GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)

Coimbatore - 641 013

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAMME SPECIFIC OUTCOMES (PSOs)

The Programme Specific Outcomes of B.E. Computer Science and Engineering programme are:

PSO1: Students at the time of graduation will be able to apply mathematics and theoretical computer science and develop computing solutions using state-of-art hardware and software techniques.

PSO2: Students at the time of graduation will be able to design efficient innovative solutions to interdisciplinary societal problems using standard practices, tools and technologies.

PSO3: Students at the time of graduation will be able to apply domain knowledge and use appropriate technology for innovative research.

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE - 641013
B.E. COMPUTER SCIENCE AND ENGINEERING
2022 REGULATIONS

THIRD SEMESTER

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22SBS308	Probability, Random Processes and Queueing Theory (Common to CSE & IT)	BS	40	60	100	3	1	0	4
2	22SES306	Digital Systems	ES	40	60	100	3	0	0	3
3	22SES307	Discrete Structures	ES	40	60	100	3	0	0	3
4	22SPC301	Data Structures (Common to *EEE*, *ECE & CSE*)	PC	40	60	100	3	0	0	3
5	22SPC302	Foundations of Data Science (Common to CSE & IT)	PC	40	60	100	3	0	0	3
THEORY WITH PRACTICAL COMPONENT										
6	22SPC303	Object Oriented Programming	PC	50	50	100	3	0	2	4
PRACTICAL										
7	22SES308	Engineering Exploration For Computer Science and Engineering (Common to CSE & IT)	ES	100	-	100	0	0	3	1.5
8	22SES309	Digital Systems Laboratory	ES	60	40	100	0	0	3	1.5
9	22SPC304	Data Structures Laboratory (Common to ECE & CSE)	PC	60	40	100	0	0	3	1.5
Total				**470**	**430**	**900**	**18**	**1**	**11**	**24.5**

FOURTH SEMESTER

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22SES410	Analog and Digital Communication	ES	40	60	100	3	0	0	3
2	22SPC405	Computer Architecture	PC	40	60	100	3	0	0	3
3	22SPC406	Data Base Management Systems	PC	40	60	100	3	0	0	3
4	22SPC407	System Programming and Operating systems	PC	40	60	100	3	0	0	3
5	22SPC408	Design and Analysis of Algorithms (Common to CSE & IT)	PC	40	60	100	3	1	0	4
6	22SPC409	Theory of Computation (Common to CSE & IT)	PC	40	60	100	3	1	0	4
PRACTICAL										
7	22SPC410	Data Base Management Systems Laboratory	PC	60	40	100	0	0	3	1.5
8	22SPC411	System Programming and Operating Systems Laboratory	PC	60	40	100	0	0	3	1.5
Total				**360**	**440**	**800**	**18**	**2**	**6**	**23**

22SBS308	PROBABILITY, RANDOM PROCESSES AND QUEUEING THEORY *(Common to CSE & IT Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	1	0	4

Course Objectives	To enhance the fundamental knowledge in probability concepts and its applications relevant to various streams of Engineering and Technology. This is a foundation course which mainly deals with topic such as probability, standard statistical distributions, statistical averages regarding one or more random variables, random process, Markov chains and queueing models with finite/infinite capacity in single/multi servers and plays an important role in the understanding of Science, Engineering and Computer Science among other disciplines.	
UNIT – I	**PROBABILITY AND RANDOM VARIABLES**	**9+3 Periods**
Sample spaces–Events – Probability Axioms–Conditional Probability–Independent Events – Baye's Theorem. Random Variables: Distribution Functions–Expectation–Moments–Moment Generating Functions.		
UNIT – II	**PROBABILITY DISTRIBUTIONS**	**9+3 Periods**
Binomial, Poisson, Geometric, Uniform, Exponential, Normal, Gamma, Weibull (Mean, Variance and Simple problems). Functions of random variables.		
UNIT – III	**MULTI DIMENSIONAL RANDOM VARIABLES**	**9+3 Periods**
Two dimensional: Joint distributions – Marginal Distributions – Conditional distributions – Covariance – Correlation and Regression lines. Multidimensional: Mean vectors and covariance matrices.		
UNIT – IV	**RANDOM PROCESSES**	**9+3 Periods**
Definition and Examples – first and Second order, Strict sense stationary, Wide sense stationary and ergodic processes- Markov processes – Poisson processes – Birth and Death processes – Markov chains – Transition probabilities – Limiting distributions.		
UNIT – V	**QUEUEING THEORY**	**9+3 Periods**
Markovian models-M/M/1 and M/M/C, finite and infinite capacity, M/G/1 queue (steady state solutions only) Pollazack Khintchine formula-Problems only.		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK

1	*Veerarajan T., **Probability and Random Processes**, with Queueing Theory and Queueing Networks, Fourth Edition, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.*
2	*Veerarajan T., **Higher Engineering Mathematics**, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.*

REFERENCES

1	*Gupta S.C and Kapoor V.K.., **Fundamentals of Mathematical Statistics**, Sultan Chand & Sons, New Delhi, 2015.*
2	*Gupta S.P., **Statistical methods**, Sultan Chand & Sons, New Delhi, 2015.*
3	*Trivedi K.S., **Probability and Statistics with Reliability, Queueing and Computer Science Applications**, Prentice Hall of India, New Delhi.*
4	*Hwei Hsu., **SchauPm's outline series of Theory and Problems of Probability and Random Process,** Tata McGraw Hill Publishing Co., New Delhi, 2015.*
5	*Kandasamy, Thilagavathy and Gunavathy, , **Probability and Random Process,** S. Chand & Co. Ramnagar, New Delhi , Reprint 2013.*
6	*Richard A. Johnson and Dean W. Wichern., **AppliedMultivariate Statistical Analysis,** Sixth Edition, Pearson Education, Asia, 2012.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Apply the knowledge of basic probability concepts in engineering problems.	K5
CO2	Identify various standard probability distributions and apply them in real life.	K5
CO3	Find the correlation and regression for multi dimensional random variables.	K5
CO4	Apply the random process in Markovian and Birth- death problems.	K5
CO5	Utilize queuing models in real life problems.	K5

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO5	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
22SBS308	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.1.2,1.2.1,1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.5, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 12.1.2 , 12.2.1, 12.2.2
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.5, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 12.1.2 , 12.2.1, 12.2.2
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.5, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 12.1.2 , 12.2.1, 12.2.2
CO4	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.5, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 12.1.2 , 12.2.1, 12.2.2
CO5	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.5, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 12.1.2 , 12.2.1, 12.2.2

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding(K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	20	10	-	-	100
CAT2	30	40	20	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	40	20	10	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	40	20	10	-	-	100
ESE	30	40	20	10	-	-	100

22SES306	DIGITAL SYSTEMS	SEMESTERIII

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	The objective of the course is to learn the basic concepts of digital systems components, to design combinational logic circuits and sequential logic circuits.	
UNIT – I	**INTRODUCTION TO NUMBER SYSTEMS AND CODES**	**9 Periods**
Binary Number Systems-Signed Binary Numbers-Binary Arithmetic-1's and 2's Complement- Binary codes: BCD, Gray code, Excess 3 code, ASCII code -Introduction To Boolean Algebra - Minimization Of Boolean Function Using Karnaugh Map-SOP-POS-Quine Mclusky Methods - Code Conversion - Binary Code to Gray Code And Gray to Binary-BCD to Excess-3 and Excess 3 to BCD Code		
UNIT – II	**COMBINATIONAL LOGIC CIRCUITS**	**9 Periods**
Introduction to combinational logic- Design procedure - Multiplexer/Demultiplexer -Decoders-Encoders - Priority Encoders- Implementation of Combinational Logic Circuits using Multiplexer and Decoder -Design of Integer Arithmetic Circuits Using Combinational Logic: Integer Adder - Ripple Carry Adder And Carry Lookahead Adder-Integer Subtraction Using Adders - Design of Combinational Circuits Using Programmable Logic Devices(PLDS):Programmable Read Only Memories(PROM)-Programmable Logic Arrays(PLA)-Programmable Array Logic(PAL) Devices.		
UNIT – III	**SEQUENTIAL CIRCUITS**	**9 Periods**
Latches:RS Latch And JK Latch-Flipflops-RS,JK,T And D Flipflops-Master-Slave Flipflops-Edge Triggered Flipflops-Analysis And Design of Synchronous Sequential Circuits: Introduction To Sequential Circuits - Characteristics Table-Characteristic Equations And Excitation Table		
UNIT – IV	**MODULAR SEQUENTIAL LOGIC CIRCUITS**	**9 Periods**
Registers-Register with parallel load -Overview of Shift Register - Counters- Ripple counter - Synchronous/Asynchronous counters-Up-Down counters, Ring counter-Johnson Counters		
UNIT – V	**ALGORITHMS STATE MACHINES AND MEMORIES**	**9 Periods**
RTL Notations - ASM Charts-Notations- VHDL : Introduction to HDL-VHDL-Library-Introduction to memories - Read,Write Cycles - Random Access Memory- TTL RAM Cell - ROMs-EPROM - MOS Static RAM Cell-Dynamic RAM Cell-Refreshing Memory Cycle.		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXT BOOK

1	*M. Morris Mano, Michael D. Ciletti **"Digital Design"** 5thedition,Pearson Education, 2013*

REFERENCES

1	*A P Malvino,D P Leach And Gountansala **"Digital Principles And Applications"** 7th Edition, Tata Mc Graw Hill, 2010*
2	*Stephen Brown,Zvonko Vranesic, **"Fundamentals Of Digital Logic Design With VHDL"**, 3rd Edition, Tata Mc Graw Hill, 2008.*
3	*Mark K Bach, **"Complete Digital Design"**, Tata Mc Graw Hill, 2003*
4	*Wakerly Pearson, **"Digital Design:Principles And Practices"**, 4th Edition, Pearson Education, 2008*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Apply knowledge of number systems and codes in problem solving related to code conversion and number system.	K3
CO2	Analyze and design combinational logic devices using logic gates.	K4
CO3	Analyze and design sequential logic devices using flip flops.	K4
CO4	Explain fundamentals of different types of memories.	K2
CO5	Simulate of digital circuits using VHDL	K6

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

Os/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	1	-	-	-	-	-	1	-	-	3	3	-
CO2	2	3	3	1	-	-	-	-	-	1	-	-	3	3	-
CO3	2	3	3	1	-	-	-	-	-	1	-	-	3	3	-
CO4	2	1	2	1	-	-	-	-	-	1	-	-	3	3	-
CO5	2	3	3	1	3	-	-	-	-	1	-	-	3	3	-
22SES306	**2**	**3**	**3**	1	1	**-**	**-**	**-**	**-**	1	**-**	**-**	**3**	**3**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4 , 3.1.1, 3.1.2, 3.1.6, 3.2.1, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.3.1, 10.1.1
CO2	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4 , 3.1.1, 3.1.2, 3.1.6, 3.2.1, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.3.1, 10.1.2
CO3	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4 , 3.1.1, 3.1.2, 3.1.6, 3.2.1, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.3.1, 10.1.3
CO4	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.2.2, 4.1.1, 4.1.2, 10.1.3
CO5	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4 , 3.1.1, 3.1.2, 3.1.6, 3.2.1, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.3.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 10.1.1

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	30	20	20	-	-	100
CAT2	30	30	20	10	-	10	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	50	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	10	-	40	-	50	100
ESE	20	30	30	10	-	10	100

22SES307	DISCRETE STRUCTURES	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	The objective of the course is to equip students with the necessary skills to apply propositional and predicate calculus to evaluate the truth value of statements, use counting techniques to develop an understanding of relations, apply algebraic structures and morphisms to solve related problems, analyze graphs, and understand the patterns and laws of graph mining.	
UNIT – I	**PROPOSITIONAL AND PREDICATE CALCULUS**	**9 Periods**
Proposition: Logical connectives and its truth tables – Conditional and Biconditionals – Applications of Propositions: Boolean Searches, Logic Puzzles – Logical Equivalences and Implications – Theory of inference for statement calculus. Predicate Calculus: Quantifiers – Formulas – Free & Bound variable – Inference theory of predicate calculus.		
UNIT – II	**COUNTING, RELATIONS AND FUNCTIONS**	**9 Periods**
Counting: The Basics of Counting – The Pigeonhole Principle – Permutation and Combinations. Relations: Graph and Matrix representation of a relation – Properties of Binary Relation – Closure of relation – Warshall's algorithm – Equivalence Relation and Partitions – Partial Ordering Relations and Lattices. Functions: Mathematical Induction - Types and Composition of Functions - Inverse Function.		
UNIT – III	**ALGEBRAIC STRUCTURES AND MORPHISM**	**9 Periods**
Groups: Subgroups – Generators and Evaluation of Powers – Cosets and Lagrange's Theorem – Permutation groups and Burnside Theorem – Codes and Group Codes. Morphism: Isomorphism and Automorphism, Homomorphism and Normal Subgroups – Rings, Integral domains and Fields.		
UNIT – IV	**GRAPH THEORY**	**9 Periods**
Introduction - Basic Terminology – Multigraphs and Weighted graphs - Digraphs and relations representation of graphs - operations on graphs - Paths and Circuits - Graph traversals - shortest paths in weighted graphs - Euclidian paths and circuits - Hamiltonian Paths and Circuits - The Traveling Salesperson Problem - Planar Graphs - Graph Coloring – Case Study.		
UNIT – V	**GRAPH MINING LAWS**	**9 Periods**
Patterns in Static Graph –Patterns in Evolving Graph – Patterns in Weighted Graph – Structure of Specific Graph : The Internet – The World Wide Web – Graph Generators : Random Graph Models – Generators for Internet Topology.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*C.L. Liu, D.P. Mohapatra* ***"Elements of Discrete Mathematics: A Computer Oriented Approach",*** *Third Edition Tata MCgraw Hill, (SIE), 2012.[Unit 1 – 4]*
2	*Deepayan Chakrabarti, Christos Faloutsos* ***"Graph Mining: Laws, Tools, and Case Studies"*** *Margon & Claypool publishers 2012.[Unit 5]*

REFERENCES

1	*Kenneth H Rosen,* ***Discrete Mathematics and its Applications with Combinatorics and Graph Theory****, Seventh Edition, MCgraw Hill Education India Private Limited, New Delhi, 2013.*
2	*Krishnaiyan Thulasiraman, Subramanian Arumugam, Andreas Brandstädt, Takao Nishizeki, "****Handbook of Graph Theory, Combinatorial Optimization, and Algorithms****", CRC press, 2016.*
3	*William Kocay, Donald L. Kreher* ***"Graphs, Algorithms, and Optimization",*** *Second Edition, CRC Press, 2017.*
4	*J.P. Tremblay and R. Manohar,* ***"Discrete Mathematical Structure and Its Application to Computer Science",*** *TMG Edition, Tata Mcgraw-Hill, 2015.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Demonstrate the ability to use propositional and predicate calculus to evaluate the truth value of statements and solve logic problems.	K5
CO2	Apply counting techniques and develop an understanding of relations and their properties, and use graph and matrix representation to solve problems.	K3
CO3	Demonstrate the ability to apply algebraic structures and morphism to solve problems related to groups, subgroups, rings, and fields.	K3
CO4	Analyze graphs and solve problems related to shortest path,Hamiltonian Paths , and graph coloring	K4
CO5	Use graph mining as a powerful pattern tool by understanding their laws to derive valuable information.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	1	-	-	-	-	-	-	-	2	3	-	3
CO2	3	2	-	1	-	-	-	-	-	-	-	2	3	-	3
CO3	3	2	-	1	-	-	-	-	-	-	-	2	3	-	3
CO4	3	2	-	2	1	-	-	-	-	-	-	2	3	3	3
CO5	3	3	-	3	1	-	-	1	-	-	-	2	3	3	3
22SES307	**3**	**2**	**-**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**3**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 4.1.1, 12.1.1, 12.2.2, 12.3.2
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.3.1, 2.3.2, 2.4.1, 4.3.3, 4.3.4, 12.1.1, 12.2.2, 12.3.2
CO3	1.1.1, 1.1.2, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.3.2, 2.4.3, 2.4.4, 4.1.1, 4.3.3, 12.1.1, 12.2.2, 12.3.2
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.1, 2.4.3, 2.4.4, 4.1.1, 4.3.3, 4.3.4, 5.1.2, 12.1.1, 12.2.2, 12.3.2
CO5	1.1.1, 1.1.2, 10.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.2, 4.3.3, 4.3.4, 5.1.2, 5.2.2, 8.2.2, 12.1.1, 12.1.2, 12.2.2, 12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total 100%**
CAT1	10	20	50	-	20	-	100
CAT2		20	60	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	30	40	-	30	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	30	30	40	-	-	100
ESE	10	20	40	20	10	-	100

22SPC301	DATA STRUCTURES *(Common to EEE, ECE & CSE Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
PROGRAMMING IN C	PC	3	0	0	3

Course Objectives	The objective of the course is to enable the students to analyze the time complexity of an algorithm, Understand and Use List, Stack, Queue, Tree and graph Data structures and effectively use sorting and searching Techniques.	
UNIT – I	**INTRODUCTION AND ABSTRACT DATATYPES**	**9 Periods**
Algorithm Analysis: Calculation of Running Time – Abstract Data Type- List ADT: Array implementation of List, Linked Lists, Doubly Linked List, Circularly Linked Lists- Cursor implementation of Linked List		
UNIT – II	**STACK AND QUEUE ADT**	**9 Periods**
Stack ADT: Stack Model, Implementation of stacks, Applications: Balancing Symbols, Postfix expression evaluation, Infix to postfix conversion, Function Calls – Queue ADT: Queue Model, Implementation of Queues, Applications.		
UNIT – III	**TREE ADT**	**9 Periods**
Preliminaries – Implementation of Trees – Tree Traversals – Binary Tree: Implementation, Expression Tree – Search Tree ADT – AVL Trees - BTrees – Red Black Trees.		
UNIT – IV	**GRAPH ALGORITHMS**	**9 Periods**
Definitions – Representation of Graphs – Traversal- Topological sort – Shortest Path Algorithms: Dijkstra's Algorithm – Network Flow Problem – Minimum Spanning Tree: Prim's and Kruskal's algorithm.		
UNIT – V	**SORTING AND SEARCHING**	**9 Periods**
Sorting: Insertion Sort – Shell Sort – Heap Sort – Merge Sort – Quick Sort – Bucket Sort – External Sorting: Simple Algorithm, Multi way merge, Poly Phase Merge – Searching : Linear Search – Binary Search – Hashing : Hash Functions– Collision Resolution: Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.		
Contact Periods: **Lecture: 45 Period** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXT BOOK

1	*Mark Allen Weiss* ***"Data Structures and Algorithm Analysis in C"*** *Second Edition, Pearson Education Limited, 2002.*

REFERENCES

1	*Thomas H. Cormen , Charles E. Leiseron, Ronald L.Rivest, Clifford Stein,* ***"Introduction to Algorithms",*** *Third Edition, PHI learning Pvt. Ltd., 2011.*
2	*Sartaj Sahni,* ***"Data Structures, Algorithms and applications in C++",*** *Second Edition, Universities Press, 2005.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Analyze the time complexity of various algorithms	K4
CO2	Define and use list, stack and queue Data Structures	K3
CO3	Define and use Tree Data Structure	K3
CO4	Define and use Graph Data Structure	K4
CO5	Use appropriate sorting and searching Techniques	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

Cos/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	1	2	1	-	-	-	-	-	-	-	1	3	3	2
CO2	2	2	2	2	2	2	-	-	-	1	-	1	3	3	2
CO3	2	2	2	2	2	2	-	-	-	1	-	1	3	3	2
CO4	2	2	2	2	2	2	-	-	-	1	-	1	3	3	2
CO5	2	2	1	1	-	-	-	-	-	-	-	1	3	3	2
22SPC301	**2**	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**-**	**1**	**3**	**3**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.3.1, 1.4.1,2.1.2, 2.2.2, 2.3.1,2.4.1,3.1.6,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,4.2.2,4.3.1,12.2.2.
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2 .2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2 .2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2 .2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO5	1.3.1,1.4.1,2.1.2.2.1,2.2.3,2.3.1,2.4.4,3.1.3,3.1.6, 3 .2.3, 3.3.2, 4.1.2, 4.2.1,4.3.1,6.1.1, 10.3.1, 11.2.1, 12.1.1,12.2.2,12.3.2

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	-	20	30	50	-	-	100
CAT2	-	10	80	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	80	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	80	20	-	-	100
ESE	-	30	50	20	-	-	100

22SPC302	**FOUNDATIONS OF DATA SCIENCE** *(Common to CSE & IT Branches)*	**SEMESTER III**

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	This course will introduce the fundamental concepts in the field of data science required for solving data science problems	
UNIT – I	**R FOR DATASCIENCE**	**9 Periods**
Reading and getting data into R – ordered and unordered factors – arrays and matrices – lists and data frames – reading data from files – probability distributions and statistical models in R - Introduction to graphical analysis –plots – displaying multivariate data – matrix plots – multiple plots in one window - exporting graph using graphics parameters.		
UNIT – II	**INTRODUCTION TO DATA SCIENCE AND DESCRIBING DATA**	**9 Periods**
Data Science Process: Roles and stages. Basic Statistical descriptions of Data - Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores		
UNIT – III	**DESCRIBING RELATIONSHIPS**	**9 Periods**
Correlation –correlation coefficient for quantitative data –computational formula for correlation coefficient – Populations, Samples and Probability – Sampling distribution of the mean		
UNIT – IV	**GENERALIZING BEYOND DATA**	**9 Periods**
Hypothesis testing: z-test, Null Hypothesis and Alternate Hypothesis, One tailed and Two Tailed Tests, Estimation of Confidence Interval		
UNIT – V	**MODELING METHODS**	**9 Periods**
Choosing and evaluating models -Linear and logistic regression: Building a model, Making Predictions, Reading Model summary and characterizing co-efficient quality unsupervised methods: Cluster Analysis		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	Nina Zumel, John Mount, **"Practical Data Science with R",** Manning Publications, 2014. (Unit I and V)
2	Robert S. Witte and John S. Witte, **"Statistics",** Eleventh Edition, Wiley Publications, 2017. (Units II, III and IV)

REFERENCES

1	W. N. Venables, D. M. Smith and the R Core Team, **"An Introduction to R",** 2013.
2	Mark Gardener, **"Beginning R - The Statistical Programming Language",** John Wiley & Sons, Inc., 2012.
3	Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, **"Practical Data Science Cookbook",** Packt Publishing Ltd., 2014
4	Montgomery, D. C. and G. C. Runger. Applied Statistics and Probability for Engineers. 5th Edition. John Wiley & Sons, Inc., NY, USA, 2011

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Use R Libraries for Data Wrangling	K3
CO2	Define the data science process	K1
CO3	Analyze and interpret data using an ethically responsible approach.	K4
CO4	Apply hypotheses and data into actionable predictions	K3
CO5	Formulate and use appropriate models of data analysis to solve problems	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	2	1	3	-	-	-	-	-	1	-	2	2	2
CO2	1	1	1	1	-	-	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	3	-	3	-	-	-	-	2	2	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	-	-	-	-	-	-	-	1	2	2	2
22SPC302	**3**	**3**	**3**	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**1**	**1**	**2**	**2**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1, 2.3.2, 3.1.2, 3.2.1, 3.2.2, 4.1.3, 5.1.1, 5.1.2, 5.2.2, 5.3.1, 5.3.2, 11.3.2
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.2.1, 2.2.3, 2.3.2, 3.1.2, 3.2.1, 3.2.2, 4.1.3
CO3	1.3.1, 1.4.1, 2.2.4, 2.4.1, 2.4.2, 2.4.4, 3.1.5, 3.2.2, 3.4.2, 4.1.2, 4.1.4, 4.3.2, 5.2.1, 5.3.1, 5.3.2, 6.2.1, 8.1.1, 8.2.1
CO4	1.3.1, 1.4.1, 2.2.4, 2.4.1, 2.4.2, 2.4.4, 3.1.5, 3.2.2, 3.4.2, 4.1.2, 4.1.4, 4.3.2
CO5	1.3.1, 1.4.1, 2.2.4, 2.4.1, 2.4.2, 2.4.4, 3.1.5, 3.2.2, 3.4.2, 4.1.2, 4.1.4, 4.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Rememberin g(K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Individual Assessment1 /Case Study 1/ Seminar 1 / Project1	30	20	40	5	5	-	100
Individual Assessment2 /Case Study 2/ Seminar 2 / Project 2	30	20	30	10	5	5	100
ESE	30	30	40	-	-	-	100

22SPC303	**OBJECT ORIENTED PROGRAMMING** *(Common to CSE & IT Branches)*	**SEMESTER III**

PREREQUISITES	**CATEGORY**	**L**	**T**	**P**	**C**
NIL	**PC**	**3**	**0**	**2**	**4**

Course Objectives	The objective of the course is to create an understand on object orientedprogramming concepts using Java programming language and to familiarize students with GUI based application development and server side programming.	
UNIT – I	**INTRODUCTION TO OOP AND JAVA**	**9+6 Periods**
Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Java Virtual Machine - Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- Java Doc comments – Inheritance –Packages –interfaces		
UNIT – II	**EXCEPTION HANDLING AND MULTITHREADING**	**9+6 Periods**
Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model– Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing		
UNIT – III	**STRINGS ,STREAMS AND OBJECT SERIALIZATION**	**9+6 Periods**
Strings: Basic String class, methods and String Buffer Class. I/O Basics – Working with files - Object Streams and Serialization - Lambda expressions, Collection framework List, Map, Set, Generics Annotations		
UNIT – IV	**GUI AND DATABASE PROGRAMMING**	**9+6 Periods**
Introducing swing – components and containers – swing controls and swing menus. Design of JDBC – JDBC configuration – executing SQL statements – Query Execution – scrollable and updatable result set – transactions - Connection Management in Web and Enterprise Applications.		
UNIT – V	**NETWORKING AND SERVER SIDE PROGRAMMING**	**9+6 Periods**
Networking basics – Inent address –TCP/IP sockets – datagrams – introducing java.net.http Introduction to servlet - servlet life cycle - Developing and Deploying Servlets - Exploring Deployment Descriptor (web.xml) - Handling Request and Response – using Cookies - Session Tracking Management.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 30 Periods Total: 75 Periods**		

List of Experiments

Program to demonstrate concepts like abstraction, encapsulation, inheritance, polyporphism and packages.
Program to demonstrate the use of inbuilt and custom generated Java Exception handling Methods
Program to demonstrate creation of thread and inter thread communication.
Program to demonstrate the application of String handling functions
Program to demonstrate the use of File handling methods
Program to demonstrate the need for object serialization and deserialization

Demonstrate the use of Java collection frameworks in reducing application development time
Build a simple GUI application using swing
Develop simple student management system using JDBC with MySQL Database
Develop simple multiuser chat application
Develop simple banking application using servlets.

TEXT BOOK

1	*Herbert Schildt, **"Java: The Complete Reference",** 11 th Edition, McGraw Hill Education, New Delhi, 2019(Unit I,II,III,IV,V)*
2	*Cay S. Horstmann, **"Core Java Fundamentals"**, Volume 2, 9 th Edition, Prentice Hall, 2013.(unit III, IV)*

REFERENCES

1	*Cay S. Horstmann, **"Core Java Fundamentals",** Volume 1, 12 th Edition, Prentice Hall, 2018.*
2	*Y. Daniel Liang, **"Introduction to Java programming-comprehensive version"** - Tenth Edition, Pearson ltd 2015*
3	*Paul J. Deitel, Harvey Deitel, **"Java SE8 for Programmers (Deitel Developer Series)"** 3rd Edition, 2014*
4	*NPTEL Course : **Programming in Java,** https://nptel.ac.in/courses/106105191*
5	*Nicholas S. Williams, **"Professional Java for Web Applications",** Wrox Press, 2014.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply object oriented concepts like classes, abstraction, encapsulation inheritance, interface, polymorphism and packages to solve simple problems	K3
CO2	Make use of exception handling mechanisms and multithreaded model to solve real world problems	K3
CO3	Build Java applications with I/O packages, files, string classes, Collections and generics concept	K6
CO4	Design and implement GUI based applications using swing and applications involving Database Connectivity for real world problems	K6
CO5	Design, Develop and Deploy dynamic web applications using Servlets and Java Server Pages	K6

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	3	2	3	-	-	-	-	-	2	-	3	2	2	2
CO2	2	3	2	3	-	-	-	-	-	2	-	-	2	2	2
CO3	2	3	2	3	-	-	-	-	-	2	-	-	2	2	2
CO4	2	3	2	3	2	-	-	-	-	2	-	3	2	2	3
CO5	2	3	2	3	2	-	1	-	-	2	-	3	2	2	3
22SPC303	**2**	**3**	**2**	**3**	**1**	**-**	**1**	**-**	**-**	**2**	**-**	**2**	**2**	**2**	**3**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 10.1.1,10.1.2,10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1
CO2	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 10.1.1,10.1.2,10.1.3
CO3	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 10.1.1,10.1.2,10.1.3
CO4	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 5.1.1,5.1.2,5.2.1,5.2.2, 10.1.1,10.1.2,10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1
CO5	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 5.1.1,5.1.2,5.2.1,5.2.2, 10.1.1,10.1.2,10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1)%**	**Understanding (K2) %**	**Applying (K3)%**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	-	20	40	20	-	20	100
CAT2	-	30	70	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	-	-	50	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	-	-	-	100	100
ESE	-	20	40	20	-	20	100

22SES308	ENGINEERING EXPLORATION FOR COMPUTER SCIENCE AND ENGINEERING *(Common to CSE & IT Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	The objective of the course is to provide an introduction to the engineering exploration	
UNIT – I	**INTRODUCTION**	**15 Periods**
Introduction to Engineering and Engineering study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, expectation for the 21st century engineer and Graduate Attributes- Evolution of OS - Software Requirement Specification Document- Engineering Failures and Software bugs		
UNIT – II	**PC HARDWARE AND TROUBLESHOOTING**	**15 Periods**
Formatting PC- Installation of Operating system - Device Drivers Installation –study on Networking devices -network interfacing - Troubleshooting PC		
UNIT – III	**APPS AND GAME DESIGN**	**15 Periods**
Case Study 1: Tic Tac Toe -Hangman- Rock, Paper and scissor game - Pacman Case Study 2: Text to Speech convertor- Voice based calculator- ChatGPT App- Classification of Images Case study 3: Pong game -Space invaders game- Dobble game- Snake and ladder		
Contact Periods: **Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods**		

REFERENCES

1	*Ryan A Brown, Joshua W. Brown and Michael Berkihiser, "**Engineering Fundamentals: Design, Principles, and Careers**", Goodheart-Willcox Publisher, Second edition, 2014.*
2	*Saeed Moaveni, "**Engineering Fundamentals: An Introduction to Engineering**", Cengage learning, Fourth Edition, 2011.*
3	*G. Polya, "**How to Solve It: A New Aspect of Mathematical Method**", Princeton Science Library, Second Edition, 2014.*
4	*K.L. James, "**COMPUTER HARDWARE, Installation, Interfacing, Troubleshooting and Maintenance**", PHI learning, 2013*
5	https://appinventor.mit.edu/
6	https://gamemaker.io/en

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Understand basic engineering concepts	K2
CO2	Write SRS for the given problem statement	K4
CO3	Format and configure OS and device drivers	K4
CO4	Troubleshoot PC and configure networking	K4
CO5	Design apps and games	K6

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	2	1	-	-	-	-	2	-	-	2	2	2	2
CO2	3	3	2	3	2	-	-	-	2	-	3	2	2	2	2
CO3	3	3	2	1	2	-	-	-	2	-	-	2	2	2	2
CO4	3	3	2	1	2	-	-	-	2	-	-	2	2	2	2
CO5	3	3	3	1	3	3	-	3	2	2	3	2	2	2	2
22SES308	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.2.1,1.3.1, 3.1.1,3.1.4, 3.1.6, 4.1.1,4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3,4.3.4, 5.1.1,6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3,9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2,12.3.1
CO2	1.2.1,1.3.1, 3.1.1,3.1.4,3.1.6, 4.1.1,4.1.3, 4.1.4,4.3.1, 4.3.2, 4.3.3, 4.3.4,5.1.1,6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3,9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2,12.3.1
CO3	1.2.1,1.3.1, 3.1.1,3.1.4, 3.1.6, 4.1.1,4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3,4.3.4, 5.1.1,6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3,9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2,12.3.1
CO4	1.2.1,1.3.1, 3.1.1,3.1.4, 3.1.6, 4.1.1,4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3,4.3.4, 5.1.1,6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3,9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2,12.3.1
CO5	1.2.1,1.3.1, 3.1.1,3.1.4, 3.1.6, 4.1.1,4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3,4.3.4, 5.1.1,6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3,9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2,12.3.1

ASSESSMENT PATTERN

Component	**Preparation/ Design**	**Presentation**	**Viva**	**Total**
Study on Engineering Exploration	10	-	-	10
Software Requirement Specification Document Preparation for given problem	10	5	5	20
Formatting PC, Installation of OS and Device drivers	5	5	10	20
Troubleshooting of PC and configuration of Networks	5	5	10	20
Design of Apps and Games	10	10	10	30
Continuous Assessment				100
Model Lab				100

Weightage for record of work done: 75%; Weightage for Model Exam: 25%

22SES309	DIGITAL SYSTEMS LABORATORY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	The objective of this course is to design combinational logic circuits usinglogic gates, to design sequential logic circuits like counters and registers using flip flops and to simulate combinational logic circuits and sequential logic circuits using VHDL.

LIST OF EXPERIMENTS

1. Verification of truth tables of logic gates.
2. Implementation of given Boolean function using logic gates in both SOP and POS form.
3. Design and verify the implementation of Half /Full Adder.
4. Design and verify the implementation of Half /Full Subtractor.
5. Implementation of combinational logic circuits using Multiplexer
6. Implementation of combinational logic circuits using Decoder.
7. Verification of State Tables of RS, J-K, T and D Flip-Flops using NAND gates.
8. Verification of State Tables of RS, J-K, T and D Flip-Flops using NOR gates.
9. Design and implementation of Shift registers.
10. Implementation of Sequence generators.
11. Simulation of Half /Full Adder, Half /Full Subtractor using VHDL.
12. Simulation of Multiplexer (8:1) and De_multiplexer (1:8): using VHDL.
13. Simulation of Encoder and Decoder using VHDL.
14. Simulation of Flip flops and counters using VHDL.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Analyze and design combinational systems using standard gates and minimization methods such as Karnaugh maps	K6
CO2	Analyze and design combinational circuits using standard combinational modules, such as multiplexers and decoders	K6
CO3	Design and implement different sequential logic circuits like counters and registers using flip flops.	K6
CO4	Simulate combinational logic circuits and sequential logic circuits using VHDL.	K6

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	3	2	3	3	-	-	-	-	3	-	-	3	3	-
CO2	1	3	2	3	3	-	-	-	-	3	-	-	3	3	-
CO3	1	3	2	3	3	-	-	-	-	3	-	-	3	3	-
CO4	1	3	2	3	3	-	-	-	-	3	-	-	3	3	-
22SES309	**1**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.4, 2.3.1,2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2
CO2	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.4, 2.3.1,2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2
CO3	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.4, 2.3.1,2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2
CO4	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.4, 2.3.1,2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2

22SPC304	**DATA STRUCTURES LABORATORY** *(Common to ECE & CSE Branches)*	**SEMESTER III**

PREREQUISITES	**CATEGORY**	**L**	**T**	**P**	**C**
PROGRAMMING IN C LABORATORY	**PC**	**0**	**0**	**3**	**1.5**

Course Objectives	The objective of the course is to Implement linear data structures and nonlinear data structures, use appropriate data structures and implement appropriate sorting and searching techniques.

LIST OF EXPERIMENTS

1. Implementation of Stack Operations using array and Linked List
2. Implementation of Queue operations using array and Linked List
3. Application of stacks in Recursion and Infix to postfix conversion
4. Application of Queue in Simulation of FCFS and Round Robin Scheduling
5. Implementation of Linear list, circularly linked list and Doubly linked list.
6. Application of Linked List in Polynomial Manipulations
7. Implementation of binary tree operations
8. Implementation of Tree Traversal Algorithms
9. Implementation of Graph Traversal Algorithms
10. Implementation of Minimum Spanning Algorithms
11. Implementation of hashing techniques.
12. Implementation of sorting techniques.
13. Implementation of searching techniques.

Contact Periods:
Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 45 Periods** **Total: 45 Periods**

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Implement queue and stack data structures using arrays and Linked Lists	K5
CO2	Implement Tree Data structure and perform tree traversals.	K5
CO3	Implement traversal on Graph Data structure.	K5
CO4	Implement hashing Techniques	K6
CO5	Implement sorting and searching Techniques.	K6

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	1	2	3	3	-	-	-	-		-	1	3	3	2
CO2	3	2	2	3	3	2	-	-	-	2	-	2	3	3	2
CO3	3	2	2	3	3	2	-	-	-	2	-	2	3	3	2
CO4	3	2	2	3	3	2	-	-	-	2	-	2	3	3	2
CO5	3	2	2	3	3	-	-	-	-	-	-	1	3	3	2
22SPC304	**3**	**2**	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**2**	**3**	**3**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1,1.3.1, 1.4.1,2.1.2, 2.2.2, 2.3.1,2.4.1,3.1.6,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,4.2.2,4.3.1,12.2.2.
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO5	1.3.1,1.4.1,2.1.2.2.1,2.2.3,2.3.1,2.4.4,3.1.3,3.1.6, 3 .2.3, 3.3.2, 4.1.2, 4.2.1,4.3.1,6.1.1, 10.3.1,11.2.1, 12.1.1,12.2.2,12.3.2

22SES410	ANALOG AND DIGITAL COMMUNICATION	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	After the completion of the course, the students are able to explain basic analog modulation techniques, explore about wireless communication systems and Digital transmission techniques, analyze about Spread spectrum techniquesand multiple access techniques and describe about working principles of mobile and satellite communication system.	
UNIT – I	**FUNDAMENTALS OF ANALOG COMMUNICATION**	**9 Periods**
Principles of amplitude modulation-AM envelope - frequency spectrum – bandwidth - modulation index percent modulation - Voltage and power distribution - AM detector – peak detector - Angle modulation FM and PM waveforms - phase deviation and modulation index - frequency deviation and percent modulation - Frequency analysis of angle modulated waves - Bandwidth requirements for Angle modulated waves - FM detector – slope detector.		
UNIT – II	**DIGITAL COMMUNICATION**	**9 Periods**
Introduction- Shannon limit for information capacity- ASK transmitter, receiver and bandwidth-FSK transmitter, receiver and bandwidth- BPSK transmitter, receiver and bandwidth- QPSK transmitter, receiver and bandwidth- Quadrature Amplitude modulation – transmitter, receiver and bandwidth efficiency- carrier recovery – squaring loop- Costas loop- DPSK – transmitter and receiver.		
UNIT – III	**DIGITAL TRANSMISSION**	**9 Periods**
Sampling theorem- reconstruction of message from its samples- Pulse modulation- PCM – PCM sampling, quantization- signal to quantization noise rate-companding – analog and digital– percentage error- delta modulation-transmitter and receiver- adaptive delta modulation- differential pulse code modulation-transmitter and receiver- pulse transmission – Inter symbol interference- ISI-Nyquist criteria for distortion less transmission.		
UNIT – IV	**SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES**	**9 Periods**
Pseudo-noise sequence -Direct Sequence spread spectrum with coherent binary PSK- Frequency-hop spread spectrum – slow and fast hopping. Multiple access techniques: FDMA- TDMA- CDMA – SDMA wireless communication-frequency reuse and cell splitting- TDMA and CDMA in wireless communication systems- source coding of speech for wireless communications.		
UNIT – V	**MOBILE AND SATELLITE COMMUNICATIONS**	**9 Periods**
Introduction to Cellular Concepts- Cellular Network Capacity- Cellular Channel Modelling- GSM Network- Digital Cellular Communications Concepts- Equalisation, Channel Diversity, and Speech Coding in Cellular Systems- CDMA and IS-95- UMTS W-CDMA and cdma2000- 4G Cellular Networks and Beyond. Satellite Channel Modelling and Antennae- Satellite Communications Systems- Satellite Applications: INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1.	*Simon Haykin* ***"Communication Systems"*** *Third edition, John Wiley & Sons, 2004. (first four units covered).*
2.	*Wayne Tomasi* ***"Electronic Communication Systems: Fundamentals Through Advanced",*** *Fifth edition, Pearson Education, 2004. (first four units few topics covered).*

3.	*W.C.Y.Lee**, "Mobile Communications Engineering: Theory and applications"**, Second Edition, McGraw-Hill International, 1998. (fifth unit covered).*
4.	*Dennis Roddy,**"Satellite Communication"**, 4th Edition, Mc Graw Hill International, 2006. (fifth unit covered).*

REFERENCES

1.	*B.P.Lathi, **"Modern Analog and Digital Communication systems"**, Fourth Edition, Oxford University Press, 2009.*
2.	*T G Kennedy, B Davis and S R M Prasanna **"Electronic communication systems"**, Fifth Edition, Tata Mc-Graw Hill Education Pvt Limited, 2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain the principles of Amplitude modulation, Frequency modulation and Phase modulation	**K2**
CO2	Describe the operation of transmitter and receiver system for digital communication.	**K2**
CO3	Apply the concept of pulse code modulation for telecommunication networks**.**	**K3**
CO4	Analyze the variousspread spectrum and multiple access techniques	**K4**
CO5	Analyze the working principles of Mobile And Satellite Communications.	**K4**

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	2	2	2	2	-	-	-	-	1	-	2	2	2	1
CO2	1	2	2	2	2	-	-	-	-	1	-	2	2	2	1
CO3	1	3	2	3	2	-	-	-	-	1	-	2	2	2	1
CO4	1	3	2	3	2	2	-	-	-	1	-	2	2	2	1
CO5	1	3	2	3	2	2	-	-	-	1	-	2	2	2	1
22SES410	**1**	**3**	**2**	**3**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**2**	**2**	**2**	**1**

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.4, 2.4.1, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 10.1.1, 10.2.1, 12.1.1, 12.1.2, 12.2.2, 12.3.2
CO2	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.4.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.3.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 10.1.1, 10.2.1, 12.1.1, 12.1.2, 12.2.2, 12.3.2
CO3	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.4.1, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6,3.2.1, 3.2.2, 3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 10.1.1, 10.2.1, 12.1.1, 12.1.2, 12.2.2, 12.3.2
CO4	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3,2.2.4, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.2, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 6.2.1, 10.1.1, 10.2.1, 12.1.1, 12.1.2, 12.2.2, 12.3.2
CO5	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3,2.2.4, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 6.2.1, 10.1.1, 10.2.1, 12.1.1, 12.1.2, 12.2.2, 12.3.2

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3)%	Analyzing (K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	60	40	-	-	-	100
CAT2	-	-	40	60	-	-	100
Individual Assessment 1 /Case Study 1/Seminar 1 / Project1	-	50	50	-	-	-	100
Individual Assessment 2 /Case Study 2/Seminar 2 / Project 2	-	-	50	50	-	-	100
ESE	-	40	20	40	-	-	100

22SPC405	COMPUTER ARCHITECTURE	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
DIGITAL SYSTEMS	PC	3	0	0	3

Course Objectives	The objective of the course is to introduce the concepts of computer architecture and organization. It describes overview of MIPS architecture in terms of instruction set, data path, pipelining and memory systems in detail along with performance metrics for designing computer systems.	
UNIT – I	**BASIC STRUCTURE OF A COMPUTER SYSTEM**	**9 Periods**
Introduction - Eight Great Ideas in Computer Architecture -Technologies for Building Processors and Memory – performance -The Power Wall - Amdahl's law - The Switch from Uniprocessors to Multiprocessors - Classes of Computing - High-Level Language to Language of Hardware - Instructions: Operation, Operands, Representing Instructions, Logical operations, Decision making, Supporting Procedures in Computer Hardware, MIPS Addressing- Parallelism and Instructions: Synchronization.		
UNIT – II	**ARITHMETIC FOR COMPUTERS**	**9 Periods**
Signed Number Representation - Fixed and Floating Point Representations - Character Representation. Computer Arithmetic - Addition and Subtraction - Multiplication - Division -Floating point- Parallelism and Computer Arithmetic: Subword Parallelism and Matrix multiplication.		
UNIT – III	**PROCESSOR AND PIPELINING**	**9 Periods**
Single-Cycle Datapath and Control-Multi-cycle Datapath and Control-Micro-programming and Hardwired Control Units.Introduction to Pipelining: Pipelined Datapath and Control – Pipeline Hazards: Structural, Data Hazards: Forwarding versus Stalling–Control Hazards – Exceptions-Parallelism via Instructions.		
UNIT – IV	**MEMORY SYSTEMS AND I/O INTERFACING**	**9 Periods**
Introduction - Memory Technologies - The Basics of Caches - Measuring and Improving Cache Performance - Dependable Memory Hierarchy - Virtual Machines - Virtual Memory - A Common Framework for Memory Hierarchy –Finite State Machine to Control Simple Cache- Parallelism and Memory Hierarchies: Cache Coherence - Redundant Arrays of Inexpensive Disks.		
UNIT – V	**PARALLEL PROCESSORS FROM CLIENT TO CLOUD**	**9 Periods**
Introduction - Difficulty of Creating Parallel Processing Programs - SISD, MIMD, SIMD, SPMD, and Vector - Hardware Multithreading - Multicore and Shared Memory Multiprocessors– Graphics Processing Units - Clusters, Warehouse Scale Computers, and Message-Passing Multiprocessors - Multiprocessor Network Topologies - Cluster Networking - Multiprocessor Benchmarks and Performance Models.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*David. A. Patterson, John L. Hennessy* ***"Computer Organization and Design: The Hardware/Software Interface"****, Fifth Edition, Morgan-Kaufmann Publishers Inc. 2014*

REFERENCES

1	*Carl Hamachar, ZvoncoVranesic and SafwatZaky, **"Computer Organization"**, 5th edition, McGraw Hill, 2011.*
2	*John P.Hayes, **"Computer Architecture and Organization"** Third Edition, Mc-Graw Hill International, 1998.*
3	*William Stallings, **"Computer Organization and Architecture: Designing for Performance"**, 10th Edition, Pearson Education, 2016.*
4	*Morris Mano. M, **"Computer system Architecture"**, 3rd edition, PHI publication, 2008.*
5	*Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, **"Computer Organization and Embedded Systems"**, Sixth Edition, Tata McGraw Hill, 2012.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Describe and analyze the main functional units of a computer and its performance evaluation.	K3
CO2	Explain the Computer Arithmetic to demonstrate the performance impact of sub word parallelism.	K2
CO3	Identify different pipelining hazards and their inference.	K4
CO4	Explain the Data path and Control and Micro-programming and Hard-wired Control Units.	K2
CO5	Understand virtual memory and caching.	K2
CO6	Understand parallel processor from client to cloud.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	3	1	2	-	-	2	-	-	-	2	1	3	3	3
CO2	3	2	2	2	-	-	2	-	-	-	-	1	3	3	3
CO3	3	3	2	3	-	-	2	-	-	-	2	1	3	3	3
CO4	3	3	2	3	-	-	2	-	-	-	2	1	3	3	3
CO5	3	3	2	3	-	-	2	-	-	-	2	1	3	3	3
CO6	3	3	2	3	-	-	2	-	-	-	2	1	3	3	3
22SPC405	**3**	**3**	**2**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**1**	**3**	**3**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.2.2, 3.2.3, 3.3.1, 3.4.2, 4.1.2, 4.1.4, 4.2.1, 4.3.3, 7.1.2, 7.2.2, 11.2.1, 11.3.1, 12.1.1, 12.3.2
CO2	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1,2.2.2, 2.2.4, 2.3.1, 2.3.2, 2.4.1,3.1.4, 3.2.1, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.2, 4.3.2, 4.3.3, 7.1.2, 7.2.2, 12.1.2, 12.3.2
CO3	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1,2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1,2.4.3, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2, 4.3.2, 4.3.3, 7.1.2, 7.2.2, 11.2.1, 11.3.1, 12.1.1, 12.3.2
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1,2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1,2.4.3, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2, 4.3.2, 4.3.3, 7.1.2, 7.2.2, 11.2.1, 11.3.1, 12.1.1, 12.3.2
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1,2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1,2.4.3, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2, 4.3.2, 4.3.3, 7.1.2, 7.2.2, 11.2.1,11.3.1,12.1.1, 12.3.2
CO6	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1,2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1,2.4.3, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2, 4.3.2, 4.3.3, 7.1.2, 7.2.2, 11.2.1,11.3.1, 12.1.1, 12.3.2

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	30	20	-	-	100
CAT2	10	25	35	30	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	10	20	30	40	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	10	25	35	30	-	-	100
ESE	20	20	40	20	-	-	100

22SPC406	DATABASE MANAGEMENT SYSTEMS	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of this course is to learn about database design and query processing. To develop transaction processing applications considering concurrency control and recovery issues. To learn about enhanced data models	
UNIT – I	**DATABASE SYSTEM CONCEPTS AND DATA MODELS**	**9 Periods**
Data base approach: Characteristics, Advantages, Applications – Data Models - Three Schema Architecture- Data base System Environment- Data Modeling with ER model-Enhanced ER Model.		
UNIT – II	**RELATIONAL DATA MODEL AND SQL**	**9 Periods**
Relational Model: Concepts - Mapping ER and EER model to relations – Constraints - Schemas – Basic SQL: Data Definition, Data types, Constraint Specification, Data retrieval Queries - Relational Algebra – Triggers - Views		
UNIT – III	**DATABASE DESIGN AND QUERY PROCESSING**	**9 Periods**
Design Guidelines – Functional Dependencies – Normal Forms based on Primary Keys –Second and Third Normal Forms – BCNF – Multi valued Dependencies and Fourth Normal Form – Join Dependency and Fifth Normal Form - Strategies for Query Processing – Query Optimization		
UNIT – IV	**TRANSACTION PROCESSING, CONCURRENCY CONTROL AND RECOVERY**	**9 Periods**
Transaction: Desirable properties, Schedules based on recoverability and serializability - Transaction support in SQL. Concurrency Control: Locking technique -Time stamp based ordering - Multi version concurrency control - Validation and snapshot isolation concurrency control. Recovery Techniques: Concepts, NOUNDO/ REDO recovery based on deferred update, Recovery based on immediate update, Shadow paging, ARIES algorithm, Recovery in multi database systems		
UNIT – V	**NOSQL DATABASES AND ENHANCED DATA MODELS**	**9 Periods**
Introduction to NOSQL Systems: CAP Theorem, Document based systems, NOSQL Key-value stores, CRUD operation using NOSQL- Enhanced Data models: Active Database, Temporal Database, Spatial, multimedia and Deductive Databases.		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXT BOOK

1	*Ramez Elmasri, Shamkant B. Navathe* ***"Fundamentals of Database Systems"*** *Seventh Edition, Pearson Education Limited, 2015*

REFERENCES

1	*Abraham Silberschatz , Henry F. Korth and S. Sudarshan,* ***"Database System Concepts"****, Sixth Edition, McGraw-Hill, 2012.*
2	*Raghu Ramakrishnan and Gehrke,* ***"Database Management Systems"****, Third Edition, McGraw Hill, 2003*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Design a database management system using ER and EER model	K4
CO2	Design a relational database system and write SQL queries in an optimized way	K4
CO3	Write transaction processing applications considering concurrency control and recovery issues	K3
CO4	Perform CRUD operation using NOSQL database	K4
CO5	Explain Active Database, Temporal Database, Spatial, multimedia and Deductive Databases	K2

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	2	-	-	-	-	-	1	-	-	3	3	1
CO2	2	3	3	2	-	-	-	-	-	1	-	-	3	3	1
CO3	2	3	3	2	-	-	-	-	-	1	-	-	3	3	1
CO4	2	3	3	2	-	-	-	-	-	1	-	-	3	3	1
CO5	2	2	2	2	-	-	-	-	-	1	-	-	3	3	1
22SPC406	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**3**	**3**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4,2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.3.1, 4.3.3, 10.1.1
CO2	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2,4.1.3, 4.2.1, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 10.1.1
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2,4.1.3, 4.2.1, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 10.1.1
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2,4.1.3, 4.2.1, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 10.1.1
CO5	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.3.1, 4.3.3, 10.1.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1)%**	**Understanding (K2) %**	**Applying (K3)%**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	30	40	-	-	10	100
CAT2	20	30	40	-	-	10	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	-	-	50	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	50	-	-	50	100
ESE	20	30	50	-	-	-	100

22SPC407	SYSTEM PROGRAMMING AND OPERATING SYSTEMS	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of the course is to form an understanding on basic working principle of system software, role of OS services in process management, process synchronization , CPU scheduling , memory management ,storage management, file management and protection. To understand concept behind virtual machine.	
UNIT – I	**INTRODUCTION TO SYSTEM SOFTWARE**	**9 Periods**
Introduction to system software – Overview of language processors – Assemblers – Elements of Assembly language programming – pass structure of assemblers – two pass assembler – single pass assembler - Macro definition and call –Macro expansion –advanced Macro facilities –Design of Macro Preprocessor - relocation and linking concept –design of linker – self relocating programs – loaders		
UNIT – II	**PROCESS MANAGEMENT AND SYNCHRONIZATION**	**9 Periods**
Operating System structure – Services - Process concepts - process scheduling – operation on processes - inter process communication – examples of IPC systems – communication in client server system – Threads - Multicore Programming - Multithreading Models - Threading Issues - Operating-System Examples Process synchronization: critical section problem - Peterson's Solution - synchronization Hardware – Mutex lock – semaphores - classical problems of synchronization - monitors – synchronization examples – alternative approaches		
UNIT – III	**CPU SCHEDULING AND DEADLOCK**	**9 Periods**
Basic Concepts - Scheduling Criteria - Scheduling Algorithms - Thread Scheduling - Multiple-Processor Scheduling - Real-Time CPU Scheduling - Operating-System Examples - Algorithm Evaluation Deadlock - System model-Deadlock characterization- Methods for Handling Deadlocks - Deadlock prevention- Deadlock avoidance - Deadlock detection- Recovery from deadlock.		
UNIT – IV	**MEMORY AND STORAGE MANAGEMENT**	**9 Periods**
Main Memory –Logical address and Physical address – Swapping – Continuous memory allocation - segmentation – paging – Structure of page table - Example: ARM Architecture - Virtual memory concepts - Demand paging - Copy-on-Write - Page replacement – Allocation of Frames -Thrashing - Memory-Mapped Files - Allocating Kernel Memory - Other Considerations - Operating-System Examples Disk Structure-Disk Attachment - Disk scheduling- Disk Management - Swap Space Management – File concept- Access methods- Directory and Disk Structure- File system Mounting - File sharing-Protection - File system implementation – Free Space Management		
UNIT – V	**PROTECTION AND VIRTUAL MACHINE**	**9 Periods**
Goals of Protection - Principles of Protection - Access Matrix - Implementation of the Access Matrix- Access Control - Revocation of Access Rights - Capability-Based Systems -Language-Based Protection		
Virtual Machines – history - Benefits and Features - Building Blocks - Types of Virtual Machines and Their Implementations - Virtualization and Operating-System Components - Examples		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*D.M.Dhamdhere **"System Programming",** Tata McGraw Hill Education Private Limited , 2011*
2	A. Silberschatz & Peter Baer Galvin and Greg Gagne **"Operating System concepts"** 9th edition, John Wiley and sons Inc., 2012.

REFERENCES

1	Andrew S. Tanenbaum, Albert S. Woodhull: **"Operating Systems, Design and Implementation",** 3rd Edition, Prentice Hall, 2011.
2	Gary Nutt: **"Operating Systems",** 3rd Edition, Pearson Education, 2009
3	D M Dhamdhere, **"Operating Systems: A Concept-based Approach",** 2nd Edition, Tata McGraw-Hill Education, 2009.
4	NPTEL Course : **"Operating System Fundamentals"** https://nptel.ac.in/courses/106105214

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain the working principle of Assembler, Macros, Linkers and Loaders	K2
CO2	Explore process management and process synchronization techniques	K4
CO3	Identify and apply appropriate CPU scheduling algorithms and Deadlock detection techniques for the given scenario	K4
CO4	Apply appropriate memory management techniques and Storage management techniques for the given scenario	K3
CO5	Explain the concepts behind virtual machine and protection mechanism in OS.	K2

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2	1	-	1	-	-	-	-	2	-	2	1	1	-
CO2	2	3	2	1	-	-	-	-	-	2	-	2	2	2	1
CO3	2	3	2	1	-	-	-	-	-	2	-	2	2	2	1
CO4	2	3	2	1	-	-	2	-	-	2	-	2	2	2	-
CO5	2	3	1	-	3	-	2	-	-	2	-	2	2	2	2
22SPC407	**2**	**3**	**2**	**1**	**1**	**-**	**1**	**-**	**-**	**2**	**-**	**2**	**2**	**2**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.2, 2.4.1, 3.1.3, 3.1.6, 5.2.2, 10.1.1, 10.1.3, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,3.1.3,3.1.6,3.2.2,3.2.3,3.3.1,4.1.2,4.1.3, 10.1.1,10.1.3, 12.2.1,12.2.2,12.3.1,12.3.2
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,3.1.3,3.1.6,3.2.2,3.2.3,4.1.2,4.1.3, 10.1.1,10.1.3, 12.2.1,12.2.2,12.3.1,12.3.2
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,3.1.3,3.1.6,3.2.2,3.2.3,4.1 .2, 4.1.3, 7.1.1, 7.2.2,10.1.1,10.1.3, 12.2.1,12.2.2,12.3.1,12.3.2
CO5	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.2,2.4.1,2.4.2,3.1.3,3.1.6,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1, 7.1.1,7.2.2,10.1.1,10.1.3, 12.2.1,12.2.2,12.3.1,12.3.2

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	40	40	20	-	-	100
CAT2	-	30	50	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 /Project1	-	-	70	30	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	60	40	-	-	100
ESE	-	40	50	10	-	-	100

22SPC408	**DESIGN AND ANALYSIS OF ALGORITHMS** *(Common to CSE & IT Branches)*	**SEMESTER IV**

PREREQUISITES	**CATEGORY**	**L**	**T**	**P**	**C**
DATA STRUCTURES	**PC**	**3**	**1**	**0**	**4**

Course Objectives	To apply important algorithmic design paradigms and methods of analysis and synthesize efficient algorithms in common engineering design situations	
UNIT – I	**INTRODUCTION TO ALGORITHM ANALYSIS**	**9+3 Periods**
Fundamentals of Algorithmic Problem Solving - Important Problem Types - Fundamentals of the Analysis of Algorithm Efficiency - Asymptotic Notations and Basic Efficiency Classes - Mathematical Analysis of Non-recursive Algorithms - Mathematical Analysis of Recursive Algorithms - Amortized Analysis		
UNIT – II	**DECREASE AND CONQUER TECHNIQUE**	**9+3 Periods**
Decrease by constant: Insertion sort - Topological algorithm. Decrease-by-a-Constant-Factor: Binary Search - Fake-Coin Problem - Russian Peasant Multiplication -Josephus Problem. Variable-Size Decrease - Computing a Median and the Selection Problem – Interpolation Search - Searching and Insertion in a Binary Search Tree - The Game of Nim.		
UNIT – III	**ALGORITHM DESIGN TECHNIQUES - I**	**9+3 Periods**
Greedy Approach : Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm - Huffman Trees and codes .Divide and Conquer : Merge Sort – Quick sort - Matrix Multiplication of Large Integers - Strassen's Matrix Multiplication Dynamic Programming : Matrix Chain Multiplication – Knapsack problem and Memory Function – optimal binary search tree - Warshall's and Floyd's Algorithms – Longest common Subsequence		
UNIT – IV	**ALGORITHM DESIGN TECHNIQUES - II**	**9+3 Periods**
Backtracking: n-Queen problem – Hamilton Circuit Problem – Subset sum problem - CNF –SAT. Branch and Bound: Assignment problem – Knapsack problem - Travelling Salesman Problem.		
UNIT – V	**NP COMPLETENESS**	**9+3 Periods**
Limitations of algorithm power – Lower bound arguments – Decision Trees - P,NP and – NP Complete problem - Approximation Algorithm for NP Hard Problems: TSP - Knapsack problem Case study (not for evaluation) : Randomized Algorithms - Exact Exponential Algorithm		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK

1	*Anany Levitin **"Introduction to the Design and Analysis of Algorithms"** Third Edition, Pearson Education, 2012*
2	*Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein **"Introduction to Algorithms"** Fourth Edition, MIT Press/McGraw-Hill, 2022.(unit 1-Amortized analysis)*

REFERENCES

1	*Singhal, Shefali, and Neha Garg "**Analysis and Design of Algorithms: A Beginner's Hope**", BPB Publications, 2018.*
2	*Sedgewick , Robert, and Kevin Wayne. "**Algorithms**". Fourth edition , Addison-wesley professional, 2011.*
3	*Michael T Goodrich and Roberto Tamassia, "**Algorithm Design: Foundations, Analysis, and Internet Examples**", Second Edition, Wiley, 2006*
4	*NPTEL Course : Design and Analysis of Algorithms https://archive.nptel.ac.in/courses/106/106/106106131/*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Argue the correctness of algorithms and analyze the running time using asymptotic notations and amortized analysis	K4
CO2	Explore different algorithmic approaches, such as Decrease by Constant, Decrease by a Constant Factor, and Variable-Size Decrease and solve problems associated with these paradigms.	K2
CO3	Develop problem-solving skills through practical application of Greedy Approach, Divide and Conquer, and Dynamic Programming.	K3
CO4	Cultivate proficient problem-solving abilities through the utilization of advanced Backtracking and Branch and Bound algorithms.	K3
CO5	Grasp the limitations of algorithmic capabilities and explore approaches to address them through the use of approximation algorithms.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	2	1	1	1	-	-	-	-	-	1	2	3	3	3
CO2	2	2	1	1	1	-	-	-	-	-	1	2	3	3	3
CO3	2	2	3	1	1	-	-	-	-	-	1	2	3	3	3
CO4	2	2	1	1	1	-	-	-	-	-	1	2	3	3	3
CO5	2	1	1	1	1	-	-	-	-	-	1	2	3	3	3
22SPC408	**2**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**3**	**3**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2,3.2.3,3.3.1,4.1.2,4.2.1,5.1.2,5.3.1,11.3.1,12.3.2
CO2	1.1.1, 1.3.1,1.4.1, 2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2, 3.1.6, 3.2.3,3.3.1, 4.1.2,4.2.1,5.1.2,5.3.1, 11.3.1,12.3.2
CO3	1.1.1, 1.3.1,1.4.1, 2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2, 3.1.6, 3.2.3,3.3.1, 4.1.2,4.2.1,5.1.2,5.3.1, 11.3.1,12.3.2
CO4	1.1.1, 1.3.1,1.4.1, 2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2, 3.1.6, 3.2.3,3.3.1, 4.1.2,4.2.1,5.1.2,5.3.1, 11.3.1,12.3.2
CO5	1.1.1, 1.3.1,1.4.1, 2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2, 3.1.6, 3.2.3,3.3.1, 4.1.2,4.2.1,5.1.2,5.3.1, 11.3.1,12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	-	30	30	40	-	-	100
CAT2	10	40	50	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	50	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	50	50	-	-	-	100
ESE	10	40	50	-	-	-	100

22SPC409	THEORY OF COMPUTATION *(Common to CSE and IT)*	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	1	0	4

Course Objectives	Understand the foundations of computation including grammars, formal languages, Automata and Turing machines.	
UNIT – I	**INTRODUCTION TO FORMAL LANGUAGES AND FINITE AUTOMATA**	**9+3 Periods**
Introduction to Formal Languages, Grammars and Automata; Types of Grammars - Chomsky's hierarchy of languages, Regular Languages and Regular Expressions, Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA), Non-deterministic Finite Automata with Epsilon transitions, Conversion of NFA into DFA, DFA Minimization..		
UNIT – II	**REGULAR LANGUAGES, CONTEXT FREE GRAMMARS AND NORMAL FORMS**	**9+3 Periods**
Kleene's theorem - Equivalence of Regular Expressions and Finite Automata, Myhill-Nerode Theorem, Moore and Mealy machines and its equivalence, Closure properties of Regular Languages, Pumping Lemma for regular languages. Context-Free Grammar (CFG) and Languages, Derivations and Parse trees, Ambiguity in grammars and languages, Normal forms for CFG, Simplification of CFG, Chomsky Normal Form (CNF) and Greibach Normal Form (GNF)		
UNIT – III	**CONTEXT FREE LANGUAGES AND PUSHDOWN AUTOMATA**	**9+3 Periods**
Closure properties of Context Free Languages, Pumping lemma for CFL, Ogden's Lemma, Push Down Automata (PDA), Languages of pushdown automata, Equivalence of pushdown automata and CFG-CFG to PDA-PDA to CFG, Deterministic Pushdown Automata.		
UNIT – IV	**TURING MACHINES**	**9+3 Periods**
Turing Machines, Language of a Turing Machine, Turing Machine as a Computing Device, Modifications of Turing Machines, Two-way Infinite Tape, Equivalence of One Way Infinite Tape and Two-way Infinite Tape Turing Machines, Multi Tape Turing Machines, Nondeterministic Turing machine, Universal Turing machines.		
UNIT – V	**RECURISVE, RECURSIVELY ENUMERABLE PROBLEMS AND UNDECIDABILITY**	**9+3 Periods**
Recursive and recursively enumerable languages, Properties, Reducibility Theory, Rice Theorem for Recursive and Recursively Enumerable Languages, Halting Problem and undecidability, Post's Correspondence Problem (PCP), Modified Post Correspondence Problem		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 15 Periods** **Practical: 0 Periods** **Total: 60 Periods**		

TEXT BOOK

1	*John C Martin , **"Introduction to Languages and the Theory of Computation"**, 4th Edition, Tata McGraw Hill, 2015*

REFERENCES

1.	*Harry R Lewis and Christos H Papadimitriou, **"Elements of the Theory of Computation"**, 2nd Edition, Prentice Hall of India, 2015.*
2.	*Peter Linz, **"An Introduction to Formal Language and Automata"**, 6th Edition, Jones & Bartlett, 2016.*
3.	*Michael Sipser, **"Introduction to Theory of Computation"**, Third Edition, Cengage learning, 2013*
4.	*Adam Brooks Webber, **"Formal languages: a practical introduction"**, Jim Leisy, 2008.*
5.	*Hopcroft J.E., Motwani R. & Ullman J.D., **"Introduction to Automata Theory, Languages and Computations"**, 3rd Edition, Pearson Education, 2008.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Write Regular Expression/Context free grammar for the given language	K2
CO2	Construct Automata/Turing Machines for the given language	K3
CO3	Explain the properties of Regular/Context Free/Recursive/Recursively Enumerable languages	K1
CO4	Use Pumping lemma	K2
CO5	Identify and prove the given problem is un-decidable using reducibility theory	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2	3	-	-	-	-	-	-	1	-	1	2	1	3
CO2	2	2	3	-	-	-	-	-	-	1	-	1	2	1	3
CO3	2	2	-	-	-	-	-	-	-	1	-	1	2	1	3
CO4	2	2	3	-	-	-	-	-	-	1	-	1	2	1	3
CO5	2	2	3	-	-	-	-	-	-	1	-	1	2	1	3
22SPC409	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2**	**1**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	2.1.1, 2.1.2, 3.1.1, 3.1.2, 1.1.1, 1.1.1
CO2	2.1.1, 2.1.2, 3.1.1, 3.1.2, 1.1.1, 1.1.1
CO3	2.1.1, 2.1.2, 1.1.1, 1.1.1
CO4	2.1.1, 2.1.2, 3.1.1, 3.1.2, 1.1.1, 1.1.1
CO5	2.1.1, 2.1.2, 3.1.1, 3.1.2, 1.1.1, 1.1.1

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	**Rememberin g(K1) %**	**Understanding (K2) %**	**Applyin g(K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creatin g(K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	20	40	5	5	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	20	30	10	5	5	100
ESE	30	30	40	-	-	-	100

22SPC410	DATABASE MANAGEMENT SYSTEMS LABORATORY	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

Course Objectives	The objective of this course is to practice DDL, DML, DCL and TCL commands, relational algebra operations, Views, stored procedures, cursors, functions, triggers and to develop a simple application with front end and back end design with report generation.

LIST OF EXPERIMENTS

Experiments should be implemented in MySQL/NoSQL

1. DDL and DML commands.
2. Views & Subqueries.
3. Relational Algebra Operations
4. Stored Procedures and Cursors.
5. Stored Functions.
6. Triggers.
7. DCL and TCL commands.
8. Form Design and report generation using PHP/Java/Django
9. Mini Project

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Create and Manipulate a database using DDL, DML, DCL and TCL commands	K6
CO2	Implement a database schema for any real world problem with integrity constraints	K6
CO3	Apply PL/SQL constructs for designing stored procedures, functions, cursors, packages and triggers to access database.	K6
CO4	Design and develop a simple application with front end and back end design with report generation.	K6

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	3	3	3	3	-	-	-	-	3	-	-	3	3	-
CO2	2	3	3	3	3	-	-	-	-	3	-	-	3	3	-
CO3	2	3	3	3	3	-	-	-	-	3	-	-	3	3	-
CO4	2	3	3	3	3	-	-	-	-	3	-	-	3	3	-
22SPC410	**2**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1,1.4.1, 2.1.1,2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2 , 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2
CO2	1.3.1,1.4.1, 2.1.1,2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2 , 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2
CO3	1.3.1,1.4.1, 2.1.1,2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2 , 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2
CO4	1.3.1,1.4.1, 2.1.1,2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2 , 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2

22SPC411	SYSTEM PROGRAMMING AND OPERATING SYSTEMS LABORATORY	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

Course Objectives	The objective of the course is to understand the concepts behind the design ofsystem software , process management, memory management, storage management, file management ,protection mechanism and virtual machine.

PRACTICALS EXERCISES ILLUSTRATING THE FOLLOWING CONCEPTS:	
SYSTEM PROGRAMMING (Experiments should be implemented in C)	
1	Design of analysis phase in a two pass assembler
2	Design of synthesis phase in a two pass assembler
3	Design of single pass assembler
4	Design of macro processor
5	Design of linkers and loaders
OPERATING SYSTEMS (Experiments should be implemented in C++/Java)	
6	Implementation of Process synchronization strategy
7	Implementation of process scheduling
8	Implementation deadlock detection algorithm
9	Implementation of paging and Segmentation
10	Implementation of page replacement algorithms
11	Implementation of Disk Scheduling
12	Study on security and protection mechanism in Windows and Linux OS
13	Setting up a Virtual Machine

Contact periods:			
Lecture: 0 Periods	**Tutorial: 0 Periods**	**Practical: 45 Periods**	**Total: 45 Periods**

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Simulate system software like single and two pass assemblers, Macroprocessor , linker and loader	K3
CO2	Implement Process synchronization , process scheduling and deadlock detection methods	K6
CO3	Implement to Virtual memory management and Disk management techniques.	K6
CO4	Explore on basic security and protection mechanisms in Windows and Linux OS	K2
CO5	Install and use virtual machine using tools like virtual box	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	3	3	2	1	-	-	-	-	3	-	2	1	1	-
CO2	2	3	3	3	1	-	-	-	-	3	-	2	2	2	1
CO3	2	3	3	3	1	-	-	-	-	3	-	2	2	2	1
CO4	2	3	3	3	1	-	2	-	-	3	-	2	2	2	-
CO5	2	3	3	3	3	-	1	-	-	3	-	3	2	2	2
22SPC411	**2**	**3**	**3**	**3**	**1**	**-**	**1**	**-**	**-**	**3**	**-**	**2**	**2**	**2**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.2,4.1.3,4.1.4,4.3.1,4.3.4, ,5.1.1, 10.1.1,10.1.2,10.1.3,10.2.2,10.3.1,12.2.1, 12.2.2,12.3.1, 12.3.2
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.3,4.3.4, 5.1.1, 10.1.1,10.1.2,10.1.3,10.2.2, 10.3.1, 12.2.1,12.2.2,12.3.1,12.3.2
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.3,4.3.4,5.1.1, 10.1.1,10.1.2,10.1.3, 10.2.2, 10.3.1 , 12.2.1,12.2.2,12.3.1,12.3.2
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.4,7.1.1,7.2.2,5.1.1,10.1.1,10.1.2 ,10.1.3, 10.2.2,10.3.1, 12.2.1, 12.2.2,12.3.1,12.3.2
CO5	1.3.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.4,5.1.1,51.2,5.2.1,5.2.2,5.3.1,5.3.2,7.2.2,10.1.1,10.1.2,10.1.3,10.2.2,10.3.1,12.1.1,12.2.1,12.2.2,12.3.1,12.3.2