Bachelor of Technology (Computer Science & Engineering)
Scheme of Studies/Examination
Semester V

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Examination Schedule (Marks)				Duration of Exam (Hrs)
					Major Test	Minor Test	Practical	Total	
1	CSE 301N	Automata Theory	3:1:0	4	75	25	0	100	3
2	CSE 303 N	Computer Networks	3:1:0	4	75	25	0	100	3
3	CSE 305N	Design and Analysis of algorithms	3:1:0	4	75	25	0	100	3
4	CSE 307N	Computer organisation and Architecture	3:1:0	4	75	25	0	100	3
5	CSE 309N	Simulation & Modelling	3:1:0	4	75	25	0	100	3
6	CSE 311N	Computer Networks Lab	0:0:3	3	0	40	60	100	3
7	CSE 313N	Design and Analysis of algorithms Lab	0:0:3	3	0	40	60	100	3
8	CSE 315 N	Simulation Lab	0:0:3	3	0	40	60	100	3
9	CSE 317N	Seminar/Industrial Training*	0:0:2	2	0	40	60	100	
10	CSE 319N	Technical Communication and Soft Skills Lab	0:0:2	2	0	100	0	100	3
		Total		**33**	**375**	**385**	**240**	**1000**	

CSE-301N	Automata Theory					
Lecture	**Tutorial**	**Practical**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**1**	**-**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To understand the challenges for Theoretical Computer Science and its contribution to other sciences					
Course Outcomes(CO)						
CO1	Students are able to explain and manipulate the different fundamental concepts in automata theory and formal languages.					
CO2	Simplify automata and context-free grammars, Prove properties of languages, grammars and automata with rigorously formal mathematical methods, minimization.					
CO3	Differentiate and manipulate formal descriptions of push down automata, its applications and transducer machines.					
CO4	To understand basic properties of Turing machines and computing with Turing machine, the concepts of tractability and decidability.					

Unit - I

Introduction to Automata: Study and Central Concepts of Automata Theory, Applications of Finite Automata, An Introduction of Deterministic Finite Automata(DFA) and Non-Deterministic Finite Automata(NFA), Finite Automata with Epsilon (€) Transitions.

Regular Expression and Languages:-Regular Expressions (RE), Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws of Regular Expressions. Closure Properties of Regular Languages, RE to NFA, DFA Conversion and DFA to RE, Equivalence and Minimization of NFA and DFA automata.

Unit-2

Context free Grammars and Languages: Parse Trees, Context Sensitive Grammar, Applications of Context Free Grammars, Regular Grammar, Ambiguity in Grammars and Languages. Normal forms of context free grammars, Subfamilies of Context Free Languages (CFL), Closure Properties of CFL, Chomsky Theorem, Chomsky Hierarchy, Chomsky Normal Form, Greibach Normal Form.

Pumping Lemma:-Introduction to Pumping Lemma, pumping lemma for context free languages, Applications of Pumping Lemma, Minimization of Finite Automata, and Recursive Language.

Unit-3

Mealey and Moore Machines:- Definitions, Representation, Equivalence of Moore and Mealey Machines and its Designing.

Push Down Automata: Introduction of Push Down Automata (PDA), Language of PDA, Equivalence of PDA's and CFG's, Deterministic Push Down Automata, Designing of PDA, Applications of PDA. Parikh Theorem and Parikh Mapping, Kleene's Theorem.

Unit-4

Introduction to Turing Machine: The Turing Machine, Programming Techniques for Turing Machine, Extensions of Turing Machine, Restricted Turing Machines, Universal Turing Machines and Designing of Turing Machines, Time and Tape Complexity Measures of Turing machines

Decidability: Post's Correspondence Problem (PCP), Rice's Theorem, Decidability of Membership, Emptiness and Equivalence Problems of Languages.

Textbooks

1. J.E.Hopcroft, R.Motwani and J.D.Ullman , "Introduction to Automata Theory Languages and computation", Pearson Education Asia , 2001.
2. K.Krithivasan and R.Rama; Introduction to Formal Languages, Automata Theory and Computation; Pearson Education, 2009.

References

1. Peter Linz, "An Introduction to Formal Language and Automata", 4th Edition, Narosa Publishing house , 2006.
2. M.Sipser; Introduction to the Theory of Computation; Singapore: Brooks/Cole, Thomson Learning, 1997.
3. John.C.martin, "Introduction to the Languages and the Theory of Computation",Third edition, Tata McGrawHill, 2003.

CSE-303N	Computer Networks					
Lecture	**Tutorial**	**Practical**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**1**	**-**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To introduce the architecture and layers of computer network, protocols used at different layers.					
Course Outcomes(CO)						
CO1	To understand the basic concept of networking, types, networking topologies and layered architecture.					
CO2	To understand data link layer and MAC sub-layer`					
CO3	To understand the network Layer functioning					
CO4	To understand the transport layer and application layer operation					

Unit -1

Introduction: introduction to Computer Networks, Data Communication System and its components, Data Flow, Computer network and its goals, Types of computer networks: LAN, MAN, WAN, Wireless and Wired networks, broadcast and point-to-point networks, Network topologies, protocols, interfaces and services, ISO-OSI reference model, TCP/IP architecture.

Physical Layer: Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Multiplexing : Frequency Division, Time Division, Wavelength Division, Introduction to **Transmission Media** : Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared), Switching: Circuit Switching, Message Switching ,Packet Switching & comparisons, narrowband ISDN, broadband ISDN and ATM.

Unit -2

Data link layer: Error Control, Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, sliding window protocols, Selective repeat ARQ, HDLC

Medium access sub layer: Point to point protocol, FDDI, token bus, token ring; Reservation, polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA, TDMA, CDMA, LLC, Traditional Ethernet, fast Ethernet, Network devices-repeaters, hubs, switches, Bridges, Router, Gateway

Unit-3

Network layer: Addressing : Internet address, subnetting; Routing techniques, static vs. dynamic routing , routing table, DHCP, IEEE standards 802.x, Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP, IGMP, IPV6; Unicast and multicast routing protocols.

Unit-4

Transport layer: Process to process delivery; UDP; TCP, RPC, Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets; Quality of service: techniques to improve QoS.

Application layer: DNS; SMTP, SNMP, FTP, HTTP & WWW; Firewalls, Bluetooth, Email, S/MIME, IMAP, **Security**: Cryptography, user authentication, security protocols in internet, public key encryption algorithm, digital signatures.

TEXT BOOK

1. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw Hill, Fourth Edition, 2011.

2. Computer Networks, 4th Edition, Pearson Education by Andrew S. Tanenbaum

REFERENCES

1. Larry L.Peterson, Peter S. Davie, “Computer Networks”, Elsevier, Fifth Edition, 2012.

2. William Stallings, “Data and Computer Communication”, Eighth Edition, Pearson Education, 2007.

3. James F. Kurose, Keith W. Ross, “Computer Networking: A Top–Down Approach Featuring the Internet”, Pearson Education, 2005.

CSE-305N	Design and Analysis of Algorithms					
Lecture	**Tutorial**	**Practical**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**1**	**-**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To introduce advanced data structures & algorithms concepts involving their implementation for solving complex applications.					
Course Outcomes (CO)						
CO1	Learn the basic concepts of data structures and their analysis.					
CO2	Study the concept of dynamic programming and various advanced data structures.					
CO3	Learn various graph algorithms and concepts of computational complexities.					
CO4	Study various Flow and Sorting Networks					

Unit 1

Introduction

Review: Elementary Data Structures, Algorithms & its complexity(Time & Space), Analysing Algorithms, Asymptotic Notations, Priority Queue, Quick Sort and merge sort.

Recurrence relation: Methods for solving recurrence(Substitution , Recursion tree, Master theorem), Strassen multiplication.

Advanced data Structures: Binomial heaps, Fibonacci heaps, Splay Trees, Red-Black Trees.

Unit 2

Advanced Design and analysis Techniques

Dynamic programming: Elements, Matrix-chain multiplication, longest common subsequence,

Greedy algorithms: Elements , Activity- Selection problem, Huffman codes, Task scheduling problem, Travelling Salesman Problem.

Backtracking algorithms: Graph coloring, N-Queen problem, Hamiltonian path and circuit.

Unit 3

Graph Algorithms

Review of graph algorithms:Traversal Methods(Depth first & Breadth first search),Topological sort, Strongly connected components, Minimum spanning trees- Kruskal's and Prim's Algorithm, Single source shortest paths, Relaxation, Dijkstra's Algorithm, Bellman- Ford algorithm, Single source shortest paths for directed acyclic graphs, Floyd-Warshall algorithm.

Unit 4

Computational Complexity: Basic Concepts, Polynomial vs Non-Polynomial Complexity, NP-hard & NP-complete classes. Flow and Sorting Networks, Flow networks, Ford- Fulkerson method, Maximum bipartite matching, Sorting Networks, Comparison network, Zero- one principle, Bitonic sorting network, merging network

Text Books:

1. Corman, Leiserson and Rivest : Introduction to Algorithms, 2/e, PHI
2. Harsh Bhaisn, Algorithms: Design And Analysis Oxford University Press,2015.

Reference Books:

1. Aho, Hopcroft and Ullman : The Design and Analyses of Computer Algorithms. Addison Wesley.
2. R.B.Patel, Expert Data Structures with C, Khanna Publications , Delhi, India, 2ndEdition 2004, ISBN 81-87325-07-0, pp.1-909.
3. R.B.Patel & M.M.S Rauthan, Expert Data Structures with C++, Khana Publications, Delhi , India, 2ndEdition 2004,ISBN : 87522-03-8.
4. Horowitz, Ellis and Sahni, Sartaj : Fundamentals of Computer Algorithms, Galgotia Publications

CSE-307N	Computer Organization and Architecture					
Lecture	**Tutorial**	**Practical**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**1**	**-**	**75**	**25**	**100**	**3 Hrs.**
Purpose	Student will be able to understand the basic concepts of computer architecture and organization, and understand the key skills of constructing cost-effective computer systems.					
Course Outcomes (CO)						
CO1	Be familiar with the functional units of the processor such as the register file and arithmetic-logical unit, and with the basics of systems topics					
CO2	Be familiar with the design trade-offs in designing and constructing a computer processor.					
CO3	Be familiar with the CPU design including the RISC/CISC architectures.					
CO4	Be familiar with the basic knowledge of I/O devices and interfacing of I/O devices with computer.					

Unit- I

Data representation and Computer arithmetic: Introduction to Computer Systems, Organization and architecture, evolution and computer generations; Fixed point representation of numbers, digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non restoring algorithms. Floating point representation with IEEE standards and its arithmetic operations.

Unit-II

Basic Computer organization and Design: Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control, instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: configuration, instructions, Program interrupt, Interrupt cycle, Micro programmed Control organization, address sequencing, micro instruction format and microprogram sequencer.

Unit-III

Central Processing Unit: General register organization, stack organization, instruction formats, addressing modes, Data transfer and manipulation, Program control. CISC and RISC: features and comparison. Pipeline and vector Processing , Parallel Processing, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors.

Unit-IV

Input-output organization: I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer. Input output Processor , CPU-IOP communication, I/O channel.

TEXT BOOK:

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Sixth Edition, Pearson Education, 2003.
2. Morris Mano, M., "Computer System Architecture," 3/e, Pearson Education, 2005.
3. John P. Hayes, "Computer Architecture and Organization," 3/e, TMH, 1998.

REFERENCES:

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Third Edition, Elsevier, 2005.
3. V.P. Heuring, H.F. Jordan, "Computer Systems Design and Architecture", Second Edition, Pearson Education, 2004.
4. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw Hill, 2002.

CSE 309N	Simulation and Modeling					
Lecture	**Tutorial**	**Practical**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**1**	**-**	**75**	**25**	**100**	**3 Hour**
Purpose	To introduce the principles and paradigms of Computer Modeling and Simulation for solving a wide variety of problems. In addition, how to use simulator to simulate the live systems.					
Course Outcomes (CO)						
CO1	Learn the basic concepts of System, System Modeling, types of Models, simulation, and need of simulation.					
CO2	Learn the simulation of continuous and discrete systems with the help of different examples.					
CO3	Learn the concept of generation of uniformly and non-uniformly distributed random numbers.					
CO4	Learn the simulation of queuing system and PERT.					

Unit-1

Modeling: System Concepts, system boundaries and environment, continuous and discrete systems, system modeling, types of Models, Model validation, Principles & Nature of Computer modeling.

Simulation: Introduction, Basic nature of simulation, when to simulate, Advantages, disadvantages and limitations of simulation, Concepts of simulation of continuous and discrete system with the help of example.

Unit-2

Continuous System Simulation: Analog vs. digital simulation, continuous simulation vs. numerical integration, simulation of a chemical reactor, simulation of a water reservoir system.

Discrete system simulation: Fixed time-step vs. event-to-event model, Monte-Carlo computation vs. stochastic simulation, generation of random numbers, and generation of non-uniformly distributed random numbers.

Unit -3

Simulators for the Live systems: Simulation of queuing Systems: basic concepts of queuing theory, simulation of single server, two server and more general queuing system.

Simulation of PERT network: Network model of a project, analysis of an activity network, critical path computation, uncertainties in activity durations, simulation of an activity network.

Unit-4

Simulation of inventory control systems: Elements of inventory theory, inventory models, generation of Poisson and Erlang variates, simulator for complex inventory systems.

Simulation of hypothetical computers.

Design and Evaluation of Simulation Experiments: Variance reduction techniques. Experiment layout and Validation.

Case Study: SciLab, Octave.

Text Books:

1. Gordon G.: System simulation, Prentice-Hall of India Pvt. Ltd. New Delhi 1993
2. Narsingh Deo: System Simulation with Digital Computer, PHI New Delhi, 1993

Reference Books:

1. Neelankavil Frances: Computer Simulation and Modelling, John Wiley & Sons, New York, 1987.
2. Payne, James A.: Introduction to simulation: Programming Techniques and Methods of Analysis, McGraw-Hill International Editions, Computer Science services, New York (1998).
3. Reitam Julian: Computer Simulation Experiments, Wiley Interscience 1971.

CSE-311N	Computer Networks Lab					
Lecture	**Tutorial**	**Practical**	**Minor Test**	**Practical**	**Total**	**Time**
--	**--**	**3**	**40**	**60**	**100**	**3 Hour**
Purpose	**To explore networking concepts using Java programming & networking tools.**					
Course Outcomes (CO)						
CO1	Do Problem Solving using algorithms.					
CO2	Design and test simple programs to implement networking concepts using Java.					
CO3	Document artifacts using applied addressing & quality standards.					
CO4	Design simple data transmission using networking concepts and implement.					

COMPUTER NETWORKS (Lab)

1. Create a socket for HTTP for web page upload and download.
2. Write a code simulating ARP /RARP protocols.
3. Study of TCP/UDP performance.
4. Performance comparison of MAC protocols
5. Performance comparison of routing protocols.
6. Write a program:
    a. To implement echo server and client in java using TCP sockets.
    b. To implement date server and client in java using TCP sockets.
    c. To implement a chat server and client in java using TCP sockets.
7. Write a program:
    a. To implement echo server and client in java using UDP sockets
    b. To implement a chat server and client in java using UDP sockets.
    c. To implement a DNS server and client in java using UDP sockets.
8. To flood the server from a spoofed source address leading to a DoS attack.
9. To sniff and parse packets that pass through using raw sockets.
10. To implement simple calculator and invoke arithmetic operations from a remote client.
11. To implement bubble sort and sort data using a remote client.
12. To simulate a sliding window protocol that uses Go Back N ARQ.

CSE-313N	Design and Analysis of algorithms Lab					
Lecture	**Tutorial**	**Practical**	**Minor Test**	**Practical**	**Total**	**Time**
--	**--**	**3**	**40**	**60**	**100**	**3 Hour**
Purpose	The student will learn the algorithm analysis techniques, become familiar with the different algorithm design techniques and Understand the limitations of Algorithm power.					
Course Outcomes (CO)						
CO1	The student should be able to Design algorithms for various computing problems					
CO2	The student should be able to Analyse the time and space complexity of algorithms.					
CO3	The student should be able to critically analyse the different algorithm design techniques for a given problem.					
CO4	The student should be able to modify existing algorithms to improve efficiency.					

List of Practical

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Using Open, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. a. Obtain the Topological ordering of vertices in a given digraph.
   b. Compute the transitive closure of a given directed graph using Warshall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
7. a. Print all the nodes reachable from a given starting node in a digraph using BFS method.
   b. Check whether a given graph is connected or not using DFS method.
8. Find a subset of a given set S = {sl,s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions{1,2,6}and{1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.
9. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
10. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
11. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using Open and determine the speed-up achieved.
12. Implement N Queen's problem using Back Tracking.
13. Implement Graph Coloring.
14. Find Hamiltonian Path using Back Tracking.
15. Implement longest common subsequence.
16. Implement Huffman code using Greedy approach.

CSE 315N	Simulation lab					
Lecture	**Tutorial**	**Practical**	**Minor Test**	**Practical**	**Total**	**Time**
-	-	**3**	**40**	**60**	**100**	**3 Hour**
Purpose	To introduce the principles and paradigms of Computer Simulation for solving a wide variety of problems. In addition, how to use simulator to simulate the live systems.					
Course Outcomes (CO)						
CO1	Learn the simulation of continuous and discrete systems with the help of different examples.					
CO2	Learn the concept of generation of uniformly and non-uniformly distributed random numbers.					
CO3	Learn the simulation of queuing system.					
CO4	Learn the concept of simulation CPM and PERT.					
CO5	Learn the concept of simulation of inventory control system.					

LIST OF EXPERIMENTS

1: Write a program to print the detailed marks certificate (D.M.C) of a student by using different binary operators.

2: Write a program to Draw graph of sine wave with respect to the time.

3: Write a program to solve following differential equation
$dy/dt = -\exp(-t) \times y^2$ by using any simulation technique.

4: Write a program to solve following differential equation by using 4^{th} order Runge-Kutta method
$dy/dx = -2x-y$, with initial condition $y = -2$ when $x = 0$.

5: Write a program to simulate Pure-Pursuit problem of continuous system simulation.

6: Write a program to select a policy among different given policies with minimum total cost of an inventory system.

7: Write a program to generate and print a sequence of 30 pseudo random numbers between 150 to 250 by using any simulation technique.

8: Write a program to determine the approximate value of $\sqrt{2}$ using 1000 random numbers.

9: Write a program to generate a sample of pseudo random values by using rejection method from a given non-uniform distribution, when the probability function of the distribution is non-zero over finite interval (a, b).

10: Write a program to simulate single server queuing system with Poisson arrival pattern and FCFS queue discipline.

11: Write a program to find minimum time of completing the project by PERT.

12: Write a program to simulate an inventory system with the objective to determine the re-order combination (P,Q) which yields the highest service level for a given value of average stock.

CSE-319N	Technical Communication and Soft Skills Lab					
Lecture	**Tutorial**	**Practical**	**Major Test**	**Minor Test**	**Total**	**Time**
-	**-**	**2**	**0**	**100**	**100**	**3 Hours**
Purpose	To enhance the students' oral communication skills in English					
Course Outcomes(CO)						
CO1	Develop oral communicative competence in English					
CO2	Improve fluency in English and thereby respond confidently due to reduced communication apprehension					
CO3	Identify and explain the biological and physiological characteristic of proper voice and diction production					
CO4	Develop correct and better pronunciation through stress on word accent, intonation, and weak forms					
CO5	Participate in Group Discussions effectively					
CO6	Make effective oral presentations in English					

LIST OF TOPICS FOR LAB ACTIVITIES

The following topics are prescribed to conduct the activities in the lab:

1. Articulation of Consonant sounds
2. Articulation of Vowel sounds
3. Pronunciation
4. Word Accent
5. Weak Forms
6. Intonation
7. Conversation in different formal situations
8. Group Discussion
9. Oral presentation