GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE - 641013

B.Tech. INFORMATION TECHNOLOGY

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	22IBS308	Probability, Random Processes and Queuing Theory (Common to CSE & IT)	BS	40	60	100	3	1	0	4
2	22IES306	Computer Organization and Architecture	ES	40	60	100	3	0	0	3
3	22IES307	Digital Logic Design	ES	40	60	100	3	0	0	3
4	22IPC301	Data Structures and Algorithms	PC	40	60	100	3	0	0	3
THEORY WITH PRACTICAL COMPONENT										
5	22IPC302	Java Programming	PC	50	50	100	3	0	2	4
PRACTICAL										
6	22IES308	Engineering Exploration	ES	60	40	100	0	0	3	1.5
7	22IES309	Digital Logic Design Laboratory	ES	60	40	100	0	0	2	1
8	22IPC303	Data Structures and Algorithms Laboratory	PC	60	40	100	0	0	3	1.5
TOTAL				**390**	**410**	**800**	**15**	**1**	**10**	**21**

FOURTH SEMESTER

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22IES410	Elements of Discrete Structures	ES	40	60	100	3	0	0	3
2	22IPC404	Embedded Systems Architecture	PC	40	60	100	3	0	0	3
3	22IPC405	Database Systems	PC	40	60	100	3	0	0	3
4	22IES411	Principles of Communication Engineering	ES	40	60	100	3	0	0	3
5	22IPC406	Design and Analysis of Algorithms (Common to CSE & IT)	PC	40	60	100	3	1	0	4
6	22IES412	Foundations of Data Science (Common to CSE & IT)	ES	40	60	100	3	0	0	3
PRACTICAL										
7	22IPC407	Database Systems Laboratory	PC	60	40	100	0	0	3	1.5
8	22IPC408	Embedded Systems Laboratory	PC	60	40	100	0	0	3	1.5
TOTAL				**360**	**440**	**800**	**18**	**1**	**6**	**22**

22IBS308	PROBABILITY, RANDOM PROCESSES AND QUEUING 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. RandomVariables: 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) PollazackKhintchine 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., **Applied Multivariate 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**
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	1
CO2	3	3	2	2	-	-	-	-	-	-	-	2	2	1
CO3	3	3	2	2	-	-	-	-	-	-	-	2	2	1
CO4	3	3	2	2	-	-	-	-	-	-	-	2	2	1
CO5	3	3	2	2	-	-	-	-	-	-	-	2	2	1
22IBS308	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**1**

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 Assignment 1 / Case Study 1 / Seminar 1 / Project 1	30	40	20	10	-	-	100
Individual Assignment 2 / Case Study 2/ Seminar 2 / Project 2	30	40	20	10	-	-	100
ESE	30	40	20	10	-	-	100

22IES306	COMPUTER ORGANIZATION AND ARCHITECTURE	SEMESTER III

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

Course Objectives	To impart knowledge on the functional units of digital computer system with the understanding of computer arithmetic and tracing the execution sequence of an instruction through the processor. To inculcate the memory and I/O systems fundamentals and their interfaces with the processor for the evaluation of different computer systems based on performance metrics.	
UNIT – I	**ARCHITECTURE: AN OVERVIEW**	**9 Periods**
Functional units of a Digital Computer – Translation from a High Level Language to Hardware Language – Technology – Performance – Power wall – RISC Vs CISC Characteristics – Instructions – Operations and Operands– Representing instructions – Logical and Control Operations – Addressing modes.		
UNIT – II	**COMPUTER ARITHMETIC**	**9 Periods**
Number and Character Representation – Addition/Subtraction Logic Unit – Design of Fast Adder – Ripple-carry adder, Carry-look ahead adder – Multiplication – Array and sequential circuit – Booth Algorithm – Fast Multiplication – Division – Restoring and Non-Restoring methods – Floating point numbers and operations.		
UNIT – III	**PROCESSOR DESIGN**	**9 Periods**
Processor and Register Organization – Instruction Cycle – Logic Design Conventions – Building a Data path and Control path – Micro-programming and Hard-wired Control – Pipelining – Pipelining Hazards – Exceptions Handling.		
UNIT – IV	**MEMORY AND I/O INTERFACING**	**9 Periods**
Memory Technologies – Basics of Cache – Measuring and Improving Cache Performance –Virtual Machines and Memory – Memory Hierarchy – RAID – Accessing I/O devices – Interrupts – Buses and bus arbitration – DMA – Interface Circuits – Standard I/O interfaces		
UNIT – V	**PARALLEL PROCESSING**	**9 Periods**
Classification of Parallel Structures – Challenges and Benefits – SISD, MIMD, SIMD, SPMD and Vector – Hardware Multithreading – Multi-core and other Shared memory Multiprocessors – Interconnection Networks – Performance Considerations.		
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/Elsevier, 2013*
2	*Carl Hamacher, ZvonkoVranesic, SafwatZaky, NaraigManjikian,* ***"Computer Organization and Embedded Systems",*** *Sixth Edition, Tata McGraw Hill, 2012.*

REFERENCES

1	*William Stallings,* ***"Computer Organization and Architecture – Designing for Performance",*** *Tenth Edition, Pearson Education, 2016.*
2	*John L. Hennessey, David A. Patterson,* ***"Computer Architecture – A Quantitative Approach",*** *Morgan Kaufmann / Elsevier Publishers, Fourth Edition, 2007.*
3	*V.P. Heuring, H.F. Jordan,* ***"Computer Systems Design and Architecture",*** *Second Edition, Pearson Education, 2004. 6. BehroozParhami, "Computer Architecture", Oxford University Press, 2007.*
4	*Douglas E. Comer,* ***"Essentials of Computer Architecture",*** *Sixth Edition, Pearson Education, 2012.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Interpret assembly language instructions.	K2
CO2	Design and analyze ALU circuits.	K3
CO3	Point out the hazards present in a pipeline and suggest remedies.	K2
CO4	Design and analyze memory, I/O devices and cache structures for processor.	K3
CO5	Evaluate the performance of computer systems.	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	PS O1	PS O2
CO1	3	3	3	3	1	1	-	-	-	-	-	1	1	3
CO2	3	3	3	3	3	1	-	-	-	-	-	1	3	3
CO3	3	3	3	3	3	1	-	-	-	-	-	1	3	3
CO4	3	3	3	3	3	1	-	-	-	-	-	1	3	3
CO5	3	3	3	3	3	1	-	-	-	-	-	1	3	3
22IES306	**3**	**3**	**3**	**3**	**3**	**1**	-	-	-	-	-	**1**	**3**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.1, 5.1.2, 6.1.1, 6.1.2, 12.3.2
CO2	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 6.1.1, 6.1.2, 12.3.2
CO3	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 6.1.1, 6.1.2, 12.3.2
CO4	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 6.1.1, 6.1.2, 12.3.2
CO5	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 6.1.1, 6.1.2, 12.3.2

ASSESSMENT PATTERN – THEORY

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

22IES307	DIGITAL LOGIC DESIGN	SEMESTER III

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

Course Objectives	To impart the knowledge of Boolean algebra and Logic Gates with the understanding of designing and analyzing the Boolean functions, combinational and sequential circuits. To know the basic memory devices and programmable logic devices for building simple and hazardless digital systems.	
UNIT – I	**BOOLEAN ALGEBRA AND LOGIC GATES**	**9 Periods**
Number Systems – Binary, Octal and Hexadecimal – Complements - Signed Binary Numbers – Arithmetic Operations - Binary Codes - Boolean Algebra - Theorems and Postulates –Boolean Functions – Truth Tables – Logic Gates – Universal Gates - Canonical and Standard Forms – Minterms and Maxterms.		
UNIT – II	**GATE-LEVEL MINIMIZATION**	**9 Periods**
Karnaugh Map – 2, 3, 4 variables – Quine-McCluskey Technique – Product of Sums – Sum of Product Simplification - Don't Care Conditions - NAND/NOR Implementations – Introduction to HDL.		
UNIT – III	**COMBINATIONAL AND PROGRAMMABLE LOGIC**	**9 Periods**
Combinational Circuits – Analysis and Design - Binary Adder / Subtractor – Carry Look-ahead Adder – BCD Adder - Binary Multiplier – Magnitude Comparator – Code Converters - Decoders – Encoders - Mux/Demux – RAM – ROM – PLA - PAL		
UNIT – IV	**SYNCHRONOUS SEQUENTIAL LOGIC**	**9 Periods**
Sequential Circuits – Latches - Flip flops – Analysis of clocked sequential circuits – Moore/Mealy models – State Reduction and Assignment – Design Procedure – Shift Registers – Ripple counters - Synchronous Counters.		
UNIT – V	**ASYNCHRONOUS SEQUENTIAL LOGIC**	**9 Periods**
Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-Free Assignment - Hazards		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*M.Morris Mano and Michael D. Ciletti,* ***"Digital Design: with an Introduction to the Verilog HDL"****, Pearson Education, 6th edition, 2021.*

REFERENCES

1	*Charles H.Roth, Larry L.Kinney,* ***"Fundamentals of Logic Design"****, 7thEdition, Cengage Learning, 2013.*
2	*John F. Wakerly,* ***"Digital Design Principles and Practices"****, 4th Edition, Pearson Education, 2018.*
3	*D.P. Leach, A. P. Malvino, GoutamGuha,* ***"Digital Principles and Applications"****, 7th Edition Tata Mc-Graw Hill, New Delhi, 2011.*
4	*S.Salivahanan and S. Arivazhagan,* ***"Digital Circuits and Design"****, 5th Edition, Oxford University Press, 2018.*
5	*Donald D. Givone,* ***"Digital Principles and Design"****, Tata McGraw-hill, 2017.*
6	*R. P. Jain,* ***"Modern Electronics"****, 4th Edition, McGraw-Hill Education Limited, 2021.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Understand the significance of Boolean Algebra and Logic Gates	K2
CO2	Design digital circuits using Boolean functions	K3
CO3	Implement digital circuits using combinational logic ICs and PLDs.	K3
CO4	Design digital circuits with synchronous sequential components.	K3
CO5	Design and analyze digital system with synchronous sequential components.	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**
CO1	3	3	3	2	1	-	-	1	-	-	-	-	3	1
CO2	3	3	3	3	1	-	-	1	-	-	-	-	3	1
CO3	3	3	3	2	3	-	-	1	-	-	-	-	3	1
CO4	3	3	3	3	3	-	-	1	-	-	-	-	3	1
CO5	3	3	3	3	3	-	-	1	-	-	-	-	3	1
22IES307	**3**	**3**	**3**	**3**	**3**	-	-	**1**	-	-	-	-	**3**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial														

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 5.1.2, 5.3.2, 8.1.1
CO2	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.2, 5.3.2, 8.1.1
CO3	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.2, 5.2.1, 5.2.2, 5.3.2, 8.1.1
CO4	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.2, 5.2.1, 5.2.2, 5.3.2, 8.1.1
CO5	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.2, 5.2.1, 5.2.2, 5.3.2, 8.1.1

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

22IPC301	DATA STRUCTURES AND ALGORITHMS	SEMESTER III

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

Course Objectives	To understand the concepts of programming in C++, Linear data structures, non-linear data structures, Sorting, Searching and hashing techniques.	
UNIT – I	**LINEAR DATA STRUCTURES**	**9 Periods**
Abstract Data Types (ADTs) – List ADT – vector and list in the STL– Implementation of vector - Implementation of list - The Stack ADT - Stack Model - Implementation of Stacks - Applications -The Queue ADT - Queue Model - Array Implementation of Queues - Applications of Queues		
UNIT – II	**SORTING AND SEARCHING**	**9 Periods**
Sorting algorithms- Insertion sort –shell sort - Heap Sort - Merge sort – Quick sort - Bucket Sort - Radix sort – External Sorting - Linear search – Binary Search		
UNIT – IV	**NON - LINEAR DATA STRUCTURES – TREES**	**9 Periods**
Preliminaries - Binary Trees- The Search Tree ADT: Binary Search trees-insertion-deletion-find - Traversal - AVL trees – Splay trees - Red Black trees - B-Trees		
UNIT – V	**NON - LINEAR DATA STRUCTURES - GRAPHS**	**9 Periods**
Representation of Graphs – Topological Sort - Shortest path algorithms – Dijkstra's algorithm - All-Pairs Shortest Path - Network Flow Problems - Breadth first search– Depth first search –Minimum Spanning Trees – Kruskal's and Prim's algorithm		
UNIT – V	**HASHING AND PRIORITY QUEUES**	**9 Periods**
Hash Function – Separate chaining – hash tables without linked list – rehashing – Hash tables with worst case O(1) Access- universal hashing – extendible hashing – Binary heap – applications of priority queue		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*Mark Allen Weiss,* ***"Data Structures and Algorithm Analysis in C++",*** *Fourth Edition, Pearson Education, 2014.*

REFERENCES

1	*T. H. Cormen, C. E. Leiserson, R. L. Rivest,* ***"Introduction to Algorithms",*** *Third Edition, Prentice Hall, 2012*
2	*Michael T, Goodrich, Roberto Tamassia, David Mount,* ***"Data Structures and Algorithms in C++",*** *Seventh Edition, Wiley Publishers, 2004*
3	*Robert Sedgewick,* ***"Algorithms in C++",*** *Third Edition, Pearson Education, 1998.*
4	*SartajSahni,* ***"Data Structures, Algorithms and Applications in C++",*** *Universities Press Pvt. Ltd.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Design, implement, and analyze linear data structures, such as lists, queues, andstacks,according to the needs of different applications	K4
CO2	Apply sorting and searching	K3
CO3	Design, implement, and analyze efficient tree data structures to meet requirements of real time applications	K4
CO4	Model problems as graph problems and implement efficient graph algorithms to solve them	K5
CO5	Apply suitable hashing and heap concepts to perform efficient insertion, deletion and searching technique	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**
CO1	1	3	3	3	3	-	-	1	-	-	-	1	3	2
CO2	2	3	3	3	3	-	-	1	-	-	-	2	3	2
CO3	2	3	3	3	3	-	-	1	-	-	-	2	3	2
CO4	2	3	3	3	3	-	-	1	-	-	-	2	3	2
CO5	2	3	3	3	3	-	-	1	-	-	-	2	3	2
22IPC301	**2**	**3**	**3**	**3**	**3**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**2**

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, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 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, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 8.2.2, 12.2.2, 12.3.2
CO2	1.1.2, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 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, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 8.2.2, 12.1.2, 12.2.1, 12.2.2, 12.3.2
CO3	1.1.2, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 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, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 8.2.2, 12.1.2, 12.2.1, 12.2.2, 12.3.2
CO4	1.1.2, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 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, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 8.2.2, 12.1.2, 12.2.1, 12.2.2, 12.3.2
CO5	1.1.2, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 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, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 8.2.2, 12.1.2, 12.2.1, 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	40	40	-	-	-	100
CAT2	20	40	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	-	50	40	10	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	-	50	40	10	100
ESE	20	40	40	-	-	-	100

22IPC302	JAVA PROGRAMMING	SEMESTER III

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

Course Objectives	To understand concepts of Object Oriented Programming, principles of packages, inheritance, interfaces, threads, generic classes, exceptions, I/O streams and JAVAFX

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 – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- JavaDoc comments

UNIT – II	**INHERITANCE, PACKAGES AND INTERFACES**	**9+6 Periods**

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces

UNIT – III	**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 CommunicationSuspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

UNIT – IV	**I/O, GENERICS, STRING HANDLING**	**9+6 Periods**

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

UNIT – V	**JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS**	**9+6 Periods**

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu – Menu bars – MenuItem.

List of Experiments

1. Write a program to demonstrate the use of basic java programming constrcuts
2. Write a program to demonstrate the application of String handling functions.
3. Write a program to demonstrate the use of Inheritance
4. Write a program to demonstrate the application of user-defined packages and sub-packages
5. Write a program to demonstrate the use of Java Exception handling methods.
6. Write a program to demonstrate the use of threads in Java.
7. Demonstrate with a program the use of File handling methods in Java.
8. Develop applications to demonstrate the features of generics classes.
9. Develop applications using JavaFX controls, layouts and menus.
10. Develop a mini project for any application using Java concepts

Contact Periods:
Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 30 Periods** **Total: 75 Periods**

TEXT BOOK

1	Herbert Schildt, **"Java: The Complete Reference",** 11 th Edition, McGraw Hill Education, New Delhi, 2019.
2	Herbert Schildt, **"Introducing JavaFX 8 Programming",** 1 st Edition, McGraw Hill Education, New Delhi, 2015.

REFERENCES

1	Y. Daniel Liang, Introduction to Java programming-comprehensive version-Tenth Edition, Pearson ltd 2015
2	Paul Deitel Harvey Deitel, Java, How to Program, Prentice Hall; 9th edition , 2011
3	Cay Horstmann BIG JAVA, 4th edition, John Wiley Sons,2009
4	Nicholas S. Williams, Professional Java for Web Applications, Wrox Press, 2014.
5	Cay S. Horstmann, **"Core Java Fundamentals",** Volume 1, 11 th Edition, Prentice Hall, 2018

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply the concepts of classes and objects to solve simple problems	K3
CO2	Develop programs using inheritance, packages and interfaces	K4
CO3	Make use of exception handling mechanisms and multithreaded model to solve real world problems	K4
CO4	Build Java applications with I/O packages, string classes, and generics concepts	K4
CO5	Integrate the concepts of event handling and JavaFX components and controls for developing GUI based applications	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**
CO1	2	3	2	3	3	-	-	-	2	2	2	3	3	2
CO2	2	3	2	3	3	-	-	-	2	2	2	3	3	2
CO3	2	3	3	3	3	-	-	-	3	2	2	3	3	2
CO4	3	3	3	3	3	-	-	-	3	3	2	3	3	2
CO5	3	3	3	3	3	-	-	-	3	3	2	3	3	2
22IPC302	**2**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**2**	**2**	**3**	**3**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators	
CO1	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, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 9.1.1, 9.1.2, 9.2.1, 9.3.1, 10.1.2, 10.1.3, 10.2.1, 10.3.2, 11.3.1, 11.3.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO2	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, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 9.1.1, 9.1.2, 9.2.1, 9.3.1, 10.1.2, 10.1.3, 10.2.1, 10.3.2, 11.3.1, 11.3.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO3	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, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 9.1.1, 9.1.2, 9.2.1, 9.3.1, 10.1.2, 10.1.3, 10.2.1, 10.3.2, 11.3.1, 11.3.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO4	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, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 9.1.1, 9.1.2, 9.2.1, 9.3.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 11.3.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO5	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, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 9.1.1, 9.1.2, 9.2.1, 9.3.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 11.3.2, 12.1.1, 12.1.2, 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	20	40	40	-	-	-	100
CAT2	20	40	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	40	40	20	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	40	40	20	-	100
ESE	20	40	40	-	-	-	100

22IES308	ENGINEERING EXPLORATION	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 field. It is designed to help the student to learn about engineering and how it is useful in our everyday life.	
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.		
UNIT – II	**ENGINEERING DESIGN**	**15 Periods**
Engineering Requirement, Knowledge within Engineering disciplines, Engineering advancements , Problem definition , Idea generation through brain storming and researching, solution creation through evaluating and communicating , text/analysis, final solution and design improvement.		
UNIT – III	**ENGINEERING DISCIPLINES**	**15 Periods**
Logic gates, algorithms, computer architecture, binary code.		
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 Introducton 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.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain technological and engineering development , change and impacts of engineering	K2
CO2	Complete initial steps (Define a problem list criteria and constraints , Brainstorm potential solutions and document ideas) in engineering designs	K3
CO3	Communicate possible solutions through drawings and prepare project reports.	K3
CO4	Draw sketches to a Design problem.	K3
CO5	Apply the concept of engineering fundamentals in Electronics and Instrumentation Engineering.	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**
CO1	2	-	1	3	1	2	-	1	2	1	1	1	2	2
CO2	2	-	1	3	1	2	-	1	2	1	1	1	2	2
CO3	2	-	1	3	1	2	-	1	2	1	1	1	2	2
CO4	2	-	1	3	1	2	-	1	2	1	1	1	2	2
CO5	2	-	1	3	1	2	-	1	2	1	1	1	2	2
22IES308	**2**	**-**	**1**	**3**	**1**	**2**	**-**	**1**	**2**	**1**	**1**	**1**	**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

22IES309	DIGITAL LOGIC DESIGN LABORATORY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	2	1

Course Objectives	To implement various logic gates, combinational and sequential circuits and to understand the execution of the coding using Hardware Description Language.

LIST OF EXPERIMENTS

1. Verification of Boolean theorems and truth table using logic gates.
2. Design and implementation of combinational circuits using gates for arbitrary functions.
3. Implementation of 4-bit binary adder/subtractor circuits
4. Implementation of combinational circuits using code converters.
5. Implementation of BCD adder, encoder and decoder circuits.
6. Implementation of 2-bit Magnitude Comparator
7. Implementation of Multiplexers and Demultiplexers.
8. Verification of Flip-flop's truth table
9. Implementation of a Universal Shift register.
10. Implementation of synchronous and asynchronous counters.
11. HDL coding for any of the combinational and sequential circuits.
12. Mini project on design of a digital circuit for solving practical problems.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Verify Boolean theorems and truth table using logic gates	K2
CO2	Design and implement combinational circuits for Boolean functions	K3
CO3	Understand and verify the truth tables of Flip-flops	K2
CO4	Design and implement shift registers and counters.	K3
CO5	Implement combinational/sequential circuits using HDL	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	PSO2
CO1	3	3	3	2	3	-	-	-	2	-	-	-	2	1
CO2	3	3	3	3	3	-	-	-	2	-	-	-	2	1
CO3	3	3	3	2	3	-	-	-	3	-	-	-	3	1
CO4	3	3	3	3	3	-	-	-	3	-	-	-	3	1
CO5	3	3	3	3	3	-	-	-	3	-	-	-	3	1
22IES309	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 5.1.2, 5.2.1, 5.2.2, 5.3.2, 9.1.1, 9.2.2, 9.2.3
CO2	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.2, 5.2.1, 5.2.2, 5.3.2, 9.1.1, 9.2.2, 9.2.3
CO3	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.2, 5.2.1, 5.2.2, 5.3.2, 9.1.1, 9.2.2, 9.2.3, 9.3.1
CO4	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.2, 5.2.1, 5.2.2, 5.3.2, 9.1.1, 9.2.2, 9.2.3, 9.3.1
CO5	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.2, 5.2.1, 5.2.2, 5.3.2, 9.1.1, 9.2.2, 9.2.3, 9.3.1

22IPC303	DATA STRUCTURES AND ALGORITHMS LABORATORY	SEMESTER III

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

Course Objectives	Develop applications using Linear data structures, non-linear data structures, Sorting, Searching and hashing techniques.

LIST OF PROGRAMS

1. Implementation of List, Stack and Queue ADTs
2. Applications of List, Stack and Queue ADTs
3. Implementation of sorting algorithms
4. Implementation of searching algorithms
5. Implementation of Hash tables
6. Tree representation and traversal algorithms
7. Implementation of Binary Search Tree
8. Implementation of AVL Tree
9. Implementation of Heaps
10. Graph representation and Traversal algorithms
11. Implementation of single source shortest path algorithm
12. Implementation of minimum spanning tree algorithms

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	Implementlinear data structures, such as lists, queues, and stacks	K5
CO2	Apply suitable linear data structures, such as lists, queues, and stacks,according to the needs of different applications	K5
CO3	Apply sorting, searching and hashing techniques.	K5
CO4	Design, implement, and analyze efficient tree structures to meet requirements such as searching, indexing, and sorting	K5
CO5	Model problems as graph problems and implement efficient graph algorithms to solve them	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
CO1	2	3	3	3	3	-	-	1	3	1	2	1	3	2
CO2	3	3	3	3	3	-	-	1	3	1	2	2	3	2
CO3	3	3	3	3	3	-	-	1	3	1	2	2	3	2
CO4	3	3	3	3	3	-	-	1	3	1	2	2	3	2
CO5	3	3	3	3	3	-	-	1	3	1	2	2	3	2
22IPC303	**2**	**3**	**3**	**3**	**3**	**-**	**-**	**1**	**3**	**1**	**2**	**1**	**3**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.1.2, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 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, 3.1.1, 3.1.2, 3.1.3, 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, 4.1.3, 4.2.2, 4.3.1, 4.3.2, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.4, 9.3.1, 10.1.1, 11.3.1, 11.3.2, 12.1.2, 12.2.1, 12.2.2, 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, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 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, 4.2.2, 4.3.1, 4.3.2, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.4, 9.3.1, 10.1.1, 11.3.1, 11.3.2, 12.1.2, 12.2.1, 12.2.2, 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, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 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, 4.2.2, 4.3.1, 4.3.2, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.4, 9.3.1, 10.1.1, 11.3.1, 11.3.2, 12.1.2, 12.2.1, 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, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 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, 4.2.2, 4.3.1, 4.3.2, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.4, 9.3.1, 10.1.1, 11.3.1, 11.3.2, 12.1.2, 12.2.1, 12.2.2, 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, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 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, 4.2.2, 4.3.1, 4.3.2, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.4, 9.3.1, 10.1.1, 11.3.1, 11.3.2, 12.1.2, 12.2.1, 12.2.2, 12.3.2

22IES410	ELEMENTS OF DISCRETE STRUCTURES	SEMESTER IV

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

Course Objectives	To inculcate the knowledge of Mathematical Logic, Inference theory, relations, functions, number theory, counting techniques and fundamental algebraic structures and graph models, their representation, connectivity and traversability.	
UNIT – I	**SET THEORY AND LOGIC**	**9 Periods**
Introduction – Combinations of Sets – Mathematical Induction – Principle of Inclusion and Exclusion – Propositions – Logical Connectives – Conditionals and Biconditionals – Tautologies – Logical Equivalences – Theory of inference for Statement calculus – Inference Theory of Predicate Calculus		
UNIT – II	**RELATIONS AND FUNCTIONS**	**9 Periods**
Introduction – Properties of binary relations – Closure of relations – Warshall's Algorithm – Equivalence relations and Partitions – Partial ordering relations and Lattices – Functions – Composition of functions – Invertible Functions – Recursive Functions		
UNIT – III	**NUMBER THEORY AND COUNTING**	**9 Periods**
Divisibility and Modular Arithmetic – Primes and Greatest Common Divisors – Solving Congruences – Pigeon-hole Principle – Permutations and Combinations – Generalized Permutations and Combinations – Solving Linear Recurrence Relations – Generating Functions		
UNIT – IV	**ALGEBRAIC STRUCTURES**	**9 Periods**
Introduction – Groups – Subgroups – Cosets and Lagrange's Theorem – Permutation groups and Burnside's Theorem – Isomorphisms and Automorphisms – Homomorphisms and Normal subgroups – Rings – Integral domains and Fields		
UNIT – V	**GRAPH THEORY**	**9 Periods**
Graphs and Graph Models – Special Types of Graphs – Representing Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths – Planar Graphs – Graph Coloring.		
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",*** *Tata McGraw Hill, Fourth Edition (SIE), 2012.(UNIT I, II & IV)*
2	*Kenneth H. Rosen,* ***"Discrete Mathematics and Its Applications",*** *Tata McGraw Hill, Eighth Edition, 2019.(UNIT – III & V)*

REFERENCES

1	*Ralph P. Grimaldi,* ***"Discrete and Combinatorial Mathematics",*** *Fifth Edition, PHI/Pearson Education, 2006.*
2	*Tremblay.J.P and Manohar.R,* ***"Discrete Mathematical Structures with Applications to Computer Science",*** *Tata McGraw Hill Company, 1997, 35 th reprint 2008.*
3	*Lipschutz, S. and Mark Lipson.,* ***"Discrete Mathematics",*** *Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.*
4	*SatinderBal Gupta,* ***"Discrete Mathematics and Structures",*** *University Science Press, Fifth edition, 2008.*
5	*Oscar Levin,* ***"Discrete Mathematics",*** *CreateSpace Independent Publishing Platform*, 2018.

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Verify the validity of the logical arguments**,** mathematical proofs and correctness of the algorithm.	K2
CO2	Interpret the properties of relations and functions.	K2
CO3	Apply combinatorial counting techniques in solving combinatorial related problems.	K3
CO4	Understand the significance of algebraic structures.	K2
CO5	Use graph models and their connectivity, traversability in solving real world problems.	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
CO1	3	3	3	3	2	-	-	2	-	-	1	2	3	1
CO2	3	3	3	3	2	-	-	2	-	-	1	2	3	1
CO3	3	3	3	3	2	-	-	2	-	-	1	2	3	1
CO4	3	3	3	3	2	-	-	2	-	-	1	2	3	1
CO5	3	3	3	3	2	-	-	2	-	-	1	2	3	1
22IES410	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**1**	**2**	**3**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.2, 5.3.2, 11.2.1,12.1.1, 12.1.2, 12.2.1
CO2	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.2, 5.3.2, 11.2.1,12.1.1, 12.1.2, 12.2.1
CO3	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.2, 5.3.2, 11.2.1,12.1.1, 12.1.2, 12.2.1
CO4	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.2, 5.3.2, 11.2.1,12.1.1, 12.1.2, 12.2.1
CO5	1.1.1, 1.3.1, 2.1.1, 2.1.2 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.2, 5.3.2, 11.2.1,12.1.1, 12.1.2, 12.2.1

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	20	30	30	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	20	30	30	20	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	20	30	30	20	100
ESE	30	40	30	-	-	-	100

22IPC404	EMBEDDED SYSTEMS ARCHITECTURE	SEMESTER IV

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

Course Objectives	To inculcate the differences between embedded and generic purpose systems and to impart knowledge on architecture and programming concepts of embedded systems in managing the processes and RTOS.	
UNIT – I	**INTRODUCTION TO MICROPROCESSOR AND EMBEDDED SYSTEM**	**9 Periods**
Embedded systems – Processor embedded into system – embedded hardware and software – examples – Embedded SoC – complex system design – Design process in embedded system and example – Classification of embedded systems.		
UNIT – II	**ARCHITECTURE, MEMORY, INTERFACING AND INTERRUPTS**	**9 Periods**
8051 architecture – I/O types and examples – serial and parallel communication – wireless devices – Timer, counter and clocks – networked embedded systems – Programmed I/O busy-wait without IS mechanism – ISR concept – interrupt sources – Interrupt servicing mechanism – Multiple interrupts – classification of interrupt servicing mechanisms – DMA		
UNIT – III	**PROGRAMMING CONCEPTS**	**9 Periods**
Programming in assembly and high level language – C program elements – object oriented programming – embedded programming in C++ and java – Program models – DFG models – state machine programming models for event controlled program flow – Multiprocessor system modeling – UML modeling.		
UNIT – IV	**IPC, PROCESS SYNCHRONIZATION, THREADS AND TASKS**	**9 Periods**
Multiple processes in an application – Multiple threads in an application – Tasks – task states – task and data – semaphores – shared data – IPC – signal function – semaphore function – message queue function – mailbox function – pipe function – socket function – RPC function		
UNIT – V	**REAL TIME OPERATING SYSTEMS**	**9 Periods**
OS services – Process management – Timer function – Event function – Memory management – Device– file– I/O subsystem management – Interrupt routines – RTOS systems – design using RTOS – RTOS task scheduling models– interrupt latency and response of tasks – OS security issues.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*RajKamal,* ***"Embedded Systems: Architecture, Programming and Design",*** *Tata McGraw Hill, 2nd edition, 2011.*

REFERENCES

1	*K.V.K.K.Prasad,* ***"Embedded Real-Time Systems: Concepts, Design &Programming",*** *Dreamtech press, 2005.*
2	*David E-Simon,* ***"An Embedded Software Primer"*** *Pearson Education, 2007.*
3	*Wayne Wolf,* ***"Computers as Components- Principles of Embedded Computer System Design",*** *Morgan Kaufmann Publisher, 2006.*
4	*Tammy Noergaard,* ***"Embedded Systems Architecture",*** *Elsevier, 2006.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Compare embedded system with general purpose system.	K3
CO2	Explain the functional dependency of components in embedded system.	K2
CO3	Program the embedded systems.	K3
CO4	Understand the communication between processes and task management.	K2
CO5	Design systems using RTOS	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	2	-	-	-	-	-	3	3	1
CO2	3	3	3	3	2	2	-	-	-	-	-	3	3	1
CO3	3	3	3	3	2	2	-	-	-	-	-	3	3	1
CO4	3	3	3	3	2	2	-	-	-	-	-	3	3	1
CO5	3	3	3	3	2	2	-	-	-	-	-	3	3	1
22IPC404	**3**	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**

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, 2.1.3, 2.2.2, 2.2.3, 3.1.3, 3.1.4, 3.1.5, 4.1.1, 4.2.1, 4.3.2, 4.3.3, 5.1.2, 6.1.1, 12.1.1, 12.2.2
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.3, 2.2.2, 2.2.3, 3.1.3, 3.1.4, 3.1.5, 4.1.1, 4.2.1, 4.3.2, 4.3.3, 5.1.2, 6.1.1, 12.1.1, 12.2.2
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.3, 2.2.2, 2.2.3, 3.1.3, 3.1.4, 3.1.5, 4.1.1, 4.2.1, 4.3.2, 4.3.3, 5.1.2, 6.1.1, 12.1.1, 12.2.2
CO4	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.3, 2.2.2, 2.2.3, 3.1.3, 3.1.4, 3.1.5, 4.1.1, 4.2.1, 4.3.2, 4.3.3, 5.1.2, 6.1.1, 12.1.1, 12.2.2
CO5	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.3, 2.2.2, 2.2.3, 3.1.3, 3.1.4, 3.1.5, 4.1.1, 4.2.1, 4.3.2, 4.3.3, 5.1.2, 6.1.1, 12.1.1, 12.2.2

ASSESSMENT PATTERN – THEORY

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

22IPC405	DATABASE SYSTEMS	SEMESTER IV

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

Course Objectives	• To learn the basics of designing the database and performing operations on database without compromising desired properties.	
UNIT – I	**DATA MODELING AND DATABASE DESIGN**	**9 periods**
Database system concepts and architectures – ER model – relational model and constraints - Functional Dependencies and Normalization for Relational Databases.		
UNIT – II	**QUERY PROCESSING AND SQL**	**9 periods**
Basic SQL – Complex SQL retrieval queries – Triggers – Views – Schemas – Relational algebra and relational calculus – Strategies for query processing – query optimization.		
UNIT – III	**DATA STORAGE**	**9 periods**
Disk storage – Basic file structures – Hashing – Modern storage architectures – Indexing structure for files and physical database design.		
UNIT – IV	**TRANSACTION MANAGEMENT**	**9 periods**
Introduction to Transaction Processing - Desirable Properties of Transactions - Concurrency Control Techniques – Database recovery techniques.		
UNIT – V	**NoSQL DATABASE DATA MODEL AND IMPLEMENTATION**	**9 periods**
Emergence of NoSQL - Data Models: Aggregates, Key value and document data models, Column Family Stores, Relationships, Graph Databases, Schemaless Databases, Materialized views – Consistency: Update, Read, Relaxing – Map and Reduce – Implementation: Key value databases, Document Databases, Column Family Stores, Graph databases.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*Ramez Elmasri and Shamkant B. Navathe,* ***"Fundamental of Database Systems",*** *Pearson Education, 7th Edition, 2016.*
2	*Pramod J. Sadalage Martin Fowler,* ***"NoSQL Distilled A Brief Guide to the Emerging World of Polyglot Persistence",*** *Pearson, 2012.*

REFERENCES

1	*Abraham Silberschatz, Henry F. Korth and S. Sudarshan,* ***"Database System Concepts",*** *McGraw Hill, 7th Edition, 2021.*
2	*Corlos Coronel and Steven Morris,* ***"Database Systems: Design, Implementation, & Management",*** *Cengage Learning, 13th edition, 2019*
3	*Kristina Chodorow,* ***"MongoDB: The Definitive Guide",*** *O'Reilly Publication, 2nd Edition, 2013.*
4	*Shashank Tiwari,* ***"Professional NoSql",*** *John Wiely & Sons, 2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Design database using ER model	K3
CO2	Construct and execute SQL queries using relational algebra.	K4
CO3	Apply indexing to improve the performance	K4
CO4	Construct queries for performing transactions without compromising the consistency.	K3
CO5	Analyze various advanced databases and adopt suitable one.	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	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	2	2	1	-	-	-	-	-	-	-	-	2	-
CO2	2	2	1	1	-	-	-	-	-	-	-	-	2	-
CO3	2	1	1	1	-	-	-	-	-	-	-	-	2	-
CO4	2	1	1	1	-	-	-	-	-	-	-	-	2	-
CO5	2	2	2	1	-	-	-	-	-	-	-	-	2	-
22IPC405	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.3.1, 2.1.3, 2.2.1, 2.2.2, 2.2.4, 2.4.1, 3.1.1, 3.2.1, 3.2.2, 3.4.1, 3.4.2, 4.2.2
CO2	1.1.1,1.3.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.4, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.4.1, 3.4.2, 4.1.1, 4.1.4, 4.2.1,
CO3	1.1.1,1.3.1, 2.2.1, 2.3.1, 3.1.1, 4.3.3, 4.3.4
CO4	1.1.1,1.3.1,2.2.1, 2.4.1, 3.1.1, 3.2.2, 4.1.2
CO5	1.1.1,1.3.1, 2.1.3, 2.2.1, 2.3.1, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.2, 4.3.2.

ASSESSMENT PATTERN – THEORY

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

22IES411	PRINCIPLES OF COMMUNICATION ENGINEERING	SEMESTER IV

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

Course Objectives	To understand the analog and digital communication techniques, data and pulse communication techniques, source and Error control coding and multi-user radio communication	
UNIT – I	**ANALOG COMMUNICATION**	**9 Periods**
Introduction to Communication Systems - Modulation – Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of SSB Techniques - Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems (AM – FM – PM).		
UNIT – II	**PULSE AND DATA COMMUNICATION**	**9 Periods**
Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of Pulse Communication Systems (PAM – PTM – PCM) - Standards Organizations for Data Communication- Data Communication Circuits - Data Communication Codes - Data communication Hardware - serial and parallel interfaces.		
UNIT – III	**DIGITAL COMMUNICATION**	**9 Periods**
Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM)		
UNIT – IV	**SOURCE AND ERROR CONTROL CODING**	**9 Periods**
Entropy, Source encoding theorem, Shannon Fano coding, Huffman coding, mutual information, channel capacity, Error Control Coding, linear block codes, cyclic codes - ARQ Techniques.		
UNIT – V	**MULTI-USER RADIO COMMUNICATION**	**9 Periods**
Global System for Mobile Communications (GSM) - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Handover Techniques - Overview of Multiple Access Schemes - Satellite Communication – Bluetooth.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*Wayne Tomasi,* ***"Advanced Electronic Communication Systems",*** *6th Edition, Pearson Education, 2009.*

REFERENCES

1	*Simon Haykin,* ***"Communication Systems",*** *4th Edition, John Wiley & Sons, 2004*
2	*Rappaport T.S,* ***"Wireless Communications: Principles and Practice",*** *2nd Edition, Pearson Education, 2007*
3	*H.Taub, D L Schilling and G Saha,* ***"Principles of Communication",*** *3 rd Edition, Pearson Education, 2007.*
4	*B.Sklar,* ***"Digital Communication Fundamentals and Applications"*** *2 nd Edition Pearson Education 2007.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply analog communication techniques.	K3
CO2	Apply digital communication techniques.	K3
CO3	Use data and pulse communication techniques.	K3
CO4	Analyze Source and Error control coding.	K4
CO5	Utilize multi-user radio communication	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
CO1	2	2	2	-	-	-	-	-	-	-	-	3	2	2
CO2	2	2	2	-	-	-	-	-	-	-	-	3	2	2
CO3	2	2	2	-	-	-	-	-	-	-	-	3	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	3	2	2
CO5	2	2	2	-	-	-	-	-	-	-	-	3	2	2
22IES411	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3,1.4, 2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,12.1.2,12.2.2,12.3.1,12.3.2
CO2	1.3,1.4,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,12.1.2,12.2.2,12.3.1,12.3.2
CO3	1.3,1.4,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,12.1.2,12.2.2,12.3.1,12.3.2
CO4	1.3,1.4,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,12.1.2,12.2.2,12.3.1,12.3.2
CO5	1.3,1.4,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,12.1.2,12.2.2,12.3.1,12.3.2

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40	-	-	-	100
CAT2	20	40	40	-	-	-	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	40	40	-	-	-	100

22IPC406	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 - Empirical Analysis of Algorithms - Algorithm Visualization		
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**
Introduction to NP Class – NP Completeness and Reducibility - Approximation Algorithm for NP Hard Problems: TSP - Knapsack problem		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK

1	*AnanyLevitin ,* ***"Introduction to the Design and Analysis of Algorithms",*** *Pearson education, Third edition 2014.*
2	*Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein* ***"Introduction to Algorithms"*** *Third Edition, MIT Press/McGraw-Hill, 2009.*

REFERENCES

1	*Michael T Goodrich and Roberto Tamassia,* ***"Algorithm Design: Foundations, Analysis, and Internet Examples",*** *Second Edition, Wiley, 2006*
2	*Mark de Berg, Mark van Kreveld, Mark Overmars and OtfriedShwarzkopf (Cheong),* ***"Computational Geometry: Algorithms and Applications"****, Third edition, Springer-Verlag, 2008.*
3	*Skiena S. Steven* ***"The algorithm design manual"****, Second edition, Springer 2008.*
4	*Dasgupta S., Papadimitriou C. and Vazirani U.,* ***"Algorithms",*** *Tata McGraw-Hill, 2009.*
5	*Jon Kleinberg and Eva Tardos,* ***"Algorithm Design"****, Pearson new international edition 2013.*

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.	K4
CO2	Describe the Decrease and Conquer techniques.	K2
CO3	Identify and apply Greedy approach and Dynamic Programming technique.	K4
CO4	Analyze algorithms deploying Backtracking and Branch and Bound technique.	K6
CO5	Examine Approximation and randomized algorithm.	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
CO1	1	1	3	3	-	-	-	-	-	1	-	2	3	3
CO2	2	3	3	3	-	-	-	-	-	1	-	2	3	3
CO3	3	3	3	3	-	-	-	-	-	1	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	1	-	2	3	3
CO5	2	3	3	3	-	-	-	-	-	1	-	2	3	3
22IPC406	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**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, 10,.1.3, 10.2.1, 10.2.2, 10.3.2, 12.1.1, 12.1.2, 12.2.2, 12.3.1
CO2	1.1.1, 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, 3.1.1, 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, 4.1.2,4.1.4, 4.2.1, 4.2.2., 4.3.3., 4.3.4, 10.2.1, 10.2.2, 10.3.2, 12.1.1, 12.1.2, 12.2.2, 12.3.1
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, 3.1.1, 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, 4.1.4, 4.2.1, 4.2.2., 4.3.3, 4.3.4, 10.2.1, 10.2.2, 10.3.2, 12.1.1, 12.1.2, 12.2.2, 12.3.1
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, 3.1.1, 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, 4.1.4, 4.2.1, 4.2.2., 4.3.3, 4.3.4, 10.2.1, 10.2.2, 10.3.2, 12.1.1, 12.1.2, 12.2.2, 12.3.1
CO5	1.1.1, 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, 3.1.1, 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, 4.1.2,4.1.4, 4.2.1, 4.2.2., 4.3.3., 4.3.4, 10.2.1, 10.2.2, 10.3.2, 12.1.1, 12.1.2, 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	-	30	30	40	-	-	100
CAT2	-	30	30	40	-	-	100
Individual Assignment1 /Case Study 1/ Seminar 1 / Project1	-	-	-	50	30	20	100
Individual Assignment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	-	50	30	20	100
ESE	-	20	40	40	-	-	100

22IES412	FOUNDATIONS OF DATA SCIENCE *(Common to CSE & IT Branches)*	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	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 BOOKS

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2
CO1	1	1	2	1	3	-	-	-	-	-	1	-	2	2
CO2	1	1	1	1	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	3	3	3	-	3	-	-	-	-	2	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	2	2
CO5	3	3	3	3	-	-	-	-	-	-	-	1	2	2
22IES412	**3**	**3**	**3**	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**1**	**1**	**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*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Individual Assignment1 /Case Study 1/ Seminar 1 / Project1	30	20	40	5	5	-	100
Individual Assignment 2 /Case Study 2/ Seminar 2 / Project 2	30	20	30	10	5	5	100
ESE	30	30	40	-	-	-	100

22IPC408	DATABASE SYSTEMS LABORATORY	SEMESTER IV

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

Course Objectives	∗ UsageofDDL,DMLandTCLcommands. ∗ Queryingthe databaseusingrelationalalgebra. ∗ Concepts oftriggers,functions andstoredprocedures inPL/SQLandNoSQL. ∗ CreatingandaccessingNOSQL database.

LIST OFEXPERIMENTS

1. DDL, DML, DCLandTCLcommands.
2. Built-Infunctions andRelationalAlgebraoperations in opensourceDBMS-MySQL.
3. Materializedviews.
4. StoredProcedures,Functions andTriggers inPL/SQL.
5. CursorImplementation inPL/SQL.
6. Create,updateanddeleteNoSQLdatabaseNoSQL.
7. QueryingNoSQL databaseusingNoSQL.
8. Buildandutilizeindex ofNoSQL
9. CursorImplementationinNoSQL
10. Developing an application to simulate bank transactions
11. Developing an application for college management
12. Developing an application for inventory control system
13. Developing an application for payroll process management
14. MiniProject:(AnyapplicationdevelopmentusingMySQL/NoSQL)

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	Design and implement a database schema for a given problem-domain	K4
CO2	Populate and query a database using SQL DDL/ DML/TCL commands.	K4
CO3	DeclareandenforceintegrityconstraintsonadatabaseusingRDBMS.	K4
CO4	Program PL/SQL and NoSQL including stored procedures, stored functions, curs or sand packages	K4
CO5	Design and build a GUI application	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
CO1	2	2	1	2	1	-	-	1	-	-	-	-	2	1
CO2	2	2	1	2	1	-	-	1	-	-	-	-	2	1
CO3	2	2	1	2	1	-	-	1	-	-	-	-	2	1
CO4	2	2	1	2	1	-	-	1	-	-	-	-	2	1
CO5	2	2	1	2	1	-	-	1	1	2	-	1	2	1
22IPC408	**2**	**2**	**1**	**2**	**1**	**-**	**-**	**1**	**1**	**1**	**-**	**1**	**2**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.3.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.4, 2.3.1, 2.4.1, 2.4.3, 3.1.6, 3.2.1, 3.2.3, 3.4.2, 4.1.2, 4.2.1, 4.3.1, 4.3.2, 4.3.4, 5.2.1, 8.1.1.
CO2	1.1.1, 1.3.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.4, 2.3.1, 2.4.1, 2.4.3, 3.1.6, 3.2.1, 3.2.3, 3.4.2, 4.1.2, 4.2.1, 4.3.1, 4.3.2, 4.3.4, 5.2.1, 8.1.1.
CO3	1.1.1, 1.3.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.4, 2.3.1, 2.4.1, 2.4.3, 3.1.6, 3.2.1, 3.2.3, 3.4.2, 4.1.2, 4.2.1, 4.3.1, 4.3.2, 4.3.4, 5.2.1, 8.1.1.
CO4	1.1.1, 1.3.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.4, 2.3.1, 2.4.1, 2.4.3, 3.1.6, 3.2.1, 3.2.3, 3.4.2, 4.1.2, 4.2.1, 4.3.1, 4.3.2, 4.3.4, 5.2.1, 8.1.1.
CO5	1.1.1, 1.3.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.4, 2.3.1, 2.4.1, 2.4.3, 3.1.6, 3.2.1, 3.2.3, 3.4.2, 4.1.2, 4.2.1, 4.3.1, 4.3.2, 4.3.4, 5.2.1, 8.1.1, 9.2.1, 9.2.3, 10.1.2, 10.2.1, 10.3.2, 12.3.1, 12.3.2.

22IPC408	EMBEDDED SYSTEMS LABORATORY	SEMESTER IV

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

Course Objectives	To study ARM processor kit and its architecture and to program the ARM processor and impart interfaces with display module and timer and to provide serial transmission of ARM processor.

LIST OF EXPERIMENTS

1. Study of ARM processor kit.
2. Simulation of arithmetic operation on arm in assembly.
3. Simulation of assembly level program for soft delay.
4. Simple LED blinking with variable speed in ASM.
5. Seven segment LED display interface in C.
6. Realizing timer peripheral in arm by polling method/Interrupt driven method.
7. Serial transmission and reception of a character in C by polling method/Interrupt method.
8. Displaying alphanumeric characters in 2x16 line LCD module.
9. Number conversion in ARM processor.
10. Accessing internal ADC of the ARM processor and to display in LCD.

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	Explain the functional architecture of ARM processor	K2
CO2	Execute assembly language program to perform operation in ARM processor.	K3
CO3	Evaluate and implement assembly language program to interface ARM processor with the display module	K2
CO4	Write assembly language program to access the timer	K3
CO5	Write assembly language program to transmit data in serial with ARM processor	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
CO1	3	3	3	2	3	-	3	3	-	-	-	3	2	2
CO2	3	3	3	3	3	-	1	3	-	-	-	3	2	1
CO3	3	3	3	2	3	-	1	3	-	-	-	3	2	2
CO4	3	3	3	3	3	-	1	1	-	-	-	3	2	1
CO5	3	3	3	3	3	-	1	3	-	-	-	3	2	1
22IPC408	**3**	**3**	**3**	**3**	**3**	**-**	**1**	**2**	**-**	**-**	**-**	**3**	**2**	**1**

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, 2.2.1,2.2.2, 2.2.3, 2.2.4, 2.3.1,2.3.2, 2.4.1,2.4.2,2.4.3,2.4.4,3.1.4, 3.1.6, 3.2.1,3.2.2, 3.4.2, 4.1.1, 4.1.2, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 7.1.1, 7.1.2,7.2.1, 8.1.1, 8.2.1, 12.1.1, 12.2.2, 12.3.1
CO2	1.3.1, 2.1.1,2.1.2,2.1.3, 2.2.1,2.2.2, 2.2.3, 2.2.4, 2.3.1,2.3.2, 2.4.1,2.4.2,2.4.3,2.4.4,3.1.4, 3.1.6, 3.2.1,3.2.2, 3.4.2, 4.1.1, 4.1.2, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 7.1.1, 8.1.1, 8.2.1, 12.1.1, 12.2.2, 12.3.1
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, 2.3.1,2.3.2, 2.4.1,2.4.2,2.4.3,2.4.4,3.1.4, 3.1.6, 3.2.1,3.2.2, 3.4.2, 4.1.1, 4.1.2, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 7.1.1, 8.1.1, 8.2.1, 12.1.1, 12.2.2, 12.3.1
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, 2.3.1,2.3.2, 2.4.1,2.4.2,2.4.3,2.4.4,3.1.4, 3.1.6, 3.2.1,3.2.2, 3.4.2, 4.1.1, 4.1.2, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 7.1.1, 8.1.1, 12.1.1, 12.2.2, 12.3.1
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, 2.3.1,2.3.2, 2.4.1,2.4.2,2.4.3,2.4.4,3.1.4, 3.1.6, 3.2.1,3.2.2, 3.4.2, 4.1.1, 4.1.2, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 7.1.1, 8.1.1, 8.2.1, 12.1.1, 12.2.2, 12.3.1