Sardar Patel Institute of Technology
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

B.Tech. (Computer Engineering)
and
B.Tech. (Information Technology)
Syllabus
(Semester I-IV)

2020 Iteration (w.e.f. 2020-21)

Sem III									
No	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA203	Probability and Statistics	3	0	0	5	08	3
1	BSC*	MA202	Foundation of Mathematics-I*	3	0	0	6	09	3
2	PC	CS201/IT201	Discrete Structures and Graph Theory	3	0	0	4	07	3
3	PC	CS202/IT202	Data Structures	3	0	2	5	10	4
4	PC	CS203/IT203	Computer Architecture and Organization	3	0	2	4	09	4
5	PC	CS204/IT204	Database Management Systems	3	0	2	5	10	4
6	ABL	SVXX/STXX	SEVA II or III /SATVA II or III	0	0	0	3	03	1
7	HSSE	HSEX1	HSS-I	2	0	0	3	05	2
			TOTAL	**17**	**0**	**6**	**29**	**52**	21

**Only for Lateral Entry Students*

Sem IV									
No	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA201	Linear Algebra	2	0	2	5	09	3
1	BSC*	MA204	Foundation of Mathematics-II	3	0	0	6	09	3
2	PC	CS205/IT205	Design and Analysis of Algorithms	3	0	2	5	10	4
3	PC	CS206/IT206	Operating Systems	3	0	2	5	10	4
4	PC	CS207/IT207	Computer Communications and Networks	3	0	2	5	10	4
5	SBC	CS208/IT208	Mini Project-I	0	0	0	4	04	2
6	ABL	SVXX/STXX	SEVA II or III /SATVA II or III	0	0	0	3	01	1
7	HSSE	HSEX2	HSS-II	2	0	0	3	05	2
8	SBC	AS201	Professional Communication Skills	1	0	2	2	05	2
9	S/M	SCX1/MNX1	SCOPE-I/Minor-I						3
			TOTAL	**14**	**0**	**10**	**32**	**56**	22

**Only for Lateral Entry Students*

Second Summer for HSC students									
No	Type	Code	Course	L	T	P	O	E	C
1	MLC	AS202	Constitution of India				06	06	NC

Second Summer (For Lateral Entry Students)									
No	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA201	Linear Algebra	2	0	2	5	09	3
1	BSC	MA203	Probability and Statistics	3	0	0	5	08	3
2	MLC	AS202	Constitution of India				06	06	NC

Semester-III

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Discrete Structures and Graph Theory	3	0	0	4	7	3	0	0	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
CS201/IT201		Theory	75		75		150			300
		Laboratory	--		--		--			--

Pre-requisite Course Codes, if any.	
Course Objective: To teach students how to think logically and mathematically. It provides the mathematical foundation that is used in most areas of computer science.	
Course Outcomes (CO):*At the End of the course students will be able to*	
XXXXX.1	Solve problems using set theory, logic and its various proof techniques.
XXXXX.2	Apply the concepts of relations, functions, lattices and recurrence relations to solve problems
XXXXX.3	Apply the concepts of graph, trees and their various types with their traversing techniques to solve problems.
XXXXX.4	Apply the basics of coding theory and cryptography to solve real world problems.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XXXXX.1												
XXXXX.2												
XXXXX.3												
XXXXX.4												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
XXXXX.1						
XXXXX.2						
XXXXX.3						
XXXXX.4						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Set Theory, Logic and Proofs**	1, 2	
	1.1	Finite and infinite set, Union, Intersection, Disjoint, and Difference of two sets. Power Set, Partition of Sets, Ordered Sets, De Morgan's Laws, Principle of Inclusion Exclusion		2
	1.2	Predicates, Propositions, Conditional Propositions, Logical Connectivity, Proposition calculus, Universal and Existential Quantifiers, First order logic, Equivalence, Normal Forms, Introduction to proofs, Mathematical Induction, Strong Induction, Well-ordering principle, Logical inference		6
2	Title	**Relations, Functions and Lattices**	1, 2	
	2.1	Product Sets and Partitions, Paths in relations and Diagraphs, Properties of Relations, Closure of Relation, Equivalence Relations, Operations on Relations, Warshall's Algorithm, Partially Ordered Sets, External Elements of Partially Ordered Sets, Hasse Diagram		8
	2.2	Composition of Functions, Invertible Functions, Recursive Functions, Hashing, Pigeon hole Principle, Extended PHP		3
	2.3	Lattice, Sub lattice, Isomorphic Lattices, Properties of Lattice, Special Types of Lattices		4
	2.4	Recurrence Relations – Introduction, Linear Recurrence Relations with constant coefficients, Homogeneous solutions, Particular Solutions, Total Solutions, Solution by the method of Generating functions, solving Recurrence Relations		5
3	Title	**Graph Theory**	1, 2	4
	3.1	Concepts and terminologies, Graphs as Model (Konigsberg Bridge Problem)		
	3.2	Matrices, Isomorphism, Bipartite Graphs, Directed Graphs		
	3.3	Minimal Spanning Trees-Prim's Algorithm and Kruskal's Algorithm		
4	Title	**Graph connectivity**	1, 2	6
	4.1	Cycles – Transport Networks, Max Flows, Matching Problems, Maximum Bipartite Matching, Perfect Matching		
	4.2	Euler Paths- Circuits, Hamiltonian Paths- Circuits		
	4.3	Coloring Graphs, Chromatic Polynomial, Planer Graphs		
5	Title	**Coding Theory**	1, 2	4
	5.1	Hamming Code, Minimum Distance		
	5.2	Number Theory, Modular Arithmetic and applications to cryptography; Diffie-Hellman Algorithm		

6	**Self-Study**	Algebraic Structures - Semi group, Monoids, Groups, Cyclic groups, Abelian groups, Normal Subgroups	**1, 2**	**5***
			Total (*Not included)	**42**

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Discrete Mathematics and it's applications	Seventh	Kenneth H. Rosen	Tata McGraw-Hill	2013
2	Discrete Mathematical Structures	Sixth	Bernad Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman	Pearson Education	2015

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Elements of Discrete Mathematics	Fourth	C. L. Liu	Tata McGraw-Hill	2012
2	Introduction to graph Theory	Second	Douglas B. West	Pearson Education	2015
3	Discrete Mathematical Structures with Applications to Computer Science	First	Jean-Paul, Tremblay R. Manohar	Tata McGraw-Hill	1987

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Foundations of Mathematics-I	2	1	0	0	3	2	1	0	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
MA202		Theory	75		75		150			300
		Laboratory	--		--		--			--

Pre-requisite Course Codes, if any.	-
Course Objective: To develop basic foundation of mathematical skills.	
Course Outcomes (CO):*At the End of the course students will be able to:-*	
MA202.1	Differentiate a function of one variable and partially differentiate a function of more than one variable.
MA202.2	Apply the concept of partial differentiation to find extreme values of a given function.
MA202.3	Find nth order derivative of a given function.
MA202.4	Expand a given function as a power series.
MA202.5	Perform operations on matrices and find inverses and determinants of them.
MA202.6	Perform vector operations and compute dot products and cross products between them.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA202.1												
MA202.2												
MA202.3												
MA202.4												
MA202.5												
MA202.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
MA202.1						
MA202.2						
MA202.3						
MA202.4						
MA202.5						
MA202.6						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	**Title**	**Differential Calculus**	1,2	**18**
	1.1	Partial fractions. Derivatives of standard functions, product and quotient rule for differentiation.		04
	1.2	Partial derivatives of first and higher order, composite differentiation		03
	1.3	Application of partial derivatives: Local Maxima and Minima of functions of two variables.		02
	1.4	Successive Differentiation: Proofs of nth derivatives of standard functions. Use of partial fractions to calculate nth derivatives of given functions. Leibnitz theorem for nth derivative of product of two functions.		05
	1.5	Infinite series: expansion of functions in powers of x using maclaurin series. Taylor's series.		04
2	**Title**	**Matrices**	1,2	**07**
	2.1	Addition and scalar multiplication of matrices. Matrix multiplication, types of matrices.		03
	2.2	Elementary row transformations, finding inverses using matrices, determinants and its properties		04
3	**Title**	**Vectors**	1,2	**03**
	3.1	Vector definition, addition, scalar multiplication, dot product of two vectors, angle between two vectors, cross product.		03
			Total	**28**

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Higher Engineering Mathematics	Forty Forth	Dr. B. S. Grewal	Khanna Publications	2020

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Advanced Engineering Mathematics	Tenth	Erwin Kreysizg	John Wiley & Sons	2011
2	Advanced Engineering Mathematics	Twenty Eighth	H.K.Dass	S. Chand Publications	2014

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Probability and Statistics	3	0	0	5	8	3	0	0	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
MA203		Theory	75		75		150			300
		Laboratory	--		--		--			--

Pre-requisite Course Codes, if any.	-
Course Objective: To give an exposure to the students the basic concepts of Probability and Statistical methods and their application.	
Course Outcomes (CO):*At the End of the course students will be able to*	
MA203.1	Familiarize with basic probability axioms, rules and their applicability.
MA203.2	Identify the characteristics of various discrete and continuous distributions.
MA203.3	Find unbiased and efficient estimates using estimation theory.
MA203.4	Test the hypothesis for means and variances using't'& F; chi-square distribution tests.
MA203.5	Find Correlation and Regression and fit different types of curves.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA203.1												
MA203.2												
MA203.3												
MA203.4												
MA203.5												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA203.1							
MA203.2							
MA203.3							
MA203.4							
MA203.5							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Probability and Random Variables**	**1, 2**	**12**
	1.1	Classical, relative frequency and axiomatic definitions of probability, addition rule and multiplication rule. Conditional Probability, Bayes' theorem and independence.		04
	1.2	Discrete, continuous and mixed random variables, probability mass function(PMF), Probability Density Function(PDF) and cumulative distribution function(CDF). Joint Distributions: Joint, marginal and conditional distribution.		04
	1.3	Mathematical expectation, moments, moments generating function, Chebyshev's inequality.		04
2	**Title**	**Probability Distributions**	**1, 2**	**12**
	2.1	Standard discrete distributions: Bernoulli, Binomial, Poisson and Geometric distributions, Probability density function, Cumulative distribution function, Expectation and Variance,		06
	2.2	Standard continuous distributions – Uniform, Normal, Exponential, Joint distribution and Joint density functions		06
3	**Title**	**Test of Hypothesis and Significance**	**1, 2**	**12**
	3.1	Statistical hypothesis, Null and Alternate hypothesis, test of hypothesis and significance, Type I and Type II errors, Level of Significance, Tests involving the Normal distribution, One-Tailed and Two-Tailed tests, P value.		03
	3.2	Special tests of significance for Large samples and Small samples (F, chi- square, z, t- test), ANOVA.		09
4	**Title**	**Correlation and Regression**	**1, 2**	**06**
	4.1	Correlation, Rank correlation, Regression Analysis, Linear and Non-linear Regression, Multiple regressions, Curve fitting by method of least squares, fitting of straight lines, Polynomials, Exponential curves.		
5	**Self Study**	1. Applicability of Bayes theorem 2. Proofs for mean & variance for all distribution: included in module 2 3. Examples to test goodness of fit using Chi-square		01* 02* 02*
Total				**42**

*** Not included in Total 42 hrs.**

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Introduction to Probability and Statistics for Engineers and Scientists	Fourth	Sheldon M. Ross	Academic Foundation	2011
2	Probability and Statistics for Engineers and Scientists	Eighth	E. Walpole, R. H. Mayers, S. L. Mayers and K. Ye	Pearson Education	2007

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Probability and Statistics in Engineering	Fifth	Douglas C. Montgomery	Wiley India	2012
2	Probability & Statistics	Third	Spiegel, M. R., Schiller, J. and Srinivasan, R. A.	Tata McGraw Hill	2010

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Data Structures	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
CS202/IT202		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	1. Problem solving using imperative programming
Course Objective: To introduce the fundamentals and abstract concepts of Data Structures for Problem Solving.	
Course Outcomes (CO):*At the End of the course students will be able to*	
XXXXX.1	Apply various operations of linear and non-linear data structures to given problems.
XXXXX.2	Apply the concepts of Trees and Graphs to a given problem.
XXXXX.3	Apply various operations of heap data structures.
XXXXX.4	Apply the concepts of hashing on a given problem

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XXXXX.1												
XXXXX.2												
XXXXX.3												
XXXXX.4												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
XXXXX.1						
XXXXX.2						
XXXXX.3						
XXXXX.4						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Introduction to Data Structures		
	1.1	Concept of Linear and Non linear Data Structures	1,2	1
	1.2	Stack: Stack as ADT, operations on stack,, Applications of Stacks	1,2	4
	1.3	Queue: Queue as ADT, Operations on Queue,, Applications of Queue , Types of Queue-Circular and Priority Queue	1,2	4
	1.4	Linked List: Linked List as ADT, Operations on Singly Linked List. Types of linked list- Linear and circular linked lists, Doubly Linked List, Circular Linked List and its operations, Generalized Linked List (GLL) concept , Applications of linked List and Generalized Linked List (GLL).	1,2	6
2	Title	Trees		
	2.1	Trees as ADT, General tree v/s Binary Tree Terminology, Traversal of Binary Tree, Operations on Binary tree, Binary Search Tree and its operations, Expression Tree	1,2	5
	2.2	AVL Trees- Properties of AVL trees, Rotations, Insertion, and Deletion	1,2	4
	2.3	Introduction to B tree- Insertion , Deletion.	1,2	3
3	Title	Graphs		
	3.1	Graph as ADT, Introduction To Graph, Representation of Graph- Adjacency Matrix, Adjacency List, Graph Traversal Technique	1,2	3
4	Title	Heap Structure		
	4.1	Heap as ADT, Introduction to Heap Structures, Min Heap, Max Heap, Construction of Heap	1,2	3
	4.2	Fibonacci heaps- Structure of Fibonacci heaps, Mergeable-heap, operations, Decreasing a key and deleting a node	1,2	5
5	Title	Hashing		
	5.1	Introduction to Hash Table, Hash functions, Collision Resolution Technique.	1,2	4
6	Self Study	Optimal Binary Search Tree and Red-Black Trees	1,2	5*
			Total	42

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
1	Implement a given problem statement using Stack.
2	Implement a given problem statement using Queue
3	Implement a given problem statement using Linked List.
4	Implement a given problem statement using Doubly Linked List.
5	Implement a given problem statement using Binary Trees.
6	Implement insertion of node in AVL tree.
7	Implementation of expression tree
8	Implement Operations of Heap Structures.
9	Implement hash functions with different collision resolution techniques.
10	Apply Graph Traversal Technique on a given problem statement to solve the problem

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Introduction to Algorithms	Third	Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein	MIT Press	2009
2	Fundamentals of Computer Algorithms	Second	Horowitz E, Sahni S and S.Rajasekaran	Galgotia Publications	2010

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Classic Data Structures	Second	Samanta Debasis	PHI	2009
2	Data Structures With C	First	Seymour Lipschutz	Schaum's Outline Series	2010

Course(Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Computer Architecture and Organization	3	0	2	4	9	3	0	1	4
CS203/IT203		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	Digital Circuits & Systems, Any Programming Language
Course Objective: Imparting concepts of each component of computer architecture thoroughly with practical aspects including memory systems and I/O communications with interfacing	
Course Outcomes (CO): ***At the End of the course students will be able to***	
XXXXX.1	Explain basic computer structure and compare computer architecture models
XXXXX.2	Design algorithms to solve ALU operations and memory mapping techniques
XXXXX.3	Comprehend processor architecture with various design methods of CPU with comparative analysis
XXXXX.4	Illustrate memory systems with design and analysis of mapping techniques for cache and virtual memory
XXXXX.5	Analyze different parallel processing and pipelining concepts with pipelining hazards
XXXXX.6	Comprehend different types of I/O buses , compare and contrast different types of data transfer methods and arbitration techniques

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XXXXX.1												
XXXXX.2												
XXXXX.3												
XXXXX.4												
XXXXX.5												
XXXXX.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
XXXXX.1						
XXXXX.2						
XXXXX.3						
XXXXX.4						
XXXXX.5						
XXXXX.6						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Overview of Computer Architecture and Organization**		5
	1.1	Introduction of Computer Organization and Architecture, Basic organization of computer and block level description of the functional units, Evolution of x86 Computers, Von Neumann model, Harvard Model, Embedded system	1	
	1.2	Performance Issues: Designing for performance, Amdahl's Law, Multi-core, GPGPU	1	
2	Title	**Data Representation and Arithmetic Algorithms**		6
	2.1	Number representation: Floating-point representation, Floating point arithmetic, IEEE 754 floating point number representation	2,3	
	2.2	Integer Data computation: Addition, Subtraction. Multiplication: Signed multiplication, Booth's algorithm.	2,3	
	2.3	Division of integers: Restoring and non-restoring division	2,3	
3	Title	**Processor Organization and Control Unit**		9
	3.1	CPU Architecture, Register Organization Instruction formats, basic instruction cycle. Instruction interpretation and sequencing, Case Study of 8086 architecture and Register Organization	1,2,4	
	3.2	Control Unit: Soft wired (Micro-programmed) and hardwired control unit design methods. Microinstruction sequencing and execution. Micro operations	2,4	
	3.3	RISC and CISC: Introduction to RISC and CISC architectures and design issues.	2,4	
4	Title	**Memory Organization**		11
	4.1	Introduction to Memory and Memory parameters. Classifications of primary and secondary memories. Types of RAM and ROM, Allocation policies, Memory hierarchy and characteristics.	1,2	
	4.2	Cache memory: Concept, architecture (L1, L2, L3), mapping techniques. Cache Coherency, Interleaved and Associative memory.	1,2	
	4.3	Virtual Memory: Concept, Segmentation and Paging, Page replacement policies	1,2,4	
5	Title	**I/O Organization and Introduction to Parallel Processing**		11
	5.1	Buses: Types of Buses, Bus Arbitration, BUS standards	2	

	5.2	I/O Interface, I/O channels, I/O modules and IO processor, Types of data transfer techniques: Programmed I/O, Interrupt driven I/O and DMA.	1,2	
	5,3	Introduction to parallel processing concepts, Flynn's classifications, pipeline processing, Pipeline stages, Pipeline Hazards	1,2,4	
6	**Self Study**	Comparative Study of microprocessors and micro architectures with respect to their important features. 8086 instructions and assembler directives with addressing modes with memory interfacing techniques. Cache memory protocol and virtual memory concepts in Pentium processors. Vector and Array Processors with VLIW architecture.	Ref. 2,5,6	**6***
			Total (* Not included)	**42**

Laboratory Component (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
1	Implement various Arithmetic Operations through Assembly Language Programming for microprocessor 8086 (MASM)
2	Simulate the operation of COPY and PASTE in 8086 (MASM)
3	Implement various String Operations in 8086 through the utilities provided by DOS interrupts (MASM)
4	Generation of alphabetic arrangement of a given string in 8086 (MASM)
5	Design password application (generation and detection) in 8086 (MASM/C)
6	Design of Carry Look Ahead Adder
7	Implement Booth's Multiplication Algorithm
8	Implement Division Algorithm (Non-Restoring and Restoring)
9	Implement Mapping techniques of Cache memory
10	Implement Page Replacement Policies

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Computer Organization	Fifth	Carl Hamacher, Zvonko Vranesic, Safwat Zaky	Tata McGraw-Hill	2002
2	Computer Organization and Architecture: Designing for Performance	Eighth	William Stallings	Pearson	2010
3	Computer System Architecture	Third	M, Morris Mano	Pearson	2007
4	Computer Architecture & Organization	Third	John P. Hayes	McGraw-Hill	1998

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Structured Computer Organization	Sixth	Andrew S. Tanenbaum	Pearson	2013
2	Microprocessor and Interfacing: Programming & Hardware	Third	Douglas V Hall	Tata-McGraw Hill	2012
3	Computer Architecture and Organization: Design Principles and Applications	Second	B. Govindarajulu	McGraw Hill	2017
4	Programmer's reference Manual for IBM Personal Computers	First	Steven Armburst	McGraw Hill	1986
5	Pentium Processor System Architecture	Second	Don Anderson, Tom Shanley, MindShare Inc, MindShare, Inc	Addison-Wesley Professional	1995
6	Modern Processor Design: Fundamentals of Superscalar Processors	Second	John Paul Shen , Mikko H. Lipasti	Waveland Press Inc.	2013

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Database Management systems	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
CS204/IT204		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	-
Course Objective: To efficiently and effectively Design, develop, maintain and retrieve the Information from DBMS.	
Course Outcomes (CO):*At the End of the course students will be able to*	
XXXXX.1	Demonstrate understanding of given system to construct a database model.
XXXXX.2	Apply various Relational and SQL commands on the populated database.
XXXXX.3	Examine the functional dependencies to make a normalized database system.
XXXXX.4	Examine transaction processing techniques on a database.
XXXXX.5	Illustrate query processing and optimization method on a database.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XXXXX.1												
XXXXX.2												
XXXXX.3												
XXXXX.4												
XXXXX.5												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
XXXXX.1						
XXXXX.2						
XXXXX.3						
XXXXX.4						
XXXXX.5						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction: Database Concepts and ER Modeling**	1,2	**09**
	1.1	Introduction to basic concept of Database, Characteristics of databases, File system V/s Database system, Users of Database system, Database Administrator, Data Independence, Codd's Rule, DBMS system architecture.		
	1.2	Introduction to ER model, Benefits of Data Modeling, Types of data Models, Phases of Database Modeling, The Entity-Relationship (ER) Model, Extended Entity-Relationship (EER) Model		
2	**Title**	**Relational Algebra and SQL**	1,2	**16**
	2.1	Introduction, Mapping the ER and EER Model to the Relational Model, Relational Algebra: Overview, Basic Operators, Extended Operators		
	2.2	Overview of SQL, Data Definition Commands, Data Manipulation commands, Data Control commands, Set operations, aggregate function, null values, Views in SQL, Subquery, Trigger, stored procedure		
3	**Title**	**Normalization**	1,2	**06**
	3.1	Design guidelines for relational schema, Functional dependencies		
	3.2	Normal Forms- 1NF, 2 NF, 3NF, BCNF and 4NF,5NF		
4	**Title**	**Transaction Processing and Recovery**	1,2	**07**
	4.1	Transaction concept, Transaction states, ACID properties, Implementation of atomicity and durability, Concurrent Executions, Serializability, Recoverability, Lock-based, Timestamp-based, Validation-based protocols.		
	4.2	Shadow paging, Deadlock handling.		
5	**Title**	**Introduction to Query Processing and Query Optimization**	1,2	**04**
	5.1	Basics of Query Processing, Measures of Query Cost		
	5.2	Query Optimization: Equivalence Rules, Pictorial representations		
6	**Self Study**	1. Relational Calculus-Information retrieval 2. NO SQL-Data type, Database creation, Basic command for creation, updating and querying the database, Mongo dB	1,2	**5***
			Total (*Not included)	**42**

Laboratory Component:

Assign a case study for group of 2/3 students and each group will perform following experiments on the case study.

Exp No.	Title of the Experiment
1	Formulate a case study and create an E-R Diagram. Mapping of E-R model to Relational Model.
2	To create a database and populate using SQL commands (With constraints) • Data Definition Language- Create, Alter, Drop, Rename, Truncate • Data Manipulation Language- Insert, Update, Delete, Select • Constraints-Not Null, Unique Key, Primary Key, Foreign Key, Check, Dropping a Constraint.
3	To perform DCL, TCL commands • Data Control Language: Grant, Revoke, Roles • Transaction Control Language: Commit, Rollback, Save point
4	To perform Date, Time, Arithmetic and Set operation on database.
5	To perform Aggregate function and Group by- Having clause on database
6	To perform Join operations on database. • Equijoins, Non-Equijoins, Self Joins, Outer Join, cross Join
7	To retrieve a data using Subquery.
8	To Create a different view of database.
9	To examine integrity of database using Triggers.
10	To improve performance of system using stored procedure.

Textbooks

Sr. No	Title	Edition	Authors	Publisher	Year
1	Database System Concepts	Seventh	Korth, Slberchatz, Sudarshan	McGraw – Hill	2019
2	Fundamentals of Database Systems	Sixth	Elmasri and Navathe	PEARSON Education	2011

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Database Management Systems	Third	Raghu Ramkrishnan and Johannes Gehrke	TMH	2003
2	Database Management Systems	First	G. K. Gupta	McGraw – Hill.	2018
3	SQL, PL/SQL programming language of ORACLE	Forth	Ivan Bayross	BPB	2010

Semester-IV

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Linear Algebra	2	0	2	5	9	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
MA201		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	Engineering Calculus/Foundation of Mathematics-I and Differential Equations and Complex Analysis/Foundation of Mathematics-II
Course Objective: To develop mathematical skills for solving engineering problems.	
Course Outcomes (CO):*At the End of the course students will be able to:*	
MA201.1	Solve a homogeneous and non-homogeneous system of linear equations using rank of a matrix.
MA201.2	Solve system of linear equations by Numerical Methods.
MA201.3	Solve equations in real life problems and to encode and decode messages using the concept of matrices.
MA201.4	Identify whether given structures are vector spaces and subspaces and construct a basis for them.
MA201.5	Show if a given matrix is diagonalisable or not.
MA201.6	Apply concepts of eigenvalues and eigenvectors to calculate functions of a square matrix, google page rank vector and solve systems of differential equations using diagonalisation of matrices.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA201.1												
MA201.2												
MA201.3												
MA201.4												
MA201.5												
MA201.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
MA201.1						
MA201.2						
MA201.3						
MA201.4						
MA201.5						
MA201.6						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	**Title**	**Basics of matrices**	**3,5**	**03**
	1.1	Revision of basic matrices and types of matrices.		01
	1.2	Row echelon form, Reduced Row Echelon form, Rank of a matrix.		02
2	**Title**	**Linear equations & its solutions**	**1,2,3,5**	**07**
	2.1	Consistency and solution of simultaneous linear homogeneous and non-homogeneous equations.		02
	2.2	Application of solving systems of equations in traffic control.		01
	2.3	Solution of system of linear algebraic equations, by (1) Gauss Elimination Method (2) Gauss Jordan method (3) Gauss Jacobi Iteration method (4) Gauss Seidel Method. (5) LU Decomposition -Crout's method		04
3	**Title**	**Vector spaces (over field of real numbers)**	**1,2,5**	**08**
	3.1	Vector space, subspace, span, linear dependence and independence of vectors, basis, dimension, orthogonal projection & gram-Schmidt process. Null space, row space, column space, Rank-Nullity theorem (only statement). Least square method.		08

4	**Title**	**Encoding & decoding using Matrices.**	**4**	**02**
	4.1	Application of matrices to Coding and Decoding		02
5	**Title**	**Eigenvalues and Eigenvectors**	**1,2,3,5**	**08**
	5.1	Eigenvalues, Eigenvectors and its properties. Cayley Hamilton theorem and its applications. Diagonalisation of matrices. Derogatory and Non-derogatory matrices.		04
	5.2	Application to find google page rank. Functions of a square matrix. Solving system of differential equations using diagonalisation.		04
6	**Self Study**	1.2 Normal form. 2.2 Forming equations using KVL for circuits and solving them using matrices. 3.1 Singular Value Decomposition. 5.1 Additional properties with proofs of eigenvalues and eigenvectors.	**1,2,3,5**	05
			Total	**28***

***Total of 28 hours does not include the self-study hours.**

Laboratory Component (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
1	Introduction to Scilab (getting started) and its benefits to use as a mathematics tool.
2	Basic commands of Scilab and vectors & matrix operations.
3	Conditional branching and iterations using Scilab.
4	Solution of linear equations using row-echelon and inverse of a matrix.
5	Solutions of linear equations using Gauss Elimination method.
6	Solutions of linear equations using Gauss Jordan method.
7	Solutions of linear equations using Gauss-Jacobi method.
8	Solutions of linear equations using Gauss-Seidel method.
9	Solutions of linear equations using Crout's method.
10	To find Eigenvalues and Eigenvectors using Scilab

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Linear Algebra and its applications	Fourth	Gilbert Strang	Cengage	2014
2	Higher Engineering Mathematics	Forty Fourth	Dr. B. S. Grewal	Khanna Publications	2020

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Linear Algebra and its applications	Third	David. C. Lay	Pearson Education	2006
2	Elementary Linear Algebra Application Version	Sixth	H Anton and Crorres	John Wiley and Sons	2010
3	Advanced Engineering Mathematics	Twenty Eighth	H.K Das	S.Chand	2014
4	Hill Ciphers	First	Jonaki B Ghosh	At Right Angles	2015
5	Advanced Engineering Mathematics	Tenth	Erwin Kreysizg	John Wiley & Sons	2011

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Foundations of Mathematics-II	2	1	0	0	3	2	1	0	3
		Examination Scheme								
MA204		Component	ISE		MSE		ESE		Total	
		Theory	75		75		150		300	
		Laboratory	--		--		--		--	

Pre-requisite Course Codes, if any.	Foundations of Mathematics-I
Course Objective: To develop basic foundation of mathematical skills.	
Course Outcomes (CO):*At the End of the course students will be able to: -*	
MA204.1	Integrate a function of one variable using various techniques
MA204.2	Sketch basic curves and solve double and triple integrals.
MA204.3	Solve basic problems using properties of complex numbers.
MA204.4	Solve differential equations of first order.
MA204.5	Apply the techniques of solving first order differential equations to electrical engineering problems.
MA204.6	Solve differential equations of higher order

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA204.1												
MA204.2												
MA204.3												
MA204.4												
MA204.5												
MA204.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
MA204.1						
MA204.2						
MA204.3						
MA204.4						
MA204.5						
MA204.6						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	**Title**	**Integral Calculus**	1,2	**13**
	1.1	Formulae for integral of standard functions, integration by parts, integration by method of substitution.		04
	1.2	Gamma functions, Beta functions. Differentiation under Integral sign with constant limits and one parameter.		04
	1.3	Standard curves (lines, circles, parabolas, ellipses). Concept of double integration. Evaluation of double and triple integrals.		05
2	**Title**	**Complex Numbers**	1,2	**03**
	2.1	Operations on complex numbers, polar form of a complex number, properties of a complex number.		03
3	**Title**	**Differential Equations**	1,2	**12**
	3.1	Exact differential equations. Linear differential equations of the first order and equations reducible to linear.		04
	3.2	Solving differential equations of first order in electrical networks.		01
	3.3	Linear differential equations with constant coefficients: complementary function and particular integral.		07
Total				**28**

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Higher Engineering Mathematics	Forty Fourth	Dr. B. S. Grewal	Khanna Publications	2020

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Advanced Engineering Mathematics	Tenth	Erwin Kreysizg	John Wiley & Sons	2011
2	Advanced Engineering Mathematics	Twenty Eighth	H.K.Dass	S.Chand	2014

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Design and Analysis of Algorithms	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
CS205/IT205		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	Advanced Data Structures
Course Objective:	
Course Outcomes (CO):*At the End of the course students will be able to*	
XXXXX.1	Analyze time and space complexity of an algorithm.
XXXXX.2	Apply divide and conquer strategy to solve problems.
XXXXX.3	Apply the concept of dynamic programming and greedy approach to solve problems.
XXXXX.4	Apply the idea of backtracking, branch and bound strategy to solve problems.
XXXXX.5	Apply various string matching algorithms.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XXXXX.1												
XXXXX.2												
XXXXX.3												
XXXXX.4												
XXXXX.5												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
XXXXX.1						
XXXXX.2						
XXXXX.3						
XXXXX.4						
XXXXX.5						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to Analysis of algorithm**		12
	1.1	Role of Algorithms in Computing, Performance analysis-space and time complexity, Growth of Functions: Asymptotic Notation, Standard Notation and Common Functions, Analysis of sorting algorithms Such as Selection sort and insertion sort.	1,2	
	1.2	Divide and Conquer Approach – General Method, Analysis of Merge Sort, Analysis of Quick sort, Analysis of Binary search, Finding the maximum and minimum, Strassen's matrix multiplication.	1,2	
	1.3	Recurrences: The substitution method, Recursion tree method, Master method and Proof.	1	
2	Title	**Dynamic Programming and Amortized Analysis**		12
	2.1	Dynamic Programming: Assembly-line scheduling, Matrix Chain Multiplication, Longest common subsequence.	1	
	2.2	Amortized analysis- Aggregate analysis, accounting and Potential Method, Dynamic Table.	1	
3	Title	**Greedy Approach**		5
	3.1	Greedy Approach: Basic strategy, application to job sequencing with deadlines problem, single source shortest path-Dijkstra's algorithm.	1,2	
	3.2	Knapsack problem, Minimum cost spanning trees-Kruskal and prim's algorithm.	1,2	
4	Title	**Backtracking and Branch-and-bound**		5
	4.1	Backtracking: General method, 8 queen problem (N-queen problem), Sum of subsets, Graph coloring.	2	
	4.2	Branch and Bound: 0/1 knapsack problem, Travelling salesman problem, 15 puzzle problem.	2	
5	Title	**Approximation and String Matching algorithms**		8
	5.1	**Approximation algorithms:** The vertex-cover problem, The traveling-salesman problem, The set covering problem	1	
	5.2	**String Matching algorithms:** The naïve string matching Algorithms, The Rabin Karp algorithm, String matching with finite automata, The Knuth-Morris-Pratt algorithm	1	
6	Self Study	**NP-complete problems:** Basic concepts, Non-deterministic Algorithms, NP-hard and NP-complete, Cook's Theorem, NP-Hard graph and scheduling Problems. NP-completeness and reducibility, decision and optimization problems, polynomial reduction	1,2	5*
Total				**42**

Laboratory Component (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
1	Experiment on finding the running time of an algorithm.
2	Experiment based on divide and conquers approach.
3	Experiment on Recurrence relation.
4	Experiment using dynamic programming approach
5	Experiment based on greedy approach
6	Experiment based on graph Algorithms
7	Experiment using Backtracking strategy
8	Experiment using branch and bound strategy
9	Experiment based on Approximation Algorithms
10	Experiment on string matching algorithms.

Text Book(s):

Sr. No	Title	Edition	Authors	Publisher	Year
1	Introduction to Algorithms	Third	Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein	MIT Press	2009
2	Fundamentals of Computer Algorithms	Second	Horowitz E, Sahni S and S. Rajasekaran	Galgotia Publications	2010

Reference Books:

Sr. No	Title	Edition	Authors	Publisher	Year
1	The Design and analysis of algorithms	First	Alfred V. Aho**,** John E. Hopcroft and Jeffrey D. Ullman	Pearson Education India	2006

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Operating Systems	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
CS206/IT206		Theory		75		75		150		300
		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	Computer Architecture and Organization
Course Objective:	
Course Outcomes (CO):*At the End of the course students will be able to*	
XXXXX.1	Comprehend the primitive concepts of Operating System services and System Programming functionality.
XXXXX.2	Articulate process scheduling algorithms in effective execution of processes.
XXXXX.3	Acquaint with efficient process synchronization techniques in effective execution of programs.
XXXXX.4	Analyze virtual memory management algorithms in effective allocation of main memory usage.
XXXXX.5	Evaluates various algorithms of File Storage & I/O management for performance and quality criterion.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XXXXX.1												
XXXXX.2												
XXXXX.3												
XXXXX.4												
XXXXX.5												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
XXXXX.1							
XXXXX.2							
XXXXX.3							
XXXXX.4							
XXXXX.5							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to System Software and Operating Systems**		8
	1.1	**System Software** – Introduction, Goal, Systems Programs and Systems Programming, Views of Systems Software. **Linkers and Loader** – Relocation and Linking Concepts, Design of Linker, Self-Relocating Programs, Linking of Overlay Structured Programs, Dynamic Linking, Loaders.	1	
	1.2	**Operating Systems** – Introduction, Structure and Principles of Operations of Operating Systems, Classes of Operating Systems, Batch Processing Systems, Multiprogramming Systems, Time Sharing Systems, Real Time Operating Systems.	1	
2	Title	**Process Management**		8
	2.1	**Processes and Threads** – Process Concept, Process Scheduling, Operations on Processes, Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues, Operating-System Examples	2	
	2.2	**UNIX Process and Threads –** Process Abstraction, Process Creation using fork and exec, invoking new process, process termination, awaiting process termination, User and Kernel Threads.	3	
3	Title	**Process Coordination**		12
	3.1	**Process Synchronization** - Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples	2	
	3.2	**CPU Scheduling** - Scheduling Criteria, Scheduling Algorithms, Real-Time CPU Scheduling, Operating-System Examples. **Deadlock** - Characterization, Methods for Handling Deadlocks, Detection, Prevention, Avoidance, Recovery methods for Deadlock.	2	
	3.3	**UNIX IPC –** Universal IPC Facilities, System V IPC, Message, Ports, Message Passing, Port Operations.	3	
4	Title	**Memory management**		6
	4.1	**Memory Management Strategies** - Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.	2	
	4.2	**Virtual Memory Management** - Demand Paging, Allocation of	2	

		Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory, Operating-System Examples.		
5	**Title**	**File Management**		**8**
	5.1	**Storage Management** - Disk Structure, Disk Scheduling, Disk Management	2	
	5.2	**File-System Implementation** - File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management	2	
	5.3	**UNIX Internal File Representation -** Inodes, Structure of Regular File, Directories, Path Name to Inode Conversion, Super Block, Inode Assignment, Allocation of Disk blocks, Other File Types.	4	
6	**Self Study**	1) Explore Features, characteristics and CPU scheduling of Real-Time Operating System along an example 2) Explore the requirements of Kernel, CPU Scheduling, Disk Scheduling for Multimedia Systems 3) Explore all UNIX System Calls for File System.	2,4	**5***
			Total (*Not included)	**42**

List of Experiments for Operating System Laboratory

Sr. No	**Title of the Experiment**
1	Installation of Linux OS on Virtual Machine.
2	Write a program for creating a static/dynamic link library for complex number operations and then test this library through linuxld linker.
3	Write a program which creates exactly 16 copies of itself by calling fork() only twice within a loop. The program should also print a tree of the pids.
4	Write a program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin d) Priority
5	The program r.c initializes *n* number of semaphores. It first assign count equal -1, which is then used by process p and q. This count is protected by semaphore. It also allocates shared memory of size 40 ints. It waits for process p and q to enter all n1 and n2 elements through different terminals. This program r.c sorts shared data in ascending order. It waits to finish p and q. At end, The program r.c detaches and deletes *n* semaphores and print the sorted list.
6	Write a multithreaded program for preventing race conditions and deadlock avoidance for the banker's algorithm as follows. Several customers' request and release resources from the bank. The banker will grant a request only if it leaves the system in a safe state. A request that leaves the system in an unsafe state will be denied.
7	Write a program which acts as a chat application between two users on the same computer using shared memory.

8	Assume that a system has a 32-bit virtual address with a 4-KB page size. Write a C program that is passed a virtual address (in decimal) on the command line and have it output the page number and offset for the given address. As an example, your program would run as follows: ./a.out 19986 Your program would output: The address 19986 contains: page number = 4 offset = 3602 Writing this program will require using the appropriate data type to store 32 bits. We encourage you to use unsigned data types as well.
9	Write a program to simulate disk scheduling algorithms a) FCFS b) SCAN c) C-SCAN
10	Write a program to prevent destructive update of files by locking as follows: Suppose the inode contains a new permission setting such that it allows only one process at a time to open the file for writing, but many processes can open the file for reading.

Note – Implement all programs in C language under Linux OS environment

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	System Programming	First	D M Dhamdhere	Tata McGraw-Hill Education	2011
2	Operating System Concepts	Ninth	Abraham Silberschatz, Peter B Galvin, Greg Gagne	Wiley	2012
3	UNIX Internals: The New Frontiers	First	UreshVahalia	Prentice Hall	1995
4	Design of the UNIX Operating Systems	First	Maurice J. Bach	Prentice-Hall	1990

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Operating Systems: Internals and Design Principles	Eighth	William Stallings	Pearson	2014
2	Modern Operating Systems	Fourth	Andrew S. Tanenbaum, Herbert Bos	Pearson	2014

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Computer Communications and Networks	3	0	2	5	10	3	0	1	4
CS207/IT207		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective: Understand the state-of-the-art in network protocols, architectures and applications.	
Course Outcomes (CO):*At the End of the course students will be able to*	
XXXXX.1	Describe the fundamental concepts of Data Communication.
XXXXX.2	Distinguish the different layers of the OSI model and TCP/IP.
XXXXX.3	Identify the different types of protocols and their functions within a network.
XXXXX.4	Apply the knowledge of subnetting, routing mechanisms and Software Defined Networking.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XXXXX.1												
XXXXX.2												
XXXXX.3												
XXXXX.4												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
XXXXX.1						
XXXXX.2						
XXXXX.3						
XXXXX.4						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Computer Communication and The Internet**	1,2	10
	1.1	Internet: A Nut and Bolts Description, A Services Description, Protocol. The Network Edge: Access Network, The Network Core: Packet Switching, Circuit Switching, A Network of Networks	1,2	
	1.2	Delay, Loss, Throughput in Packet Switched Networks: Overview of Delay in Packet Switched Networks, Queuing Delay and Packet Loss, End to End Delay, Throughput in Computer Networks.	1,2	
	1.3	Protocol Layers and their Service Models: Layered Architecture and their Encapsulation.	1,2	
	1.4	Data and Signals: Analog and Digital, Periodic analog signals, Digital signals, Transmission impairment.	2	
	1.5	Digital Transmission: Digital-to-Digital conversion, Analog-to-Digital conversion. Transmission modes, Analog Transmission: Digital-to-Analog conversion, Analog-to-Analog conversion.	2	
2	Title	**Application Layer**	1,2	6
	2.1	Principles of Network Applications: Network Applications Architecture, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application Layer Protocols.	1,2	
	2.2	The Web and HTTP: Overview of HTTP, Non Persistent and Persistent Connections, HTTP Message Format, User Server Interaction: Cookies, Web Catching, The Conditional Get.	1,2	
	2.3	File Transfer Ftp: Ftp Commands and Replies. FTP, SMTP, Mail Access Protocol (IMAP, POP), DNS	1,2	
3	Title	**Transport Layer**	1,2	8
	3.1	Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet	1,2	
	3.2	Multiplexing and Demultiplexing	1,2	
	3.3	Connectionless Transport - UDP: UDP Segment Structure, UDP Checksum	1,2	
	3.4	Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N (GBN), Selective Repeat (SR),	1,2	
	3.5	Connection-Oriented Transport - TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout,	1,2	

		Reliable Data Transfer, Flow Control, TCP Connection Management		
	3.6	Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control.	1,2	
4	**Title**	**The Network Layer**	1,2	**10**
	4.1	Introduction: Forwarding and Routing, Network Service Models.	1,2	
	4.2	Virtual Circuit and Datagram Networks: Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks.	1,2	
	4.3	Router: Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane.	1,2	
	4.4	The Internet Protocol (IP): Forwarding and Addressing in the Internet, Datagram Format, IPv4 Addressing, Internet Control Message Protocol (ICMP), IPv6	1,2	
	4.5	Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing	1,2	
	4.6	Software Defined Networking: Introduction and Overview	R3	
5	**Title**	**The Link Layer: Links, Access Networks, and LANs**	1,2	**8**
	5.1	Introduction to the Link Layer: The Services Provided by the Link Layer, Implementation of the Link Layer	1,2	
	5.2	Error-Detection and Correction Techniques: Parity Checks, Checksumming Methods, Cyclic Redundancy Check (CRC)	1,2	
	5.3	Multiple Access Links and Protocols: Channel Partitioning Protocols, Random Access Protocols, Taking-Turns Protocols.	1,2	
6*	**Title**	**Self Study Topic**	1,2	**5***
	6.1	Transmission Media: Guided media, Unguided media: Wireless	1,2	
	6.2	ARP and RARP usage	1,2	
	6.3	Multicast routing and Broadcast routing	1,2	
	6.4	Routing in the Internet: Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP	1,2	
	6.5	Network Function Virtualization	R3	
Total				**42**

***This module hrs. not included in Total 42 hrs**

Laboratory Component (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
1	Use and interpret basic Networking Utilities
2	Describe various Network Topology and Networking Hardware
3	Experiment with Packet Tracers/Analyzers
4	Implement Web server and DHCP server for given scenario

5	Implement TELNET and FTP server for given scenario
6	Implement SMTP server for given scenario
7	Implement DNS server for given scenario
8	Develop client-server model using Socket Programming for given scenario
9	Illustrate basic Mininet operations for Software Defined Networking
10	Implement in Mininet to control switch manually

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Computer Networking: Top Down Approach	Sixth	James Kurose and Kieth Ross	Pearson	2013
2	Data Communication and Networking	Second	Behrouz Forouzan	McGraw Hill	2000

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Computer Networks	Fifth	Andrew Tanenbaum	Pearson	2013
2	Computer Networks	Third	Larry L. Peterson and Bruce Davie	Morgon Huffman	2003
3	SDN and NFV Simplified	First	Jim Doherty	Addison Wesley	2016

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(SBC)	Professional Communication Skills	1	0	2	2	5	1	0	1	2
AS201		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	--		--		--			--
		Laboratory	200		--		--			200

Pre-requisite Course Codes, if any.	
Course Objective:	
Course Outcomes (CO):*At the End of the course students will be able to*	
AS201.1	Demonstrate the spoken and written skills for job placements.
AS201.2	Draft professional documents.
AS201.3	Design written communication for social media.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS201.1												
AS201.2												
AS201.3												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
AS201.1						
AS201.2						
AS201.3						

BLOOM'S Levels Targeted (Pl. appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	L Hrs.	P Hrs
1.	Title	**Placement Skills**		6	12
	1.1	Resume Writing & Cover Letter			
	1.2	Group Discussion			
	1.3	Case Studies/Pitching a startup			

	1.4	Team Building Skills/Work			
	1.5	Interview Skills			
2	**Title**	**Corporate Communication**		**6**	**12**
	2.1	Presentation Skills			
	2.2	Meeting: Notice, Agenda, Minutes			
	2.3	Proposal Writing			
	2.4	Report Writing: Informative, Analytical report			
3	**Title**	**Research Writing**		**2**	**4**
	3.1	Sourcing information through digital media			
	3.2	Written communication using social media: Blog			
4	**Self Study**	Research Paper, News Analysis			**6***
			Total	**42 hrs**	

***Not included in the total**

List of ISEs

Sr. No	Title of the Experiment
1	Resume
2	Cover Letter
3	GD
4	Mock Interview
5	Presentation
6	Blog Writing
7	Team Building Activity
8	Minutes of the Meeting/Notice & Agenda
9	Proposal Writing
10	Report Writing

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Interpersonal Skills at Work	2002	John Hayes	McGraw Hill Education	2002
2	Campus Placement: A Comprehensive Guide	2016	Ankur Malhotra	McGraw Hill Education	2016

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	If I Understood You, Would I Have This Look on My Face? My Adventures in the Art and Science of Relating and Communicating	FIRST	Alan Alda	Random House	2017
2	Handbook for Writing Proposals	SECOND	Robert J. Hamper, Sue Baugh	McGraw Hill Education	2010
3	Effective Communication Skills for Scientific and Technical Professionals	2000	Harry Chambers	Paperback Basic Books	2000
4	The Art Of Writing Together	2008	William Issac	Crown Business	2008
5	Communication Skills	2011	Meenakshi Raman, Sangeeta Sharma	Oxford, India	2011

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned				
		L	T	P	O	E	L	T	P	O	Total
(SBC)	Mini Project-I	0	0	0	4	4	0	0	0	2	2
		Examination Scheme									
		Component			ISE		MSE		ESE		Total
CS208/IT208		Theory			--		--		--		--
		Laboratory			100		--		100		200

Pre-requisite Course Codes, if any.	
Course Objective:	
Course Outcomes (CO):*At the End of the course students will be able to*	
XXXXX.1	Discover potential research areas for addressing societal issues
XXXXX.2	Conduct a survey of basic and contemporary literature in the preferred field of study.
XXXXX.3	Formulate and propose a plan for creating a solution for the research plan identified.
XXXXX.4	Exercise the team building, communication and management for design and implementation of projects.
XXXXX.5	Compare and contrast the several existing solutions for research challenge
XXXXX.6	Report and present the findings of the study conducted in the preferred domain.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XXXXX.1												
XXXXX.2												
XXXXX.3												
XXXXX.4												
XXXXX.5												
XXXXX.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
XXXXX.1						
XXXXX.2						
XXXXX.3						
XXXXX.4						
XXXXX.5						
XXXXX.6						

BLOOM'S Levels Targeted (Pl. appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Mini-project is an opportunity to make a difference in the experience of education in its own way. It is an attempt of scientific study of the problem in surrounding in order to guide, correct and evaluate the actions and decisions about it. It is based on a small project correlating scientific knowledge and day to day experience which encourages development of scientific attitude to solve real life problems among students.

The Objectives of Action Research are:

- ✓ To make students sensitive towards societal issues
- ✓ To learn scientific principles from day-to-day experiences
- ✓ To develop psycho-technological skills through observation, classification, statement of hypothesis etc.
- ✓ Development of communication, organizational skills and maturity through discussion, presentation etc.
- ✓ To develop ability to correlate science, technology and society
- ✓ To apply engineering knowledge and propose innovative, sustainable solutions to the real-life challenges

Steps for Implementation (ISE: 2 Phases) and ESE

- ✓ Keen observation of the surrounding/society
- ✓ Identification of the problem
- ✓ Analysis of the problem
- ✓ Collection of relevant information by formulating research questions
- ✓ Suggesting plan of action
- ✓ Conducting experiments
- ✓ To draw conclusion
- ✓ To find the possible solution to rectify the problem
- ✓ To execute experiments and remedial measures wherever possible

Students can seek guidance from teachers, other experts and make effective use of other sources of information available around them. Students must ensure that problem to be solved in manageable in one semester.

Criteria of a good project:

- ✓ Appropriate idea, clear understanding, and proper presentation of the concept
- ✓ Quality of work
- ✓ Project plan and its execution
- ✓ Credibility of the work
- ✓ Probable impact of the work on the attitude of students and society
- ✓ Scientific attitude, creativity and novelty reflected in project work and analysis of the situation
- ✓ Utility and innovation of the remedial measures
- ✓ Desirability, Feasibility and Viability in real life

The H/W and S/W resources required to complete the Mini-Project-I may be beyond the scope of curriculum of courses taken or may be based on the courses but thrust should be on

- Learning additional skills
- Development of ability to define and design the problem and lead to its accomplishment with proper planning
- Learn the behavioral discipline by working in a team. The team may be maximum three (03) students.

Evaluation:

Project report should contain project title, student details, certificate and acknowledgements. Other sections of the report shall be decided by the department based on projects. But it must have introduction, necessity of project, objectives, hypothesis, plan, observations, analysis of results, conclusion and references along with other sections related to technology. The ISE and ESE evaluation will be carried out based on the rubrics framed by the Department. The ESE marks will be based on final demonstration of the project and viva based on it and report/poster/technical paper of the project in the standard format provided by the Department.