Evaluating Postfix Expressions.

UNIT IV:

Trees: Basic Terminology in Trees, Binary Trees-Properties, Representation of Binary Trees using Arrays and Linked lists. Binary Search Trees- Basic Concepts, BST Operations: Insertion, Deletion, Tree Traversals,



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UNIT V:

Graphs: Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Applications- Minimum Spanning Tree Using Prim's & Kruskal's Algorithm, Dijkstra's shortest path

Exercise -1 (Searching):

- Write C program that use both recursive and non recursive functions to perform Linear search for a Key value in a given list.
- Write C program that use both recursive and non recursive functions to perform Binary search for a Key value in a given list.

Exercise -2 (Sorting-I):

- Write C program that implement Bubble sort, to sort a given list of integers in ascending order
- Write C program that implement Quick sort, to sort a given list of integers in ascending order
- Write C program that implement Insertion sort, to sort a given list of integers in ascending order

Exercise -3(Sorting-II):

- Write C program that implement radix sort, to sort a given list of integers in ascending order
- Write C program that implement merge sort, to sort a given list of integers in ascending order

Exercise -4(Singly Linked List):

- Write a C program that uses functions to create a singly linked list
- Write a C program that uses functions to perform insertion, deletion operations on a singly linked list
- Write a C program to reverse elements of a single linked list.

Exercise -5(Queue)

- Write C program that implement Queue (its operations) using arrays.
- Write C program that implement Queue (its operations) using linked lists

Exercise -6(Stack)

- Write C program that implement stack (its operations) using arrays
- Write C program that implement stack (its operations) using Linked list
- Write a C program that uses Stack operations to evaluate postfix expression

Exercise -7(Binary Tree)

Write a recursive C program for traversing a binary tree in preorder, inorder and postorder.

Exercise -8(Binary Search Tree)

- Write a C program to Create a BST
- Write a C program to insert a node into and delete a node from a BST.

Text Books:

- Data Structures Using C. 2nd Edition. Reema Thareja, Oxford.
- Data Structures and algorithm analysis in C, 2nded, Mark Allen Weiss.

Reference Books:

- Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahni, Universities Press.
- Data Structures: A PseudoCode Approach, 2/e, Richard F. Gilberg, Behrouz A. Forouzan, Cengage.
- Data Structures with C, Seymour Lipschutz TMH



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e-Resources:

- 1) <http://algs4.cs.princeton.edu/home/>
- 2) https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf