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

Bharatiya Vidya Bhavan's

Sardar Patel Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai)

Master Of Computer Applications

First Year MCA

(Sem. I Sem. II)

Effective from Academic Year 2023-24

Board of Studies Approval : 8th May, 2023

Academic Council Approval : 3rd February, 2023

Dr. D.R. Kalbande	**Dr. Y.S. Rao**	**Dr. B.N. Chaudhari**
HOD, CSE-MCA	**Dean Academics**	**Principal**

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Nomenclature of the Courses

BSC	Basic Science Course
SBC	Skilled Based Course
PC	Program Core
TE	Thread Elective
PE	Program Elective
MLC	Mandatory Learning Course
OE	Open Elective
HSSE	Humanities and Social Science Elective
LLC	Lifelong Learning Course
ABL	Activity Based Learning

Abbreviations

L	Lecture Hour	O	Other Work (Assignments, Self-Study, etc)
T	Tutorial Hour	E	Total Engagement in Hours for the Learners
P	Laboratory Hour	C	Credit Assigned

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CURRICULUM STRUCTURE

Sem I (For Computer/IT Graduates)									
No	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	BSC	MA501	Linear Algebra	2	1	0	5	8	3
2	PC	MC501	Data Structures	2	0	2	4	8	3
3	PC	MC502	Database Management System	3	0	2	5	10	4
4	PC	MC503	Software Engineering	3	0	2	5	10	4
5	SBC	MC504	Web Technology Lab	0	0	4	4	8	2
6	SBC	AS501	Writing Skills	1	0	2	2	5	2
7	HSSE	HSEX1	HSS-I	2	0	0	3	5	2
8	ABL	LLC	LLC-I	0	0	0	2	2	1
			TOTAL	**13**	**1**	**12**	**30**	**56**	**21**

Sem I (For Non Computer/IT Graduates)									
No	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	BSC	MA501	Linear Algebra	2	1	0	5	8	3
2	BSC*	MA502	Discrete Mathematics	2	0	0	3	5	2
3	PC	MC501	Data Structures	2	0	2	4	8	3
4	PC	MC502	Database Management System	3	0	2	5	10	4
5	PC	MC503	Software Engineering	3	0	2	5	10	4
6	SBC	MC504	Web Technology Lab	0	0	4	4	8	2
7	PC*	MC505	Problem Solving using OOPs Lab	2	0	2	2	6	3
8	SBC	AS501	Writing Skills	1	0	2	2	5	2
			TOTAL	**15**	**1**	**14**	**30**	**60**	**23**

*** indicates MOOC Course.**

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Sem II (For Computer/IT Graduates)									
No	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	BSC	MA503	Probability and Statistics	3	0	0	4	7	3
2	PC	MC506	Java Programming	2	0	4	3	9	4
3	PC	MC507	Design and Analysis of Algorithms	2	0	2	3	7	3
4	PC	MC508	Process Automation	2	0	2	4	8	3
5	PE	MC5XX-I	Thread Elective-I /Program Elective-I	3	0	2	4	9	4
6	SBC	MC509	Mobile Programming Lab	0	0	4	4	8	2
7	SBC	AS502	Communication & Presentation Skills	1	0	2	2	5	2
8	HSSE	HSEX2	HSS-II	2	0	0	3	5	2
			TOTAL	**15**	**0**	**16**	**27**	**58**	**23**

Sem II (For Non Computer/IT Graduates)									
No	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	BSC	MA503	Probability and Statistics	3	0	0	4	7	3
2	PC*	MC510	Operating System	3	0	0	4	7	3
3	PC	MC506	Java Programming	2	0	4	3	9	4
4	PC	MC507	Design and Analysis of Algorithms	2	0	2	3	7	3
5	PC	MC508	Process Automation	2	0	2	4	8	3
6	PE	MC5XX-I	Thread Elective-I /Program Elective-I	3	0	2	4	9	4
7	SBC	MC509	Mobile Programming Lab	0	0	4	4	8	2
8	SBC	AS502	Communication & Presentation Skills	1	0	2	2	5	2
			TOTAL	**16**	**0**	**16**	**28**	**60**	**24**

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THREAD ELECTIVES

Sr. No.	Thread	Thread Elective I	Thread Elective II	Thread Elective III
1	**Data Science**	Machine Learning (MC511)	Deep Learning (MC512)	Data Visualization and Analytics (MC513)
2	**Software Testing**	Software Testing (MC514)	Quality Assurance (MC515)	Risk Analysis (MC516)
3	**Design**	Design Thinking** (MC517)	Human Machine Interaction (MC518)	User Experience Design (MC519)
4	**Full Stack Development**	DevOps (MC520)	React (MC521)	Springboot and Microservices (MC522)
5	Any new thread approved by BoS			

****MC517 of 4 credits will be offered with 2 credits for theory and 2 credits for laboratory.**

PROGRAM ELECTIVES / MOOC

MC523	IoT and I2oT
MC524	Cloud Computing
MC525	Artificial Intelligence and Soft Computing
MC526	Cyber Security
MC527	Block Chain Technology
MC528	Data Warehousing and Mining
MC529	Computer Graphics
MC530	Ethical Hacking
	Any other Course approved by the Dean Academics and Principal

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SEMESTER I

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
BSC	Linear Algebra	2	1	-	5	8	2	1	-	3
MA501		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
		Laboratory		-		-		-		-

Pre-requisite Course Codes, if any.	
Course Objective: To develop mathematical skills for solving computer science problems.	
Course Outcomes (CO): ***At the End of the course students will be able to:***	
MA501.1	Solve a homogeneous and non-homogeneous system of linear equations using rank of a matrix.
MA501.2	Solve system of linear equations by Numerical Methods.
MA501.3	Solve equations in real life problems and to encode and decode messages using the
MA501.4	Identify whether given structures are vector spaces and subspaces and construct a basis for them.
MA501.5	Show if a given matrix is diagonalizable or not.
MA501.6	Apply concepts of eigenvalues and eigenvectors to calculate functions of a square

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
MA501.1	2	2	-	-	-	-	-	-	-	-	-	-
MA501.2	2	2	-	-	-	-	-	-	-	-	-	-
MA501.3	2	2	-	-	-	-	-	-	-	-	-	-
MA501.4	2	2	-	-	-	-	-	-	-	-	-	-
MA501.5	2	2	-	-	-	-	-	-	-	-	-	-
MA501.6	2	2	2	-	-	-	-	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MA501.1	-	-	1	1	-
MA501.2	-	-	1	1	-
MA501.3	-	-	1	1	-
MA501.4	-	-	1	1	-
MA501.5	-	-	1	1	-
MA501.6	-	-	1	1	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand ✓	Apply	Analyze	Evaluate	Create

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Theory Component

Module No.	Topics	Ref	Hrs.
1	**Basics of matrices**	3,5	03
	Revision of basic matrices and types of matrices, Row echelon form, Reduced Row Echelon form, Rank of a matrix.		
2	**Linear equations & its solutions**	1,2,3,5	07
	Consistency and solution of simultaneous linear homogeneous and non-homogeneous equations, Application of solving systems of equations in traffic control. 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		
3	**Vector spaces (over field of real numbers)** Vector space, subspace, span, linear dependence and independence of vectors, basis, dimension, orthogonal projection & gram-schmidt process.	1,2,5	08
	Null space, row space, column space, Rank-Nullity theorem (only statement). Least square method.		
4	**Encoding & decoding using Matrices.**	4	02
	Application of matrices to Coding and Decoding		
5	**Eigenvalues and Eigenvectors**	1,2,3,5	08
	Eigenvalues, Eigenvectors and its properties. Cayley Hamilton theorem and its applications. Diagonalisation of matrices.		
	Derogatory and Non-derogatory matrices. Application to find google page rank. Functions of a square matrix. Solving system of differential equations using diagonalisation.		
6	**Self-Study Topics**	1,2,3,5	
	Normal form, Forming equations using KVL for circuits and solving them using matrices, Singular Value Decomposition, Additional properties with proofs of eigenvalues and eigenvectors, Spectral theorem for Hermitian matrices, Quadratic forms, Classification of quadrics.		

Total	**28**

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Tutorial Component

Sr. No	Title of the Tutorial
1	Problems on vectors and matrix operation
2	Problems on rank of a matrix.
3	Solution to any linear system
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

Text books :

[1] Gilbert Strang ," *Linear Algebra and its applications*", Cengage publications,4th Edition,2014
[2] Dr.B.S.Grewal," *Higher Engineering Mathematics*", Khanna Publications,44th Edition,2020

Reference Books:

[3] David.C.Lay," *Linear Algebra and its applications*", Pearson Education ,3rd Edition,2006
[4] H Anton and Crorres," *Elementary Linear Algebra Application Version*", John and Wiley Sons, 6th Edition,2010
[5] H.K Das ," *Advanced Engineering Mathematics*", S.Chand,28th Edition,2014
[6] Erwin Kreysizg," *Advanced Engineering Mathematics*", 10th Edition, 2011

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Data Structures	2	-	2	4	8	2	-	1	3
MC501		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		50		50		100		200
		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	
Course Objective: To learn fundamentals of Data Structures.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC501.1	Apply various operations of Stack, Queue and Linked List to solve problems from different domains.
MC501.2	Apply various operations of Tree and Graph to solve problems from different domains.
MC501.3	Make use of searching and hashing techniques for efficient data retrieval and data mapping.
MC501.4	Compare efficiency of various sorting algorithms.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC501.1	3	3	-	-	-	-	-	-	1	-	2	-
MC501.2	3	3	-	-	-	-	-	-	1	-	2	-
MC501.3	-	-	-	3	-	-	-	-	1	-	2	-
MC501.4	-	3	-	-	-	-	-	-	1	-	2	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC501.1	3	1	-	-	1
MC501.2	3	1	-	-	1
MC501.3	3	1	-	-	-
MC501.4	3	1	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze ✓	Evaluate	Create

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Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Introduction to Data Structure and Algorithms** Types of Data Structure, Characteristics of an Algorithm, Abstract Data type (ADT) , Introduction to Time and Space Complexity, Asymptotic Notations (Big O, Omega, Theta)	1,2	2
2	**Linked List, Stack and Queue** **Linked List** (Linked List as an ADT, Linked List Vs. Arrays, Types of Linked List: Singly, Doubly, Circular , Operations of Linked List (Insert, delete, traverse, count, search), Application of Linked List: Polynomial addition and Subtraction) **Stack** (The Stack as an ADT, Stack operations, Array and Linked list Representation of Stack, Application of stack – Evaluation of Postfix expression, Infix to Postfix expression conversion) **Queue** (The Queue as an ADT, Queue operations, Array and Linked Representation of Queue, Circular Queue, Priority Queue. Doubly Ended Queue, Application of Queues – Round Robin CPU Scheduling Algorithm)	1,2	9
3	**Tree and Graph** **Tree** (Tree Definition and Terminologies, Binary Tree, Binary Search Tree, Expression tree, Huffman tree, AVL tree, B Tree, Heap tree) **Graph** (Graph Definition and Terminologies, Graph Representation, Graph Traversal Techniques, Single Source Shortest Path Algorithms , All Pair Shortest Path Algorithms)	1,2	9
4	**Searching and Hashing Techniques** **Searching** : Sequential search, Binary search, Interpolation Search **Hashing Techniques** (Direct, Subtraction, Modulo Division, Mid square, Digit Extraction, Folding, Double hashing), Collision resolution techniques (Linear probe, Quadratic probe, Key offset, Chaining)	1.2	4
5	**Sorting Techniques** Internal Sorting Techniques (Bubble sort, Insertion sort, Selection Sort, Radix Sort, Quick sort, Heap Sort), External Sorting Techniques (Merge Sort), Complexity Calculation	1.2	4
6	**Self-Study Topics** Applications of Linked list : Sparse Matrix and other real life applications, Applications of Stack : Recursion and other real life applications, Applications of Queue : Johnson's Algorithm and other real life applications, Applications of Tree, Applications of Graph, Competitive coding		
		Total	**28**

Laboratory Component

Sr. No	Title of the Experiment
1	Linked List implementation
2	Stack implementation
3	Queue implementation
4	Binary Search Tree implementation
5	Heap Tree implementation
6	Graph Traversal (BFS,DFS) implementation
7	Shortest Path Algorithms implementation
8	Searching Techniques implementation
9	Hashing Techniques implementation
10	Sorting Techniques implementation

Text Books:

[1] T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C Stein, "*Introduction to Algorithms*", MIT Press/McGraw Hill, Third Edition, 2009.

[2] Richard F Gilberg, Behrouz A Forouzan, "*Data Structure A Pseudocode Approach with C*", Brooks/Cole Publishing Company, Second Edition, 2004.

Reference Books:

[3] Moshe, Tenenbaum, "*Data Structures Using C and C++*", Pearson Education Asia Pvt. Ltd., Second Edition, 2006.

[4] Tremblay, Jean-Paul & Sorenson, "*An Introduction to Data Structures with Applications*",Tata McGraw-Hills, Second Edition, 2017.

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Course (Category)	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC MC502	Database Management System	3	-	2	5	10	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective: To learn the fundamentals of database systems.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC502.1	Design ER diagram and relational database.
MC502.2	Apply normalization on given database.
MC502.3	Analyze transaction and concurrency control mechanism.
MC502.4	Illustrate emerging database systems.
MC502.5	Formulate SQL queries for information retrieval.
MC502.6	Demonstrate various PL/SQL queries.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC502.1		2	1	-	-	-	-	-	1	-	2	-
MC502.2	3	2	-	-	-	-	-	-	1	-	2	-
MC502.3	3	2	-	-	-	-	-	-	1	-	2	-
MC502.4	3	2	-	-	-	-	-	-	1	-	2	-
MC502.5	3	2	-	-	2	-	-	-	1	-	2	-
MC502.6	3	2	-	-	2	-	-	-	1	-	2	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC502.1	2	1	1	2	2
MC502.2	2	1	-	2	-
MC502.3	1	1	-	-	-
MC502.4	2	-	-	-	1
MC502.5	3	1	1	2	2
MC502.6	3	1	1	2	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze ✓	Evaluate	Create

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Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Introduction to DBMS, ER and Relational Model** File system organization, Purpose of Database system, Data models, Codd rules, DBMS architecture, Entity set & Relationship set, Mapping cardinalities, Designing of ER diagram, EER features, ER to Relational Model Designing	1,2	6
2	**Query optimization, Normalization and Functional Dependencies** Query processing steps, Evaluation of Query, Relational Optimization. Functional dependency and its types, Normal forms : 1NF, 2NF, 3NF, BCNF, 4NF, 5NF	1,2,3	8
3	**Transaction Management, Concurrency Control Techniques, Database Recovery Techniques** ACID properties, Transaction states, Serializability and its types, Recoverability, Concurrency control mechanism, Lock based protocol, Timestamp based protocol, Recovery Techniques based on Deferred and Immediate Update, Shadow paging and ARIES recovery algorithm	1,2,3	10
4	**Distributed Database, Parallel Database** Distributed Databases (Overview, Types of Distributed databases, Data fragmentation, replication and allocation techniques, Query processing and Concurrency control) Parallel Databases (Architecture, Types of parallelism, Types of Partitioning)	1,2	8
5	**XML Database, Object Based Database** XML (XML documents, Approaches to store XML documents, Extracting XML documents from Relational Database) Object Based Databases (Overview, Complex data types, Inheritance in SQL, Object identity and Reference types in SQL, Object View)	1,2,3	10
6	**Self-Study Topics** EER diagram designing, Tuple Relational Calculus and Domain Relational Calculus, Advanced Transaction Processing, LDAP model of Distributed Database ,Database Security, Mobile Database, Multimedia Database, Data Storage Structures and Indexing	1,2	
Total			**42**

Laboratory Component

Sr. No	Title of the Experiment
1	SQL DDL,DML, DCL and TCL statements
2	Design ER diagram and convert it into Relational database
3	SQL Joins
4	SQL Subqueries
5	PL/SQL Cursors, Triggers
6	PL/SQL Exceptions, Records
7	PL/SQL Functions, Procedures, Packages
8	Data Fragmentation
9	OODBMS (ADT, Varray, Nested Tables, Methods, Inheritance, Reference, Overloading, Overriding, Object Views)
10	Extracting XML Documents from Relational Databases
11	Mini Project

Text Books:

[1] Henry F. Korth and S. Sudarshan, "*Database System Concepts*", McGraw Hill Education, Seventh Edition, 2019.

[2] Elmasri and Navathe, "*Fundamentals of Database Systems*", Pearson Education, Seventh Edition, 2015.

Reference Books:

[3] C. J. Date, A. Kannan and S. Swamynathan, "*An Introduction to Database Systems*", Pearson Education, Eighth Edition, 2003.

[4] Dr. P.S. Deshpande, "*SQL & PL/SQL for Oracle 11g*", Dreamtech Press, First Edition, 2011.

[5] Kevin Loney, "*Oracle Database 11g the complete Reference*", McGraw Hill Education, First Edition, 2009.

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Software Engineering	3	-	2	5	10	3	0	1	4
MC503		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective: To introduce the fundamentals of Software engineering principles and practices	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC503.1	Analyze requirements for relevant process model.
MC503.2	Design system models with Software Requirement Specification.
MC503.3	Apply estimation techniques for software planning
MC503.4	Apply umbrella activities for the Software.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC503.1	2	2	3	1	-	-	-	3	2	-	-	-
MC503.2	2	2	3	-	2	-	-	3	2	-	-	-
MC503.3	2	2	-	-	2	-	-	2	2	-	2	-
MC503.4	-	2	-	-		-	-	3	2	1	2	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC503.1	1	-	2	2	2
MC503.2	-	-	2	2	3
MC503.3	-	-	2	2	3
MC503.4	-	-	2	2	3

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate✓	Create

Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Introduction to Software Process Models**	1,2,3	6
	Software Engineering concepts and Process Models : Prescriptive Model , Evolutionary Process Model and Incremental Model, Agile Software Development: Basics of Agile Process models, Principles of Agile, Agile Manifesto; Test Driven Development		
2	**Requirement Engineering**	1,2,5	6
	Functional and Non-functional Requirement Elicitation :Interviews ,Questionnaire, Brainstorming, Facilitated Application Specification Technique , Requirement Analysis Feasibility Study, Types of Feasibility Software Requirement Specification, Validation, Agile Requirements : User stories ,Backlog Management, Agile Architecture : Feature Driven Development		
3	**Software Design**	1,2,6	9
	Architectural Design: Client Server, Pipe and Filter. Overview of UML Diagrams : Behavioral and Implementation view ,Design Patterns – Gang of four patterns		
4	**Software Project Scheduling**	1,2,3	8
	WBS, CPM and PERT, Gantt Chart Estimation – Decomposition techniques, Empirical estimation models, Agile Maturity Model and Agile Estimation Techniques - Planning Poker-Shirt Sizes. Dot Voting, Bucket System.		
5	**Software Testing**	1,2,4	4
	Verification & Validation, Overview of White Box Testing and Black Box Testing, Overview of Testing strategies and Agile Testing		
6	**Software Umbrella Activities**	1,2,4	9
	Risk Management Risk Identification, Risk Assessment, Risk Projection, RMMM ,Software Configuration Management, SCM process, version and change control, Overview of SQA ,McCall's Quality Model		
7	**Self-Study Topics**	1,2	
	Requirement Prototyping, Cost Benefit Analysis, Cohesion and Coupling, Cleanroom Software engineering, 3R -Refactoring Reengineering Reusability		
Total		**42**	

Laboratory Component

Sr. No	Title of the Experiment
1	Check Feasibility Study & Prepare SRS.
2	Prepare User Stories
3	Draw Use case diagram and prepare the specification
4	Draw Activity and Sequence diagram with specification
5	Draw the Implementation and environmental view diagram
6	Create Work breakdown Structure
7	Plan for development using Gantt chart
8	Prepare Test cases
9	Identify risk, assess impact and assign priority Prepare RMMM plan for highest priority risk.
10	Use of CI/CD tools for version controls.

Text Books

[1]Roger Pressman,"*Software Engineering: A Practitioner Approach*",McGraw-Hill,10th Edition, 2018.
[2]Ian Somerville, "*Software Engineering*", Addison Wesley, 10th Edition, 2016.
[3]Mike Cohn, "*Agile Estimating and Planning*", Prentice Hall, 6th Edition, 2018.
[4]Robert C. Martin, "*Agile Software Development, Principles, Patterns and Practices*", Pearson, 8th Edition, 2013

Reference Books

[5]Rajib Mall, "*Fundamentals of Software Engineering*",PHI,5th edition,2018.
[6]James Rambaugh, Michael Blaha, "*Object Oriented Modeling and Design with UML*",Prentice, 2nd edition, 2012.

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
SBC	Web Technology Lab	-	-	4	4	8	-	-	2	2
		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
MC504		Theory	--		--		--		--	
		Laboratory	100		--		100		200	

Pre-requisite Course Codes, if any.	
Course Objective: To introduce the web technology concepts that are required for developing web applications. The key technology components are descriptive languages, server side program elements and client side program elements.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC504.1	Create web pages using HTML5, CSS3, and Java scripting.
MC504.2	Design web pages using Angular concepts and components.
MC504.3	Develop dynamic web pages using Node and Express js.
MC504.4	Develop WebPages and store it in database using node js.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC504.1	2	2	3	-	2	-	-	-	1	-	1	-
MC504.2	2	2	3	-	2	-	-	-	-	-	-	-
MC504.3	2	2	3	-	2	-	-	-	-	-	-	-
MC504.4	2	2	3	-	2	-	-	-	1	-	1	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC504.1	-	-	-	-	-
MC504.2	1	-	1	-	1
MC504.3	1	-	1	-	1
MC504.4	1	-	1	-	1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create ✓

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Laboratory Component

Sr. No	Title of the Experiment	Ref.
1	Part1: Write a program to sum of two numbers as entered by user Part 2: Write a program to create multiplication table of a user entered number	**1,2**
2	Create a sample form program that collects the first name, last name, email, user id, and password and confirms password from the user. All the inputs are mandatory and the email address entered should be in the correct format. Also, the values entered in the password and confirm password text boxes should be the same. After validating using JavaScript, In output display proper error messages in red color just next to the textbox where there is an error.	**1,2,3**
3	Create a responsive website using HTML,CSS and Javascript	**1,2**
4	Write a program using angular to create a calculator.	**5**
5	Use Angular js feature to make a shopping list, where you can add or remove items	**5**
6	Write a program using angular to create a task manager.	**5**
7	Create a hello world program using rest api and express js.	**6,7**
8	Write a program to add two numbers using rest api and express js.	**6,7**
9	Build a basic CRUD application with node and express	**6,7**
10	Build a chat application using Angular,Node and socket	**6,7**

Text books:

[1] DT Editorial Services, "*HTML 5, Black Book*", dreamtech Press, 2nd Edition, 2016.

[2] Ben Frain, "*Responsive web design with HTML5 and CSS3*", Packt, 2nd Edition, 2015.

[3] Michael Morrison, "*Head First JavaScript*", O'Reilly publication, 2008.

[4] Jonathan Chaffer, Karl Swedberg, "*Learning jQuery*", Packt, Shroff Publication,4th Edition, 2013

[5] Rodrigo Branas, Chandermani Arora, Et al, "*Angular JS: Maintaining web applications*", Packt publications, April 21, 2016.

[6] Valentin Bojinov, David Herron, Et al, "*Node.js Complete Reference Guide*", Packt publications, December 21, 2018.

[7] Alexandru Vlăduțu, "*Mastering Web Application Development with Express*", Packt Publications, September 24, 2014.

References:

[8] Nate Murray, Felipe Coury, Ari Lerner, and Carlos Taborda, "ng-book: The Complete Guide to Angular 5", Fullstack.io.,2018.

Web Reference:

[9] https://angular.io/

[10] https://nodejs.org/en/

[11] https://www.javascript.com/

[12] https://html.spec.whatwg.org/

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
SBC	Writing Skills	1	-	2	2	5	1	-	1	2
		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
AS501		Theory	100		--		--		100	
		Laboratory	100		--		--		100	

Pre-requisite Course Codes, if any.	
Course Objective:	
Course Outcomes (CO): ***At the end of the course students will be able to***	
AS501.1	Apply the principles of business writing for professional documents.
AS501.2	Develop advance vocabulary and grammar for spoken and written communication.
AS501.3	Draft a formal report.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS501.1	-	-	-	-	-	-	3	-	3	-	3	-
AS501.2	-	-	-	-	-	-	3	-	3	-	3	-
AS501.3	-	-	-	-	-	-	3	-	3	-	3	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
AS501.1	1	3	2	-	-
AS501.2	1	3	2	-	-
AS501.3	1	3	2	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create

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Theory Component

Module No.	Topics	L Hrs	P Hrs
1	**Vocabulary Building & Grammar** Concept of word formation, the root words from foreign languages and their use in English, Common errors in writing, confused pair of words, redundancies, clichés	2	4
2	**Writing Skills** Principles of Business Writing: 7Cs of communication, sentence structure, organizing paragraph in direct and indirect style, Summarization	3	6
3	**Practices in Writing** Business E-mail: e-mail etiquettes, Business letter: full block format, modified block format, enquiry, complaints and redressal, Job Application Letter: Cover letter, Resume Writing, Meeting: Notice, Agenda, Minutes Report Writing: Informative, Analytical report	9	18
4	Basic Rules Of Grammar, GRE Vocabulary, Reading a book(fiction/non-fiction) and writing a review of it	6	

List of ISEs:

Sr. No	Title of the Assignments	Marks
1	ISE 1 – Summary Writing	10
2	ISE 2 – 7Cs of Communication	10
3	ISE 3 – Grammar & Vocabulary	10
4	ISE 4 – E-mail Writing	10
5	ISE 5 – Letter Writing	10
6	ISE 6 – Resume	10
7	ISE 7 – Cover Letter	10
8	ISE 8 – Notice & Agenda/ Minutes of the meeting	10
9	ISE 9 – Report Writing	20
	Total	100

Text Books:

[1] Shirley Mathews, "*Communication Skills*", Technical Publication, Pune, 2013.
[2] Michael McCarthy, Felicity O'Dell," *English Vocabulary in Use*", Cambridge University Press, India, 1999.

Reference Books:

[3] John Eastwood, "*Oxford Practice Grammar*", Oxford, India, 1999.
[4] Meenakshi Raman, Sangeeta Sharma," *Communication Skills*", Oxford, India, 2011.
[5] Dr. Meera Bharwani," *Communication Skills*", Synergy Knowledge ware, India, 2010.
[6] Geoffrey Leech, "*English Grammar for Today*", Palgrave, UK, 2005.
[7] Norman Lewis," *Word Power Made Easy*", Anchor Books, New York, 1978.

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
BSC	Discrete Mathematics	2	-	-	3	5	2	-	-	2
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
MA502		Theory	50		50		100			200
		Laboratory	-		--		-			-

Pre-requisite Course Codes, if any.	
Course Objective: To be familiar with a broad range of mathematical objects like sets, functions, relational graphs that is omnipresent in computer science.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MA502.1	Construct simple mathematical proofs and verify them.
MA502.2	Apply core ideas of Set Theory, Logic, Relations Functions, and Recurrence Relations.
MA502.3	Solve examples using graphs, trees and their various types with their traversing techniques

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA502.1	3	3	-	2	-	-	1	-	-	-	-	-
MA502.2	3	3	-	2	-	-	1	-	-	-	-	-
MA502.3	3	3	-	2	-	-	1	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MA502.1	-	-	-	-	-
MA502.2	-	-	-	-	-
MA502.3	-	-	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create

Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Set Theory and Logic**	1,2,4	6
	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, Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Methods of Proof, Mathematical Induction Relations and Diagraphs- Properties of Relations, Closure of Relation, Equivalence Relations, Operations on Relations		
2	**Relational Structures on Sets : Relations & Graphs**	1,2	8
	Relations, Equivalence Relations. Functions, Bijections. Binary relations and Graph, Trees (Basics), Posets and Lattices, Hasse Diagrams. Boolean Algebra		
3	**Sizes of Sets : Counting & Combinatorics**	1,2	8
	Counting, Sum and product rule, principle of Inclusion Exclusion Double Counting, Pigeon Hole Principle, Counting by Bijections Linear Recurrence relations - methods of solutions. Generating Functions, Permutations and counting.		
4	**Structured Sets : Algebraic Structures -**	1,2,3	6
	Structured sets with respect to binary operations, Groups, Semigroups, Monoids, Rings, and Fields, Vector Spaces, Basis.		
5	**Self-Study Topics**		
	Coding Theory , Isomorphic Lattices , Regular Grammar, Finite Automata	1,2	
	Total	**28**	

Textbooks:

[1] Kenneth H. Rosen," *Discrete Mathematics and its Applications*", McGraw Hill Publishers, 7th Edition, 2007

[2] Oscar Levin," *Discrete Mathematics-An open Introduction*", 3rd Edition, 2019

Reference Books:

[3] Bernard Kolman, Robert C. Busby," *Discrete Mathematical Structures*", Pearson Education, 6th Edition, 2018

[4] C. L. Liu, D. P. Mohapatra," *Elements of Discrete Mathematics*", Dreamtech Press, 4th Edition, 2012

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Problem Solving Using Object Oriented Programming Lab	2	-	2	2	6	2	-	1	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
MC505		Theory		--		--		--		--
		Laboratory		200		--		100		300

Pre-requisite Course Codes, if any.	
Course Objective: To develop programming skills of students, using object oriented programming concepts, learn the concept of class and object using C++ and develop classes for simple applications.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC505.1	Construct programs using basic control structures
MC505.2	Apply objects and structures in problem solving
MC505.3	Apply arrays and pointers efficiently to solve the problems
MC505.4	Design the solutions using inheritance and polymorphism.
MC505.5	Apply concepts of virtual functions, exception handling to create efficient solutions.
MC505.6	Construct the solutions using File handling and Standard Template Library

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC505.1	3	2	-	-	1	-	-	-	-	-	-	-
MC505.2	3	2	-	-	1	-	-	-	-	-	-	-
MC505.3	3	2	-	-	1	-	-	-	-	-	-	-
MC505.4	3	2	2	-	1	-	-	-	-	-	-	-
MC505.5	3	2	-	-	1	-	-	-	-	-	-	-
MC505.6	3	2	2	-	1	-	-	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC505.1	-	-	-	-	-
MC505.2	-	-	-	-	-
MC505.3	-	-	-	-	-
MC505.4	-	1	-	-	1
MC505.5	-	-	-	-	-
MC505.6	-	1	-	-	1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create

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Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Introduction** Problem Solving Methodology and Techniques, Introduction to Object-Oriented Programming, Basic Elements of C++, Control Structures	1,2	3
2	**Objects and Classes** A Simple Class, Classes and Objects, Defining the Class, Physical C++ Objects as Data Types, Function Structure, Objects As Function Arguments, Returning Objects From Functions, Passing Arguments To Functions Returning Values From Functions, Reference Arguments, Recursion, Inline Functions, Default Arguments, macros, friend function, static functions, Constructors, Destructors, Arrays as class Member Data, Arrays of object, String, The standard C++ String class, Addresses and pointers, The address of operator and pointer and arrays, Memory management: New and Delete, pointers to objects, Pointers to objects, this pointer, Pointer to functions	1,2	8
3	**OOP Concepts** **Overloading** Overloaded Functions, Overloading unary operations. Overloading binary operators, data conversion, pitfalls of operators overloading and conversion keywords **Inheritance** Inheritance: Concept of inheritance. Derived class and based class. Derived class constructors, member function, class hierarchies, public and private inheritance Aggregation : Classes within classes, inheritance and program development **Virtual Functions** Normal Member Functions Accessed with Pointers Virtual Member Functions Accessed with Pointers Late Binding, Abstract Classes and Pure Virtual Functions Virtual Destructors, Virtual Base Classes Friend Functions, friend Classes, Static Functions, Accessing static Functions, Numbering the Objects **Exception Handling** Introduction of Exception handling–throw, catch, Re-throw an exception , specifying exceptions etc.	1,2	12
4	**File Handling** C++ streams, unformatted / formatted I/O operations, Managing output with manipulators, creating/ opening / closing / deleting files, File pointers and their manipulators, random access to file, Errors handling during file operations, command line arguments.	1,2	5

5	**Self-Study Topics**		
	STL (Standard template library) Introduction to STL, components of STL, Containers, Iterators and function objects		
Total			**28**

Laboratory Component

Sr. No	Title of the Experiment
1	Problem solving using control structures
2	Implementation of Objects and Classes
3	Problem solving using Structures and Functions
4	Implementation of multidimensional arrays
5	Use of Strings and library functions
6	Problem solving using Pointers
7	Experiment on Overloading
8	Implementation of Inheritance
9	Implementation of Virtual Functions
10	Implement Exception Handling on stack

Text Books:

[1] Robert Lafore and R, "*Object Oriented Programming in C++*", Fourth Edition, PEARSON INDIA, 2017.

[2] Stanley B. Lippman , Josée Lajoie, Barbara E. Moo, "*C++ Primer*", Fifth Edition, PEARSON INDIA,2012.

References:

[3]E. Balagurusamy ,"*Object-Oriented Programming with C++*", Ninth edition, McGraw Hill,2018.

[4] A. K. Sharma, "*Object-Oriented Programming with C++*", PEARSON INDIA, 2009.

[5] SCHILDT and HERBERT,"*C++: The Complete Reference*", fourth edition, McGraw Hill,2014.

[6] David Parsons, "*Object-Oriented Programming With C++*", Second Edition, Cengage Learning EMEA,2014.

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SEMESTER II

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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	-	-	4	7	3	-	-	3
MA503		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	-		-		-			-

Pre-requisite Course Codes, if any.	
Course Objective: To give an exposure to the students about 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***	
MA503.1	Apply different statistical measures on various types of data
MA503.2	Perform Hypothesis testing on the data given to validate the Assumptions
MA503.3	Illustrate basic probability axioms, rules and their applicability.
MA503.4	Apply probability distribution to solve given problems.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA503.1	2	2	2	-	-	-	-	-	-	-	-	-
MA503.2	2	2	2	-	-	-	-	-	-	-	-	-
MA503.3	2	2	2	-	-	-	-	-	-	-	-	-
MA503.4	2	2	2	-	-	-	-	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MA503.1	-	-	1	1	-
MA503.2	-	-	1	1	-
MA503.3	-	-	1	1	-
MA503.4	-	-	1	1	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create

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Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Measures of Central Tendency & Measures of Dispersion** Continuous Frequency Distribution, Histogram, Frequency Polygon, Stem and leaf diagram, ogives, Arithmetic Mean, Geometric mean, Harmonic mean, Median, Range, Quartile Deviation, Mean Deviation, Box whisker plot, Standard Deviation, Coefficient of Variation	1,2	4
2	**Skewness, Correlation & Regression** Karl Pearson's coefficient of Skewness, Bowley's coefficient of Skewness, Scatter Diagram, Correlation, Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient, Linear Regression and Estimation, Coefficients of regression	1,2	8
3	**Testing of Hypothesis** Hypothesis, Type I and Type II errors, Tests of significance – Student's t-test: Single Mean, Difference of means, F,Z, Paired t-test, ANOVA, Chi-Square test: Test of Goodness of Fit, Independence Test	1,2	8
4	**Introduction to Probability** Random experiment, Sample space, Events, Axiomatic Probability, Algebra of events, Discrete, continuous and mixed random variables, probability mass function(PMF), Probability Density Function(PDF) and cumulative distribution function(CDF).	1,2	4
5	**Conditional Probability** Conditional Probability, Multiplication theorem of Probability, Independent events, Baye's Theorem, Special Theoretical Probability Distributions- Bernoulli, Binomial, Uniform, Normal, Exponential Cumulative distribution function, Expectation and Variance,	1,2	9
6	**Random variables and Mathematical Expectation** Discrete random variable, Continuous random variable, Two-dimensional random variable, Joint probability distribution, Stochastic independence, Properties of expectation, Properties of variance, Covariance	4	9
7	**Self-Study Topics** Applied Probability, Stochastic Processes, Geometric Probability	1,2	
	Total		**42**

Textbooks:

[1] J.Susan Milton, Jesse C. Arnold," *Introduction to Probability & Statistics*", Tata McGraw Hill, 4th Edition, 2014

[2] Kishore Trivedi, "*Probability and Statistics with Reliability, Queuing, And Computer Science Applications*", Wiley publication,2nd Edition,2018

Reference Books:

[3] Dr J Ravichandran," *Probability & Statistics for Engineers*", Wiley,1st Edition,2010

[4] Schaum's ,"*Outlines Probability, Random Variables & Random Process*", Tata McGraw Hill , 3rd Edition, 2017

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	JAVA Programming	2	-	4	3	9	2	-	2	4
MC506		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
		Theory	50		50		100		200	
		Laboratory	100		--		100		200	

Pre-requisite Course Codes, if any.	OO programming
Course Objective:	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC506.1	Build programming concept using OO constructs
MC506.2	Analyze real world problem for database connection and file handling using Exception handling
MC506.3	Develop Web Applications using JSP and servlets
MC506.4	Explain concept of Spring and Hibernate in advanced JAVA programming

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC506.1	2	2	-	-	-	-	-	-	-	-	-	-
MC506.2	2	2	2	2	-	-	2	-	-	2	-	-
MC506.3	2	2	-	2	-	-	-	-	-	-	-	-
MC506.4	2	2	-	2	2	-	-	-	-	2	2	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC506.1	2	-	-	2	-
MC506.2	2	-	-	2	-
MC506.3	-	-	-	-	2
MC506.4	-	-	-	2	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create ✓

Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Introduction to JAVA** Classes, Instance variables, Methods, Constructors, Access Specifiers, Abstract Classes and Wrapper Classes, Inheritance, Polymorphism, Method Overriding, final, super and this keyword Creating user defined package, Access control protection, Defining interface, Implementing interface	1, 2	5
2	**Concurrent Programming** Exception Keywords - Try, catch, finally, throw, throws, Creating User defined Exceptions, Working with Thread class and the Runnable interface, Thread priorities, File handling with java, File stream, File connection methods, JDBC architecture, Types of drivers, Java.sql package, Establishing connectivity and working with connection interface	1	5
3	**Web development using Servlets** Server side programming with Java Servlet, HTTP and Servlet, Servlet API, life cycle, configuration and context, Request and Response objects	1	6
4	**JAVA server Pages** JSP architecture, JSP page life cycle, JSP Directives, JSP scripting elements, JSP Actions, Error handling in JSP, Session tracking techniques in JSP	3	6
5	**Java Web Frameworks** Spring Architecture, Spring MVC Module, Life Cycle of Bean Factory, Spring Aspect of Object Oriented Concepts – Join Point and Point Cuts	6, 7	6
6	**Self-Study Topics** Generic Class, Generic Methods, Bounded Type, Java thread model, Life Cycle of Thread, Session handling and event handling in servlet, The JSP Expression Language EL, Spring with JPA, Exploring Architecture of Hibernate, Hibernate Annotation, Hibernate Query Language CRUD Operation using Hibernate API	1, 2, 7	
		Total	**28**

Laboratory Component

Sr. No	Title of the Experiment
1	Fundamentals of Java Programming
2	Designing a real world problem based on Packages and Interfaces Lambda Expression
3	Implementation of Generics and Collections
4	Apply file handling methods for JAVA
5	Design and implementation of Exception handling Multi-threading and File Handling
6	Event handling and GUI programming Database Programming
Single problem statement/case study including all of the below	
7	Implementation of real world problem based on servlet concept
8	Implementation of real world problem based on JSP designing concept
9	Demonstrate implementation of real world problem based on Spring Frameworks
10	Demonstrate Working model based on real time problem using Hibernate

Text Books

[1] Herbert schildt, "*The complete reference JAVA*" Tata McGraw Hill, Seventh 2007
[2] Sharanam Shah and Vaishali Shah "*Core Java for beginner*" SPD 2010

Reference Books

[3] K. Arnold and J. Gosling "*The JAVA programming language*" Pearson Education third edition 2008
[4] Black Book "*Java server programming J2EE*" Dream Tech Publishers first edition 2008
[5] James Keogh "*Complete Reference J2EE*" McGraw Hill Education Indian Edition 2001
[6] Claudio Eduardo de Oliveira, Dinesh Rajput, Rajesh R V "*Spring MVC: Beginner's Guide*" Packt Second edition 2016
[7] Paul Tepper, Fisher, Brian Murphy "*Spring Persistence with Hibernate*" Springer-Verlag Berlin and Heidelberg GmbH & Co. KG First edition 201

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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	2	-	2	3	7	2	-	1	3
MC507		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
		Theory	50		50		100		200	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	Data Structures
Course Objective:	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC507.1	Analyze time and space complexity of different algorithms.
MC507.2	Analyze various divide & conquer algorithms.
MC507.3	Apply greedy and dynamic method to given problem.
MC507.4	Make use of backtracking, branch and bound techniques, graphs to solve a problem.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC507.1	3	3	1	2	-	-	1	-	-	-	-	-
MC507.2	3	3	1	2	-	-	1	-	-	-	-	-
MC507.3	3	3	2	2	-	-	1	-	-	-	-	-
MC507.4	1	3	2	2	-	-	1	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC507.1	-	-	-	-	1
MC507.2	-	-	-	-	1
MC507.3	-	-	-	-	1
MC507.4	-	-	-	-	1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate ✓	Create

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Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Fundamentals of Algorithmic problem solving and efficiency**	1,2	4
	The Role of Algorithms in Computing, Growth of Functions, The substitution method, master method, Recursion tree method. Time complexity: worst case, best case, average case analysis, space complexity. Asymptotic notations (Big O, Omega, Theta)		
2	**Analysis of various algorithms and Divide and Conquer**	1	4
	Binary Search analysis, Merge sort analysis, Quick sort analysis Matrix multiplication, Internal Sorting Techniques , External Sorting, Techniques, Complexity calculation of Sorting Techniques using Asymptotic notation		
3	**Greedy Method & Dynamic Programming**	3,2	6
	Introduction to Greedy method, Knapsack problem, Minimum cost spanning tree- kruskal and prims algorithm **Introduction to Dynamic programming** 0/1 Knapsack problem, Matrix Chain Multiplication, Longest Common Subsequence, Optimal Binary Search Tree		
4	**Backtracking**	1	5
	Introduction to Backtracking method, 8 queens problem, Graph coloring. Hamiltonian cycles, The subset sum problem		
5	**Branch and Bound**	1	4
	Introduction to Branch and bound technique, Bounding and FIFO branch and bound, Least Cost search branch and bound .15 puzzle problem, Travelling salesman problem		
6	**Graph algorithm**	1,2	5
	Single source shortest path- Dijkstra's algorithm, Bellman Ford Algorithm, All pair shortest path-Floyd Warshalls algorithm, Johnson's Algorithm, Max Flow Algorithm: Ford-Fulkerson method, Maximum, Bipartite Matching, Push-relabel algorithm		
7	**Self-Study Topics**		
	String Matching Algorithm : Brute Force String matching , String Matching with Finite Automata, Rabin Carp string matching **Approximation Algorithm:** P and NP complete problem. P and NP hard problem.		
	Total		**28**

Laboratory Component

Sr.no	Title of the Experiment
1	To implement Divide and conquer method
2	To implement Greedy Technique
3,4	To implement dynamic algorithms
5	To implement Backtracking algorithm
6	To implement branch and bound algorithm
7	To implement Single source shortest path
8,9	To implement All pair shortest path
10	To implement String matching algorithm

References:

[1] T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C Stein, "*Introduction to Algorithms*", MIT Press/McGraw Hill,2012 Version, 2/E, PHI Learning, 3rd Edition,

[2] S. Baase, S and A. Van Gelder, "*Computer Algorithms: Introduction to Design and Analysis*",Addison Wesley, 2000, 3rd edition.

[3] Michael Gooddrich & Roberto Tammassia, "*Algorithm design foundation, analysis and internet examples*", Second edition , wiley student edition.

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Process Automation	2	-	2	4	8	2	-	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
MC508		Theory	50		50		100			200
		Laboratory	50		-		50			100

Pre-requisite Course Codes, if any.	
Course Objective: To give students exposure about process automation, its working, importance and security related to it.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC508.1	Explain the basics of Process Automation
MC508.2	Analyze the methodologies and techniques used in Process Automation
MC508.3	Develop the BOTs using Process Automation
MC508.4	Explain different intelligent Process Automation techniques
MC508.5	Analyze the securities required for Process Automation

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC508.1	3	-	-	-	-	-	-	-	-	-	-	-
MC508.2	-	2	-	2	-	-		-	-	-	-	-
MC508.3	-	-	3	-	3	-	2	-	-	1	-	-
MC508.4	2	2	-	-	-	-	-	-	-	-	-	-
MC508.5	-	3	-	1	-	-	-	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC508.1	-	-	-	-	-
MC508.2	-	-	-	-	-
MC508.3	-	-	2	-	2
MC508.4	-	-	-	-	-
MC508.5	-	-	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create ✓

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Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Robotics Process Automation : Foundations and Skills** Introduction to RPA, Different types of RPA Approaches, History of RPA, Benefits and Limitations of RPA, Terms and concepts used in RPA, Levels of RPA.	1, 2	5
2	**RPA Methodologies, Planning and Vendor Evaluation** Introduction to Lean, Introduction to Six Sigma, Six Sigma roles and levels, Lean Six Sigma, Finding the right balance and apply lean and six sigma to RPA, ROI for RPA.	1	5
3	**Developing BOTs using RPA** Analysis of Business Process and development of BOT, Activities, Flowcharts and sequences, Log Message, loops and conditions, Best practices for BOT Development, Evaluating BOT Performance, Testing, Monitoring.	1	6
4	**Intelligent Automation** Cognitive Automation, Intelligent Process Automation or IPA, Examples of cognitive RPA, Web Scraping	3	6
5	**Security of Process Automation** Security Challenges for RPA, Secured BOT Development and Secured BOT Deployment, , Secured BOT architecture design	6, 7	6
6	**Self-Study Topics** RPA compared to BPA, BPM and BPO, Key challenges in RPA, RPA use cases and the planning, RPA vendor evaluation, Type of Data for RPA, Data Process and Types of Algorithms, Managing RPA Implementation Cycle, Types of BOTs, Examples of BOTs	1, 2, 7	
Total			**28**

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Laboratory Component

Sr. No	Title of the Experiment
1	Working with Linux commands: ● Basic Linux/Unix commands ● Changing file permissions and ownership ● Types of links soft and hard link ● Filter commands ● Simple filter and advance filter commands ● Start and stop services ● Find and kill the process with id and name ● Package installation using RPM and YUM
2	Demonstrate the use of Docker : ● Installation ● Downloading Dockers images. ● Uploading the images in Docker Registry and AWS ECS ● Understanding the containers ● Running commands in container. ● Running multiple containers.
3	Part 1: Use of recorder, editors and basic commands to build simple tasks. Part 2: Run Bot from Control Room and Schedule Bot from Control Room
4	Automate task of replacing few characters from a string and copying files from a source folder to destination folder.
5	Automate task of writing text into Notepad file
6	Extract data from JSON file and display output in message box
7	Part 1: Automate the task of extracting the data from an Excel File according to some condition and storing the extracted data in another File. Part 2: Automate the task of extracting the data from multiple PDF documents and storing the data into a CSV file.
8	Manipulate web-based components like textbox, drop down and Extract data and table from website and store it in excel or database.
9	Demonstrate Scheduler and trigger
10	Design IQ BOT and resilience BOT

- **Practicals 3-10 to be done in "Automation Anywhere / UiPath" software.**

Text Books:

[1] Tom Taulli, "*The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems*", 1st Edition, Apress Publisher, 2019.

[2] Gerardus Blokdyk, "*Robotic Process Automation RPA a Complete Guide - 2020 Edition*", 1st Edition, 5STARCooks, 2019.

Reference Books:

[3] Mathias Kirchmer, Peter Franz and Danny Bathmaker and Danny Bathmaker , "*Value-Driven Robotic Process Automation Enabling Effective Digital Transformation Effective Digital Transformation*" ,White paper: BPM-D Paper - London, Philadelphia 2019 .

[4] Alok Mani Tripathi,"*Learning Robotic Process Automation*", Packt Publishing, 2018.

Web References:

[5] https://www.infobeans.com/robotic-process-automation-lifecycle

[6] https://www.uipath.com/blog/the-evolution-of-rpa-past-present-and-future

[7] https://www.chatbot.com/blog/6-types-of-bots-that-can-serve-your-clients/

[8]https://www.onesourcevirtual.com/resources/blogs/technology-and-innovation/prepare-for-robotic-process-automation-with-lean-six-sigma.html

[9]https://docs.automationanywhere.com/bundle/enterprise-v11.3/page/enterprise/topics/aae-client/bot-creator/commands/commands.html

[10]https://university.automationanywhere.com/rpa-learning-trails/automation-anywhere-university-essential-level-prep-courses-mba-students/

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
TE	Machine Learning	3	-	2	4	9	3	-	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
MC511		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	Linear Algebra
Course Objective: To introduce basic concepts and techniques of machine learning and develop skills of using recent machine learning software for solving practical problems.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC511.1	Explain basic concept and need of machine learning
MC511.2	Apply machine learning algorithms to solve the given problem
MC511.3	Explain various reinforcement learning techniques
MC511.4	Apply Dimensionality reduction techniques.
MC511.5	Make use of basic concepts of Python/R to solve given problems.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
MC511.1	2	-	-	-	-	-	-	-	-	-	-	-
MC511.2	2	2	2	2	2	-	-	-	1	-	1	-
MC511.3	2	-	-	-	-	-	-	-	-	-	-	-
MC511.4	2	2	2	-	2	-	-	-	1	-	1	-
MC511.5	2	2	2	-	3	-	-	-	1	-	1	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC511.1	-	-	-	-	
MC511.2	-	2	1	-	2
MC511.3	-	-	-	-	2
MC511.4	-	2	1	-	2
MC511.5	-	-	-	-	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create ✓

Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Introduction To Machine Learning** Need of machine learning, machine learning vs AI, machine learning vs Deep learning ,Learning types : Supervised Learning, Unsupervised learning, Reinforcement learning, What makes Machine Learning tick purpose or objectives, variety of algorithms- learning style, similarity style, Applications of machine learning, General Steps or Process of Machine Learning- SourceX -> Feature Extraction -> Feature Correlation -> Feature TransformX-> Train Model-> Ensemble-> Evaluate Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets. Estimators, Bias and Variance, likelihood, Stochastic Gradient Descent.	1,2,4	8
2	**Supervised Learning** Hypothesis testing, Training versus Testing, Gradient Descent, Over fitting & Regularization ,Regression: Regression fundamentals, Linear Regression, Polynomial regression, Regularization technique (LASSO), Classification: Classification fundamentals, Logistic Regression, Decision trees,-CART,-Random Forest, Naïve Bayes , Support Vector Machine, Time Series, Neural Networks , Case Study(Classification)	1,2,4	14
3	**Unsupervised Learning** Clustering basics: K-means clustering, K-Nearest Neighbor , Association Rule Learning , Hierarchical	1,2,3	6
4	**Dimensionality Reduction** Feature Engineering, Feature Selection methods, - Filters; Wrappers, Embedded, PCA, SVD, -tSNE -Case Study (Clustering/Anomaly/Fraud Detection)	2	6
5	**Reinforcement Learning** Markov Decision, Monte Carlo Prediction, -Case Study (next best offer, dynamic pricing)	2,4	4
6	**Machine Learning Applications across Industries** Healthcare, Retail, Financial Services, Hospitality	1,2	4
7	**Self-Study Topics** Cloud Based ML Offerings, Comparing Machine Learning as a Service: Amazon, Microsoft Azure, Google Cloud AI, IBM Watson, Explore tools used in ML, TensorFlow, Keras, Scikit learn		
	Total		**42**

Laboratory Component

Sr. No	Title of the Experiment
1	**Introduction to Python/R** Introduction Python/R, Python/R data types and objects, reading and writing data, Python/R Packages
2	**Python/R flow control** Control structures, scoping rules, dates and times, data manipulation in Python/R
3	**Functions and Modules** Loop functions, debugging tools, Mathematical Functions**,** Data Processing and handling
4	Apply Linear regression
5	Apply Logistic regression
6	Apply decision tree for given problems
7	Apply Random Forest for given problems
8	Apply Naïve Bayes for given problems
9	Apply K means clustering for given problem
10	Apply PCA for given problem

Text Books:

[1] Shai Shalev-Shwartz and Shai Ben-David*," Understanding Machine Learning: From Theory to Algorithms*", Cambridge University Press, 1st Edition,2014

[2] Mehryar Mohri Afshin , Rostamizadeh ,Ameet Talwalkar," *Foundation of Machine Learning*", The MIT Press, 2nd Edition,2018

Reference Books:

[3] Gareth James, Daniela Witten, Trevor Hastie Robert Tibshirani," *An Introduction to Statistical Learning*", Springer, 7th Edition,2007

[4] Andrew Ng, *Machine Learning Yearning*, Deeplearning.ai, Draft v0.5, 2018

[5] Dr Dinesh Kumar," *Machine-learning-using-python*", WileyIndia,1st Edition, 2019

Web References:

[6]https://www.altexsoft.com/blog/datascience/comparing-machine-learning-as-a-service-amazon-microsoft-azure-google-cloud-ai-ibm-watson/

[7] https://cloud.google.com/products/ai

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
TE	Software Testing	3	-	2	4	9	3	-	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
MC514		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective: To study fundamental concept of Software Testing	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC514.1	Apply various Software testing Techniques and strategies to find bugs in software
MC514.2	Design test cases suitable in testing
MC514.3	Apply test management and automation in testing environment
MC514.4	Illustrate Agile Testing approach

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
MC514.1	2	2	-	2	2	-	-	-	2	-	-	-
MC514.2	2	-	2	-	1	-	-	-	2	-	-	-
MC514.3	-	2	-	-	3	-	-	1	2	-	2	-
MC514.4	-	-	2	-	1	-	-	-	2	-	2	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC514.1	1	-	-	-	2
MC514.2	1	-	-	-	2
MC514.3	1	-	-	-	2
MC514.4	1	-	-	-	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate✓	Create

Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Introduction to Software Testing**	1,2	4
	Evolution of Software Testing, Goals of Software Testing, Software Testing Definitions, Effective Software Testing vs. Exhaustive Software Testing, Software Failure Case Studies, Principles of Testing.		
2	**Software Testing Methodology**	1,2	5
	Software Testing Life Cycle (STLC), Software Testing Methodology, Verification and Validation (V&V),Verification of Requirements, High-level Design ,Low-level Design, Generic types of Testing-Functional, Non Functional		
3	**Dynamic Testing: Black-Box Testing Techniques**	1,2	6
	Equivalence Class Partitioning, State Transition Test ,Cause Effect Graphing, Boundary Value Analysis, Decision Table Technique		
4	**Dynamic Testing: White-Box Testing Techniques**	1,2	6
	Need of White-Box Testing **,**Logic Coverage Criteria, Basis Path Testing**,** Graph Matrices**,** LoopTesting**,** Data Flow Testing**,** Mutation Testing		
5	**Static Testing**	1,2	3
	Structured Group Examinations – Reviews, types of reviews, General process, Roles and responsibilities, Selection criteria. The compiler as a static analysis tool		
6	**Test Levels**	1,2,5	4
	Unit Testing , Integration Testing , System Testing, Test Point Analysis ,Acceptance Testing, Performance Testing, Regression Testing, Ad-hoc testing, Alpha, Beta Tests		
7	**Test Management**	1,2,4	5
	Test organization, Test Planning, Test plan hierarchy Detailed test design and test specifications. Incident Management – Test Log, Incident Reporting, Classification, Status		

8	**Test automation**	**1,2,4**	**4**
	Need for automation, Categorization of testing tools, Selection of testing tools, Costs incurred in testing tools, Guidelines for automated testing, Overview of some commercial testing tools		
9	**Agile Testing**	**3**	**5**
	Agile Testing Lifecycle, Agile Testing Quadrants, Agile Testing Techniques: Behavior Driven Development, Session Based testing, Acceptance Driven testing, Exploratory Testing		
10	**Self-Study Topics**		
	Distributed Testing, Outsourced Testing, Insourced Testing, Role of Tester in Risk based Testing, Orthogonal Array Testing System, keyword-driven automation approach		
	Total		**42**

Laboratory Component

Sr. No	Title of the Experiment
1	Write and test a program using Black box Testing methods
2	Write and test a program using White box Testing methods
3	Study of automation tool, run test cases and use Base URL to run test cases in different domains
4	Selenium commands-selenese, Matching Text Patterns, Performance Testing Concepts :Load Testing, Stress Testing
5	Web Driver Implicit & Explicit Wait, Cross Browser Testing, API Testing
6	Apply of bug tracking tool.
7	Study of mobile apps testing tool.
8	Run test cases on mobile devices and emulators.
9	Study of Behavior Driven development tool
10	Study of test management tool.

Text Books:

[1] Andreas Spillner, "*Software Testing Foundations*", Shoff, 4th Edition, 2014.

[2] Naresh Chauhan, "*Software Testing: Principles and Practices*", Oxford University Press,1st Edition, 2010.

[3] Lisa Crispin,Janet Gregory, "*Agile Testing: a brief Introduction*", Library and Archives Canada ,3rd edition 2019.

Reference Books:

[4] Aditya P. Mathur, "*Foundations of Software Testing*", Pearson Education, 2nd edition,2013.

[5] Rex Black,Erik Van, "*Foundations of Software Testing ISTQB certification*", Cengage Learning , 3rd edition, 2012.

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
TE	Design Thinking	2	0	4	4	9	2	0	2	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
MC517		Theory	50		50		100			200
		Laboratory	100		--		100			100

Pre-requisite Course Codes, if any.	
Course Objective:	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC517.1	Understand the principles and foundations of design thinking
MC517.2	Foster a user-centric mindset to drive innovation using design thinking
MC517.3	Design solutions that address real-world problem
MC517.4	Create the prototype for proposed design.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC517.1	-	2	-	-	-	-	-	-	-	-	-	-
MC517.2	-	-	3	-	2	-	-	-	-	-	-	-
MC517.3	-	-	3	-	-	-	2	-	-	2	-	-
MC517.4	-	-	3	-	2	-	-	-	-	2	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC517.1	1	-	-	-	-
MC517.2	2	-	2	-	-
MC517.3	-	-	2	-	-
MC517.4	-	-	2	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create ✓

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Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Introduction** Why Design? – Four Questions, Ten Tools – Principles of Design Thinking – The process of Design Thinking – How to plan a Design Thinking project	1,2	3
2	**UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM** Search field determination – Problem Clarification – Understanding of the problem – Problem Analysis – Reformulation of the problem – Observation Phase – Empathetic design – Tips for Observing – Methods for Empathetic Design – Point – of – View – Phase – Characterization of the target group – Description of customer needs.	1,2	8
3	**IDEATION AND PROTOTYPING** Ideate Phase – The creative process and creative principles – Creativity techniques – Evaluation of Ideas – Prototype Phase –Lean Start-up Method for Prototype Development – Visualization and Presentation techniques	1,2	6
4	**TESTING AND IMPLEMENTATION** Test Phase – Tips for interviews – Tips for surveys – Kano Model – Desirability Testing – How to Conduct workshop – Requirements for the space – Material requirements – Agility for Design Thinking	1.2	7
5	**FUTURE** Design Thinking meets the corporation – The New Social Contract - Design Activism – Designing Tomorrow.	1.2	4
6	**Self-Study Topics** Case Study of Airbnb, Pepsico, few case studies from Stanford University and CMU		4
		Total	**28**

Laboratory Component

Sr. No	Title of the Experiment
1.	Redesigning a Transportation System for a Smart City using stakeholder Mapping.
2.	Enhancing User Safety in a Medical Device using Usability Testing and Human Factors Analysis
3.	Designing a Sustainable Packaging Solution for a Product using Life Cycle Assessment and Material Exploration
4.	Improving Energy Efficiency in a Building using Energy Monitoring and Retrofit Analysis
5.	Creating an Autonomous Drone for Agricultural Monitoring using Rapid Prototyping and Field Testing
6.	Redesigning a Public Space for Community Engagement using Observation and Participatory Design
7.	Developing a Renewable Energy Microgrid System using System Modeling and Simulation
8.	Designing an Augmented Reality (AR) Training Tool for Industrial Maintenance using User Research and Prototyping
9.	Enhancing education system in an Urban Area using Data Analytics and Sensor Technology
10.	Creating a User-Friendly Interface for Industrial Automation Equipment using User-Centered Design and Usability Testing

Text Books:

1. Christian Mueller-Roterberg, Handbook of Design Thinking – Tips & Tools for how to design thinking, Nov..2018 ,paperback.
2. Designing for Growth: a design thinking tool kit for managers By Jeanne Liedtka and Tim Ogilvie. ,Columbia Business School publishing, 2011.
3. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown, HarperCollins e-books; 1st edition (16 September 2009)

REFERENCES:

1. Johny Schneider, "Understanding Design Thinking, Lean and Agile", O'Reilly Media, 2017.
2. Roger Martin, "The Design of Business:Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
3. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand-Improve – Apply". Springer, 2011.

WEB REFERENCES:

4. http://ajjuliani.com/design-thinking-activities/
5. https://venturewell.org/class-exercises

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	DevOps	3	0	2	4	9	4	-	-	3
		Examination Scheme								
MC520		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	Web Technology Lab
Course Objective: This course is designed to provide the core knowledge necessary to understand DevOps concepts, its principles and practices and tools.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC520.1	To understand basic concepts of DevOps
MC520.2	Install, configure & use container technologies
MC520.3	Apply testing tools for software,quality code & security testing
MC520.4	Deploy and continuous monitoring of systems

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
MC520.1	2	2	-	-	2	-	1	-	-	-	-	-
MC520.2	2	2	2	2	3	-		-	-	-	-	-
MC520.3	2	2	-	-	3	-	2	1	-	-	-	-
MC520.4	2	2	2	2	3	-	2	2	-	-	1	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC520.1	-	-	-	1	1
MC520.2	-	-	-	2	2
MC520.3	-	-	-	2	2
MC520.4	-	-	-	2	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create ✓

Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Overview of DevOps** Introduction to DevOps: Define the concept of DevOps, explain its origins, and describe its benefits and challenges., DevOps Delivery Pipeline, DevOps Ecosystem Version Control with Git –version control basics, Git fundamentals, Git for your organization, Installation of Git, Common commands in Git,	1,2	6
2	**Git, Jenkins, Ansible, SonarQube & Maven Integration** 2.1 Branching and Merging in Git,Git workflows,Git cheat sheet,CI introduction, introduction to Jenkins (With Architecture), Introduction to Maven 2.2 Continuous Integration using Jenkins Jenkins Management,Adding a slave node to Jenkins, Building Delivery Pipeline, Pipeline as a Code, SonarQube- Quality code testing, Puppet, Ansible	1,2	8
3	**Containerization with Docker** Introducing Docker, Understanding images and containers,Running Hello World in Docker,Introduction to Container,Container Life Cycle,Sharing and Copying Base Image,Docker File Working with containers	1,2	10
4	**Containerization using Kubernetes** Revisiting Kubernetes, Cluster Architecture,Spinning up a Kubernetes Cluster on Ubuntu VMs, Exploring your Cluster Understanding YAML,Creating a Deployment in Kubernetes using YAML,Creating a Service in Kubernetes,Installing Kubernetes Dashboard,Deploying an App using Dashboard,Using Rolling Updates in Kubernetes,Containers and Container Orchestration	1,2,3	6
5	**Functional Testing, Security Testing and Continuous Monitoring with Nagios** 5.1 Security Testing- Auditing,Analyzing Vulnerabilities OpenVAS, Burpsuite, OWASP-ZAP 5.2 Continuous Monitoring, Introduction to Nagios, Installing Nagios, Nagios Plugins(NRPE) and Objects, Nagios Commands and Notification	1,2	6
6	**Introduction to DevOps on Cloud** Introduction to Cloud Computing, Why DevOps on Cloud, Introduction to AWS Various	1,2	4
7	**Self-Study Topics** Microservices, virtual machine configurations using Vagrant, container configuration using Docker, container deployment/orchestration using Docker Swarm and Kubernetes, automated deployments using Terraform, continuous integration and deployment (CI/CD) using Jenkins, cloud-deployments in Amazon Web Services. Infrastructure as Code (IAC)		
		Total	**42**

Laboratory Component

Sr. No	Title of the Experiment
1	Setup Virtualization Software: Docker, Proxmox, KVM, VirtualBox, VMware
2	Version Control Basics: Create a new repository on GitHub or GitLab and practice basic version control operations like committing changes, branching, merging, and resolving conflicts. This lab can teach the basics of source code management and collaboration
3	Containerization Basics: Use Docker Compose to define a multi-container application and run it locally. This lab can teach the basics of container orchestration and networking.
4	Continuous Deployment (CD) Basics: Use a CD tool like Travis CI or CircleCI to deploy a simple application to a cloud provider like Heroku or AWS. This lab can teach the basics of automated deployment and continuous delivery
5	To perform Jenkins/Ansible/Qualitycode testing using SonarQube
6	To perform functional testing using selenium.
7	To perform Security testing using OpenVAS
8	Performance monitoring using Nagios
9	Securing & Monitoring container with Kubernetes
10	Implement zero trust architecture

Text Books:

[1] Implementing DevSecOps with Docker and Kubernetes by José Manuel Ortega Candel, BPB Publications

[2] Visualizing Google Cloud by Priyanka Vergadia, Wiley Publication

Reference Books:

[3] Kubernetes in Action (Second Edition) by Marko Luksa, Manning Publication

Web References:

https://devops.com/

Sardar Patel Institute of Technology

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	IOT and IIOT	3	-	2	4	9	3	-	1	4
		Examination Scheme								
MC523		Component	ISE		MSE		ESE		Total	
		Theory	75		75		150		300	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	
Course Objective:	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC523.1	Describe the Architectural Overview of IoT and IIOT
MC523.2	Analyze and select various IoT platforms with Security level
MC523.3	Standardize the importance of Data Analytics in IoT
MC523.4	Design IoT system based on the real time problem statement

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC523.1	2	-	-	-	-	-	-	-	-	-	-	-
MC523.2	2	-	-	-	-	-	2	-	-	-	-	-
MC523.3	2	-	-	-	-	-	-	-	-	-	-	-
MC523.4	2		2	2	-	-	2	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MC523.1	-	-	-	-	-	-	-
MC523.2	-	-	-	-	-	-	-
MC523.3	-	-	-	-	-	-	-
MC523.4	-	-	2	-	-	2	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze ✓	Evaluate	Create

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Theory Component			
Module No.	**Topics**	**Ref.**	**Hrs.**
1	**Introduction to IOT, and IIOT** Architectures of IOT and IIOT Advantages & disadvantages, Components of IIOT - Sensors, Interface, Networks, People & Process, Hype cycle, IOT Market, Trends & future Real life examples, Key terms – IOT Platform, Interfaces, API, clouds Core IoT Functional Stack, Business processes in IoT, Everything as a Service(XaaS)	**2, 3,5**	**4**
2	**Sensor and Interfacing** Introduction to sensors, Transducers, Classification, Roles of sensors in IIOT , Various types of sensors , Design of sensors, sensor architecture, special requirements for IIOT sensors, Role of actuators, types of actuators. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNet , Current, M2M etc	**2, 3**	**12**
3	**IoT layer protocols** Need of protocols; Types of Protocols, Network Layer-IPv4, IPv6, 6LoWPAN, DHCP, ICMP, Session Layer HTTP, CoAP, XMPP, AMQP, MQTT, Security in IoT Protocols – MAC 802.15.4 , 6LoWPAN, RPL	**2**	**10**
4	**Big data platform for the IOT** Big Data Platforms for the Internet of Things: network protocol- data dissemination, Improving Data and Service Interoperability with Structure, Compliance, Conformance and Context Awareness: interoperability problem in the IoT context-	**4**	**8**
5	**Security in IoT** Vulnerabilities of IOT, Security requirements, Challenges for a secure Internet of Things, Threat modeling, Threat analysis, Security Architecture, Security Model, Attacks Modeling, Security attacks, Key Elements of IOT Security	**6**	**4**
6	**Internet of Things Applications** Smart Metering, e-Health Body Area Networks, Smart Cards, City Automation, Automotive Applications, Home Automation, Plant Automation	**3**	**4**

7	**Self-Study Topics**		
	Role of IIOT in Manufacturing Processes, Wireless sensor network (WSN) and Internet of Things (IoT)**,** Business models: Saas, Paas, Iaas.**,** big-data analytics infrastructures 5.4 Secure IoT Higher Layers, Secure Communication Links in IoTs, Real life examples of IIOT in Manufacturing Sector **Business Models For The Internet Of Things:** Business Models and Business Model Innovation Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things.		
		Total	**42**

Laboratory Component

Sr. No	Title of the Experiment
1	Introduction to Programming the Arduino, Basic electronic components
2	Programs based on interfacing with LED's, Switches
3	Programs based on interfacing withAlarm sensors
4	Programs based on interfacing with Display sensors
5	Programs based on interfacing with Photo resistor
6	Programs based on interfacing with temperature sensor
7	Programs based on interfacing with Passive infrared sensors (PIR), Ultrasonic sensors
8	Programs based on interfacing Potentiometer, servo motors
9	Interfacing IoT device with Cloud using mobile phone demonstrating MQTT protocol
10	Mini projects such as Home automation, Robots, Wearable projects, art projects etc

Text Books

[1] Daniel minoli "*Building the Internet of Things with Ipv6 and Mipv6*" ISBN No. 978-1-118-47347-4, WILEY

[2] "*Enterprise IoT*" Grayscale edition O'REILLY

[3] Arshdeep Bahga, Vijay Madisetti, "*Internet of Things A hands-on approach*" Universities Press 2015

Reference Books :

[4] Stackowiak, R., Licht, A., Mantha, V., Nagode, L "*Big Data and The Internet of Things Enterprise Information Architecture for A New Age*" Apress 2015

[5] David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry "*IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things*" Cisco Press 2017

[6] Fei Hu "*Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations* " Kindle

[7] Olivier Hersent, David Boswarthick, Omar Elloumi, "*The Internet of Things: Key Applications and Protocols*" ISBN: 978-1-119-99435-0, Second edition Willy Publications

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Cloud Computing	3	-	2	4	9	3	-	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
MC524		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective: To have a comprehensive understanding of Cloud computing.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC524.1	Illustrate fundamentals of Cloud Computing.
MC524.2	Analyze different virtualization techniques and their role in enabling the cloud computing system model.
MC524.3	Categorize various Cloud architecture and Infrastructure.
MC524.4	Analyze security issues and synchronization protocols of cloud.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC524.1	1	-		3	2	-	-	-	-	-	-	-
MC524.2	1	-	2	-	2	-	-	-	-	-	-	-
MC524.3	-	2	1	-	2	-	-	-	-	-	-	-
MC524.4	2	-	1	1	3	-	-	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC524.1	2	-	-	-	2
MC524.2	2	-	-	-	2
MC524.3	2	-	-	-	2
MC524.4	2	-	-	-	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze✓	Evaluate	Create

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Theory Component			
Module No.	**Topics**	**Ref.**	**Hrs.**
1	**Introduction to Cloud Computing** Trends in computing - Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing Defining a Cloud ,Vision of Cloud,Cloud Computing Reference Model, Characteristics and benefits ,Challenges of Cloud	**1,2,3**	**7**
2	**Virtualization in Cloud** Introduction & benefit of Virtualization, Implementation Levels of Virtualization, Types: Full and para virtualization Taxonomy of virtualization techniques - Execution Virtualization, Virtualization and cloud computing, Pros and cons of virtualization	**1,2,3**	**6**
3	**Cloud Architecture** Cloud Types: Private Cloud, Public cloud,Hybrid cloud, community cloud. Cloud as a service : Infrastructure as a service, Platform as a service, Software as a service,Xaas	**1,2**	**4**
4	**Cloud Security** Identity and access management, security challenges, Storage basics, Storage as a service providers, aspects of data security AAA model, SSO model,Threat Agents - Anonymous Attacker, Malicious Service Agent, Trusted Attacker, Malicious Insider Cloud Security Threats - Traffic Eavesdropping, Malicious Intermediary, Denial of Service, Insufficient Authorization, Virtualization Attack, Overlapping Trust Boundaries, Common Attacks, Cloud-Specific Attacks,Flawed Implementations, Risk Management	**2,4**	**8**
5	**Cloud Infrastructure Mechanisms** Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication Ready-Made Environment. Specialized Cloud Mechanisms - Automated Scaling Listener, Load Balancer, SLA Monitor, Pay-Per-Use Monitor Monitor, Pay-Per-Use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, MultiDevice Broker, State Management Database.Types of Data Center – Enterprise Data Centers; managed ServicesData Centers; Colocation; Cloud Data CentersDesign consideration for Private Cloud (Enterprise Data Centers),On Premise vs. Cloud propositions	**1,2**	**10**
6	**Synchronization in cloud environment** Clock synchronization protocols in cloud data centers, Leader Election protocols in cloud ,Gossip Protocols and its types	**3**	**7**
7	**Self-study Topics** Economics of Cloud ,Challenges in Cloud, Fog Computing, Edge Computing, Mobile Cloud Computing ,Business Transformation with Google Cloud Superpowers of Cloud	**1,2**	
	Total		**42**

Laboratory Component

Sr. No	Title of the Experiment
1	Study and implementation of Infrastructure as a Service.
2	Implementation of identity management.
3	Study and installation of Storage as Service.
4	User Management in Cloud.
5	Study and implementation of Single-Sign-On
6	Study of containerization tool
7	Analyze various Clock synchronization
8	Analyze various mutual exclusion algorithm
9	Analyze various Election Algorithms.
10	Case study :Google/Ms Azure/Amazon

Textbooks:

[1] RajkumarBuyya, Christian Vecchiola, "*Mastering Cloud Computing Foundations and Applications Programming*", Morgan Kaufmann, 2nd Edition, 2013.

[2] Thomas Erl, Zaigham Mahood, Ricardo Puttini, "*Cloud Computing, Concept, Technology and Architecture*", Prentice Hall, 1st Edition, 2013.

Reference Books:

[3] Rajiv Mishra, Yashwant Singh Patel, "*Cloud and Distributed Algorithms and systems*", Wiley publications, 1st edition 2020.

[4] Zaigham Mahmood, "*Cloud Computing - Challenges, Limitations and R&D Solutions*", Springer International Publishing,1st edition,2014.

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Artificial Intelligence and Soft Computing	3	0	2	4	9	3	-	1	4
MC525		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
		Theory	75		75		150		300	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	
Course Objective: To learn fundamentals of Data Structures.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC525.1	To conceptualize the basic ideas and techniques of AI and SC.
MC525.2	Identify and describe Fuzzy Logic techniques in building intelligent machines
MC525.3	Identify and describe Artificial Neural Network techniques to solve real time problems
MC525.4	To familiarize with Hybrid systems and to build expert system.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC525.1	3	3	-	-	-	-	-	-	1	-	2	-
MC525.2	3	3	-	-	-	-	-	-	1	-	2	-
MC525.3	-	-	-	3	-	-	-	-	1	-	2	-
MC525.4	-	3	-	-	-	-	-	-	1	-	2	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC525.1	3	1	-	-	1
MC525.2	3	1	-	-	1
MC525.3	3	1	-	-	-
MC525.4	3	1	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Artificial Intelligence(AI) and Soft Computing**		05
	1.1	Introduction and Definition of Artificial Intelligence.		
	1.2	Intelligent Agents : Agents and Environments ,Rationality, Nature of Environment, Structure of Agent		
	1.3	Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques.		
2		**Problem Solving**		05
	2.1	Problem Solving Agent, Formulating Problems, Example Problems		
	2.2	Uninformed Search Methods: Depth Limited Search, Depth First Iterative Deepening (DFID)		
	2.3	Informed Search Method: A* Search		
3		**Fuzzy Logic**		06
	3.1	Introduction to Fuzzy Logic: Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, membership functions, Fuzzy Reasoning.		
	3.2	Fuzzy inference systems: Mamdani FIS and Sugeno FIS, fuzzy decision making & Applications of fuzzy logic		
	3.3	Fuzzy System Design: Fuzzification, defuzzification and Fuzzy controllers.		
4		**Artificial Neural Network**		10
	4.1	Introduction – Fundamental concept– Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron, Activation Functions		
	4.2	Supervised Learning algorithms: Perceptron SLP, MLP, Delta learning rule, Back Propagation algorithm.		
	4.3	Un-Supervised Learning algorithms: Hebbian Learning, KSOFM, LVQ		
5		**Hybrid Approaches and Expert System**		6
	5.1	Neuro Fuzzy System,		
	5.2	Expert system : Introduction, Characteristics, Architecture, Stages in the development of expert system,		
		Total		42

Laboratory Component

Sr. No	Title of the Experiment
1	Study of Prolog programming lang for simple real time problems like temperature conversion, Monkey banana problem, fibonaci series.
2	Design ANN to implement logic gates.
3	Implement SLP Create a perceptron with an appropriate number of inputs and outputs. Train it using a fixed increment learning algorithm until no change in weights is required. Output the final weights
4	Implement MLP Write a program to implement artificial neural networks without back propagation. Write a program to implement artificial neural networks with back propagation.
5	Hebb's rule and Delta Rule for a given problem statement
6	Operations on fuzzy Sets: Implement Union, Intersection, Complement and Difference operations on fuzzy sets.
7	Operations on Fuzzy Relations: Implement Max-min, max-product composition
8	Design of Fuzzy Logic controller for a given problem statement
9 -10	Mini Project on : Hybrid system

Text Books:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach "Second Edition" Pearson Education.
2. Samir Roy and Chakraborty, "Introduction to soft computing", Pearson Edition.
3. Timothy J.Ross "Fuzzy Logic With Engineering Applications" Wiley.
4. S. N. Sivanandam, S. N. Deepa "Principles of Soft Computing" Second Edition, Wiley Publication.
5. S. Rajasekaran and G. A. Vijayalakshmi Pai "Neural Networks, Fuzzy Logic and Genetic Algorithms" PHI Learning.
6. Jacek M. Zurada "Introduction to Artificial Neural Sytems" Jaico Publishing House.

Reference Books:

1. Elaine Rich and Kevin Knight "Artificial Intelligence" Third Edition, Tata McGraw-Hill Education Pvt. Ltd., 2008.
2. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press.
3. Satish Kumar "Neural Networks A Classroom Approach" Tata McGrawHill.
4. Zimmermann H.S "Fuzzy Set Theory and its Applications"Kluwer Academic Publishers.
5. Hagan, Demuth, Beale,"Neural Network Design" CENGAGE Learning, India Edition.
6. J.-S.R.Jang "Neuro-Fuzzy and Soft Computing" PHI 2003.

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PE)	Cyber Security	3	0	2	4	9	3	0	1	4
		Examination Scheme								
MC526		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective: To give insights to students about cyber crimes , importance of cyber security ,laws for various crimes and forensics to analyze the given scenario.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC526.1	Analyze the issues and challenges in cybercrimes and cyber offenses.
MC526.2	Explain the methods used in cybercrimes and its countermeasures.
MC526.3	Analyze the Cyber Laws which are used against cybercrimes and cyber criminals.
MC526.4	Explain the basics of computer forensics.
MC526.5	Analyze the forensics of hand-held devices.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC526.1	-	3	-	-	-	-	-	-	-	-	-	-
MC526.2	-	-	-	3	3	-	-	-	-	-	-	-
MC526.3	-	2	-	-	-	-	-	-	-	-	-	-
MC526.4	2	-	-	2	-	-	-	-	-	-	-	-
MC526.5	-	-	-	3	3	-	-	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC526.1	1	-	-	-	1
MC526.2	-	-	2	-	2
MC526.3	1	-	-	1	-
MC526.4	1	-	-	-	1
MC526.5	-	-	2	-	2

BLOOM'S Levels Targeted

Remember	Understand	Apply	Analyze ✓	Evaluate ✓	Create ✓

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Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Cyber offenses & Cybercrime: Issues and challenges**	1,2	8
	1.1	Cybercrime definition and origins of the world		
	1.2	Classifications of cybercrime		
	1.3	How criminals plan the attacks, Social Engineering		
	1.4	Cyber stalking, Botnets,		
	1.5	Attack vector, Cloud computing		
	1.6	Credit Card Frauds in Mobile and Wireless Computing Era		
	1.7	Attacks on Mobile/Cell Phones		
	1.8	Web Treats for Organizations: The Evils and Perils		
	1.9	Best practices with social media marketing tools		
2	Title	**Tools and Methods Used in Cybercrime**	1,2	10
	2.1	Proxy Servers and Anonymizers		
	2.2	Password Cracking		
	2.3	Keyloggers and Spywares		
	2.4	Virus and Worms		
	2.5	Steganography		
	2.6	DoS, DDoS Attacks		
	2.7	SQL Injection		
	2.8	Buffer Overflow		
	2.9	Attacks on Wireless Networks		
	2.10	Phishing (Methods, Techniques, Countermeasures)		
	2.11	Identity Theft (Types, Techniques, Countermeasures)		
	2.12	Vulnerability Assessment and Penetration Testing (VAPT)		
3	Title	**Cyber Laws : ITA, Security Standards and International Laws.**	1,2	8
	3.1	The Legal Perspectives Why do we need Cyber law: The Indian Context		
	3.2	Positive and Weak areas of ITA 2000		
	3.3	Information Security Standard compliances: SOX, GLBA, HIPAA, ISO.		
	3.4	International Laws: E-Sign, CIPA and COPPA		
4	Title	**Understanding Computer Forensics**	1,2	10
	4.1	Historical background of cyber forensic		
	4.2	Need for computer forensic		
	4.3	Cyber forensic and Digital Evidence, Forensic Analysis of E-mail		
	4.4	Digital Forensic life cycle.		

	4.5	Chain of custody, network forensic		
	4.6	Approaching a forensic Investigation		
	4.7	Computer Forensic and Steganography		
	4.8	Relevance of OSI 7 layer model to computer forensic		
	4.9	Forensic and social networking sites: The security/ privacy threats		
5	**Title**	**Forensics of Hand-held devices**	1,2	**6**
	5.1	Mobile Phone Forensics, Printer and scanner forensics, Smartphone.		
	5.2	Challenges in Forensics of Digital Images and Still Camera.		
	5.3	Toolkits for Hand-Held Device Forensics (EnCase,Forensic card reader, MOBILedit)		
	5.4	Organizational Guidelines on Cell Phone Forensics.		
6	**Self-Study**	1.10 Ransomware 2.12 Credit card and debit card security Social Media Security Mobile banking security Digital infrastructure security Security Risk Assessment and Risk Analysis		
			Total	**42**

Laboratory Component

Sr. No	Title of the Experiment
1	Demonstrate password cracking tools
2	Performing SQL injection and suggest its countermeasures. A. Manual SQL Injection, John the Ripper. B. Automate SQL Injection with Sql Map.
3	Demonstrate Proxy Server
4	Demonstrate Social Engineering attack and suggest its countermeasures.
5	Implement Key logger software and suggest its countermeasures.
6	Implement steganography and suggest its countermeasures.
7	Demonstrate email spoofing and phishing attack and suggest its countermeasures.
8	Part 1:Demonstrate Cloning and imaging using commands Part 2: Demonstrate EnCase forensic toolkit
9	Demonstrate MobileEdit forensic toolkit
10	Demonstrate and analyze Email forensics

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives	ISBN: 9788126521791	Nina Godbole, Sunit Belapure	Wiley India	2012
2	Cybersecurity: The Essential Body of Knowledge	-	Dan Shoemaker, William Arthur Conklin, Wm Arthur Conklin	Cengage Learning	2011

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
3	Digital Forensics with open source tools	-	Cory Altheide and Harlan Carvey	Elsevier Publications	2011
4	Cyber Security	First Edition	Edward Amoroso	Silicon Press	2007
5	Information Systems Security	-	Nina Godbole	Wiley India	2008

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Block Chain Technology	3	-	2	4	9	3	-	1	4
		Examination Scheme								
MC527		Component	ISE		MSE		ESE		Total	
		Theory	75		75		150		300	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	
Course Objective: To give insights to students about blockchain and its various technologies to gain knowledge	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC527.1	Explain the basics of Block chain
MC527.2	Analyze various block chain Technology
MC527.3	Demonstrate the working of Bitcoin and Ethereum
MC527.4	Explain the basic of Multichain technology
MC527.5	Explain the use of IoT in block chain

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
MC527.1	3	-	-	-	-	-	-	-	-	-	-	-
MC527.2	-	2	-	1	-	-	-	-	-	-	-	-
MC527.3	-	-	2	-	3	-	1	-	-	-	-	-
MC527.4	2	1	-	-	-	-	-	-	-	-	-	-
MC527.5	3	-	-	-	-	-	1	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MC527.1	-	-	-	-	-	-	-
MC527.2	-	-	-	-	-	-	-
MC527.3	-	-	-	-	-	-	3
MC527.4	-	-	-	-	-	-	-
MC527.5	-	-	-	-	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand ✓	Apply	Analyze ✓	Evaluate	Create ✓

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Theory Component			
Module No.	**Topics**	**Ref.**	**Hrs**
1	**Introduction** Blockchain Basic , Four Core building blocks of blockchain, , Life cycle of Blockchain, Blockchain working, Difference between blockchain and databases, Centralized, De-Centralized and Distributed system, Distributed Ledger Technology, Blockchain ecosystem and structure, Features of Blockchain, Advantages of Blockchain.	**1,2**	**7**
2	**Blockchain Technology** Generation and evolution of Blockchain, Blockchain Solutions beyond Finance, Types of Blockchain Technology, Difference between public blockchain and private blockchain, Blockchain characteristics comparison, Blockchain requirement flowchart, Consensus Algorithm: introduction and objectives, Types of Consensus Algorithm: Proof of Work and Proof of Stake, Comparison between POW and POS, Blockchain Wallets introduction	**1,2**	**9**
3	**Bitcoin and Ethereum** History of Cryptocurrency, Cryptography in blockchain, Hash Functions, SHA hash Function, Merkle Tree, Digital Signatures, How does bitcoin transaction works, Bitcoin improvement Proposal (BIP) introduction, Types of BIP, BIP Lifecycle, Introduction to ethereum, Ethereum Technology Stack, Advantages and Drawbacks of ethereum, Smart Contract, ether, solidity.	**1,2**	**10**
4	**Introduction to Multichain** Multichain helping enterprise in blockchain, Multichain development timeline, Bitcoin to private blockchain, Aim of Multichain, The Handshaking Process, Use Cases of Multichain, Multichain permissions, Multichain assets, Multichain streams, Mining in multichain Technology and its flexibility, Security, speed and scalability in Multichain.	**1,2**	**9**
5	**IoT in Blockchain** Introduction to IoT, IoT Schematic Diagram, Challenges in IoT devices, Benefits of using Blockchain with IoT, Use Cases of blockchain IoT connected devices(Automotive industry ,Smart Vehicle monitoring system)	**1,2**	**7**
6	**Self-Study Topics** Use Cases Of Blockchain Technology: ● Blockchain in Supply Chain ● Blockchain in Manufacturing ● Blockchain in Automobiles		

	• Blockchain in Healthcare • Blockchain in Cyber security • Blockchain in Financial Industry Use Cases of blockchain IoT connected decives: • Agri-food supply chain management • Smart Environmental Monitoring • Smart Waste Management system • Smart Street Lightening		
		Total	**42**

Laboratory Component

Sr. No	Title of the Experiment
1	Demonstrating secret key cryptography techniques
2	Demonstrating public key cryptography techniques
3	Demonstrating Hashing Techniques (SHA and MD5)
4	Demonstrate the working of the Merkle tree.
5	Implementing basic program using solidity
6	Implementing calculator using solidity
7	Implementing and demonstrating smart contract
8	Demonstrating Tokens in ethereum
9	Working with Web3.js in ethereum
10	Case study on bitcoin

Text Books :

[1] Tiana Laurence,"*Blockchain For Dummies*",First Edition,John Wiley & Sons, Inc,2017.

[2] Mark Gates,"*Blockchain :Ultimate guide to understanding blockchain, bitcoin, cryptocurrencies smart contracts and the future of money*", First Edition,Wise Fox Publishing and Mark Gates ,2017.

Reference Books :

[3] Joseph J. Bambara Paul R. Allen,"*Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions*", McGraw-Hill Education,2018.

[4] Ritesh Modi,"*Solidity Programming*",Packt Publishing,2018.

[5] Mayukh Mokhopadhyay,"*Ethereum Smart Contract Development*", Packt Publishing,2018

Web References

[6] https://ethereum.org/en/

[7] https://web3js.readthedocs.io/en/v1.2.9/

[8] https://studio.ethereum.org/

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Data Warehousing and Mining	3	-	2	4	9	3	-	1	4
		Examination Scheme								
MC528		Component	ISE		MSE		ESE		Total	
		Theory	75		75		150		300	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	DBMS, Mathematics
Course Objective:	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC528.1	Identify the scope and essentiality of Data Warehousing and Mining.
MC528.2	Compare different data mining techniques like classification, prediction, clustering and association rule mining
MC528.3	Build Data ware house for real time problems
MC528.4	Identify appropriate data mining algorithms 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	PO 10	PO 11	PO 12
MC528.1	-	2	-	-	-	-	-	-	-	-	-	-
MC528.2	2	-	2	-	-	-	-	-	-	-	-	-
MC528.3	-	-	-	2	-	-	-	-	-	2	-	-
MC528.4	-	-	-	2	2	-	2	-	-	2	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC528.1	2	-	-	2	-
MC528.2	2	-	-	2	-
MC528.3	2	-	-	-	2
MC528.4	2	-	-	-	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate ✓	Create

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Theory Component			
Module No.	**Topics**	**Ref.**	**Hrs.**
1	**Basic Concepts of Data Warehousing** Introduction to Data WareHouse, Differences between operational database systems and data WareHouse, Data WareHouse characteristics, Data WareHouse Architecture and its components, Extraction-Transformation-Loading, Logical (Multi-Dimensional), Data Modeling	**3, 4**	**8**
2	**Data Warehouse and OLAP Technology for Data Mining** Schema Design, star and snow-Flake Schema, Fact Constellation, Fact Table, Fully Addictive, Semi-Addictive, Non-Addictive Measures, Dimension Table characteristics; Fact-Less-Facts, Dimension Table characteristics, OLAP cube, OLAP Operations, OLAP Server Architecture-ROLAP, MOLAP and HOLAP	**1, 2**	**8**
3	**Introduction to Data Mining** Data Mining, Definition, KDD, Challenges, Data Mining Tasks Data Preprocessing- Data Cleaning, Missing Data Dimensionality Reduction, Feature Subset Selection, Discretization and Binarization, Data Transformation; Measures of similarity and dissimilarity-Basics	**1,2**	**8**
4	**Association Rules** Problem Definition, Frequent Item Set Generation, The APRIORI Principle, Support and Confidence Measures, Association Rule Generation, APRIORI Algorithm, The Partition Algorithms, FP-Growth Algorithms, Compact Representation of Frequent Item Set-Maximal Frequent Item Set, Closed Frequent Item Set	**2**	**6**
5	**Classification** Problem definition, General Approaches to solving a classification problem, Evaluation of Classifiers, Classification techniques, Decision trees-Decision Tree Construction, Methods for expressing attribute test conditions, Algorithm for Decision tree Induction, Naïve-Bayes Classifier, K-nearest neighbor classification-Algorithm and characteristics	**2**	**6**
6	**Clustering** Problem Definition, Clustering overview, Evaluation of clustering algorithms, Partitioning clustering K-Means Algorithm, K-Means Additional Issues, PAM Algorithm, Hierarchical Clustering-Algorithm-Agglomerative Methods and Divisive Methods, Key Issues in Hierarchical Clustering, Outlier Detection	**2**	**6**

7	**Self-Study Topics** Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Modeling for Data Mining, general principles including model scoring, search and optimization, Advanced Apriori algorithm, Measures for Selecting the Best split, Bayesian Belief Networks, Basic Agglomerative Hierarchical Clustering Algorithm, Multimedia Data Mining, Text Mining, Spatial Data Mining, Data Mining Applications, Data Mining System Products and Research Prototypes,.		
Total			**42**

Laboratory Component

Sr. No	Title of the Experiment
1	**Design Data ware house :** Build a simple DW using SQL queries, Design multi-dimensional data models namely Star, Snowflake and Fact Constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, manufacturing, Automobiles, sales etc). Write ETL scripts and implement using data warehouse tools.
2	**Build Data Warehouse – Part 1:** Setting Up and Starting Warehouse Builder, Defining Source Metadata, Ensuring Data Quality Using Data Profiling
3	**Build Data Warehouse – Part II:** Defining Staging Metadata and Mapping Tables, Deriving Data Rules and Running Correction Mappings, Defining a Relational Dimensional Model, Handling Slowly Changing Dimensions
4	**Study of OLAP:** OLAP operations such slice, dice, roll up, drill up and pivot, Analytical Queries, Grouping Functions, Windowing Functions, RollUp and Cube
5	Open source tool for study of Association Rules
6	Open source tool for study of Classification Models
7	Open source tool for study of Regression Models
8	Open source tool for study of Clustering Models
9	ETL working with open source tool
10	Dimensional modelling tool working
11	Beyond the Syllabus -Simple Project on Data Preprocessing

Text Books

[1] Jiawei Han, Micheline Kamber, Morgan Kaufmann "*Data Mining-Concepts and Techniques*" Second Edition Elsevier 2006

[2] Ning Tan, Vipin Kumar, Michael Steinbanch "*Introduction to Data Mining*", Pang Pearson Education.

Reference Books

[3] Paulraj Ponnaiah "*Data Warehousing Fundamentals*" Student Edition Wiley

[4] Arun K Pujari "*Data Mining Techniques*" Universities Press Second Edition 2015

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Computer Graphics	3	-	2	4	9	3	-	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
MC529		Theory	75		75		150		300	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	Linear Algebra
Course Objective: To give students knowledge about the basics of graphics, its operations and applications which they can apply in real world problems.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC529.1	Apply output primitive algorithms on a given scenario
MC529.2	Apply 2D geometric transformation functions and clipping algorithms.
MC529.3	Apply basics of 3D concepts and Fractals.
MC529.4	Apply image processing techniques in a given scenario

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC529.1	2	1	-	-	2	-	-	-	-	-	-	-
MC529.2	2	2	-	-	3	-	-	-	-	-	-	-
MC529.3	-	3	-	2	-	-	-	-	-	-	-	-
MC529.4	-	-	2	-	3	-	-	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC529.1	-	-	-	-	2
MC529.2	-	-	-	-	2
MC529.3	-	-	-	-	-
MC529.4	-	-	-	-	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create

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Theory Component			
Module No.	**Topics**	**Ref.**	**Hrs.**
1	**Introduction** Introduction to Computer Graphics, Elements of Computer Graphics, Graphics display systems.	**1,2**	**2**
2	**Output primitives & its Algorithms** Points and Lines, Line Drawing algorithms: DDA line drawing algorithm, Bresenham‟s drawing algorithm, Circle and Ellipse generating algorithms :Mid-point Circle algorithm ,Mid-point Ellipse algorithm, Parametric Cubic Curves :Bezier curves Fill area algorithms: Scan line polygon fill algorithm ,Inside-Outside Tests, Boundary fill algorithms, Flood fill algorithms	**1,2**	**10**
3	**2D Geometric Transformations & Clipping** Basic transformations, Matrix representation and Homogeneous Coordinates, Composite transformation, shear & reflection. Transformation between coordinate systems, Window to Viewport coordinate transformation, Clipping operations – Point clipping, Line clipping : Cohen – Sutherland line clipping, Midpoint subdivision, Polygon Clipping: Sutherland – Hodgeman polygon clipping,Weiler – Atherton polygon clipping	**1,2**	**11**
4	**Basic 3D Concepts & Fractals** 3D object representation methods: B-REP Fractals, Sweep representations, CSG, Basic transformations, Reflection, shear, Projections – Parallel and Perspective Halftone and Dithering technique, Self-similarity: Koch Curves/snowflake, Sirpenski Triangle	**1,2**	**8**
5	**Introduction to Image Processing and image enhancement** Fundamental Steps in Digital Image Processing ,Components of an Image Processing System, Some Basic Intensity, Transformation Functions: Image Negatives, Log Transformations, and Power Law Transformations, Piecewise Linear Transformation Functions: Contrast stretching, Gray-level slicing, Bit plane slicing, Introduction to Histogram, Image Histogram and Histogram, Equalization, Image Subtraction, and Image Averaging	**3**	**11**
6	**Self-Study Topics** Color and shading models, Ray tracing		
		Total	**42**

Laboratory Component

Sr. No	Title of the Experiment
1	Implement Line drawing algorithms
2	Implement Mid-point circle algorithm
3	Implement boundary fill algorithm
4	Implement flood fill algorithm
5	Implement transformation, shear and reflection in a given scenario.
6	Implement Sutherland line clipping algorithm
7	Implement Sutherland – Hodgeman polygon clipping algorithm
8	Implement Koch Curves in a given scenario
9	Implement basic intensity transformation function on an image
10	Implement Histogram on an image

Text Books:

[1] Donald Hearn and M Pauline Baker,"*Computer Graphics C Version*", Second edition, Pearson Education,2012.

[2] David F. Rogers, James Alan Adams,"*Mathematical elements for computer graphics*", Second edition, McGraw-Hill,2011.

[3] Rafael C. Gonzalez and Richard E. Woods,"*Digital Image Processing*", Third Edition, Pearson Education,2009.

Reference Books:

[4] S. Sridhar, "*Digital image Processing*", Second Edition, Oxford University Press,2011.

[5] Zhigang Xiang, Roy.A. Plastock, "*Schaum's outline of theory and problems of computer graphics*", Second Edition, McGraw-Hill,2000.

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Ethical Hacking	3	-	2	4	9	3	-	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
MC530		Theory	75		75		150		300	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	
Course Objective: To give students the knowledge about ethical hacking,its techniques and the countermeasures to prevent themselves from any kind of attacks.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC530.1	Explain the basics of ethical hacking.
MC530.2	Analyze various types of attacks in ethical hacking.
MC530.3	Explain hijacking techniques and its countermeasures.
MC530.4	Analyze network and Web attacks and its countermeasures
MC530.5	Explain mobile and wireless attacks and its countermeasures.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC530.1	3	-	-	-	-	-	-	-	-	-	-	-
MC530.2	-	2	-	2	3	-	1	-	-	-	-	-
MC530.3	2	-	-	2	2	-	1	-	-	-	-	-
MC530.4	1	-	-	2	2	-	1	-	-	-	-	-
MC530.5	1	-	-	1	2	-	1	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC530.1	-	-	-	-	-
MC530.2	-	-	-	-	2
MC530.3	-	-	-	-	1
MC530.4	-	-	-	-	1
MC530.5	-	-	-	-	1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze ✓	Evaluate ✓	Create ✓

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Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Introduction to Ethical Hacking** Basics of Ethical Hacking, White, Grey, Black hat hackers, Various types of footprinting, footprinting tools, and countermeasures, Network scanning techniques and scanning countermeasures, Enumeration, System Hacking	1,3	8
2	**Various types of attacks** Malware Threats, Packet sniffing techniques and how to defend against sniffing, Social Engineering techniques and social engineering countermeasures, Identify theft, DoS/DDoS attack techniques, , DDoS attack tools, and DoS/DDoS countermeasures Botnets	1,3	9
3	**Hijacking and Hacking** Session Hijacking introduction, Session hijacking techniques and countermeasures, Different types of web server attacks, Web server attack methodology, Web server countermeasures	1,3	8
4	**Wireless and SQL injection attack** Working of viruses , Virus analysis, Malware analysis procedure, Computer worms, Countermeasures, SQL Injection attacks and detection tools, Firewall : Introduction and Configuration	1,3	9
5	**Mobile and Network attack** Hacking Mobile Platforms, Wireless Encryption , Wireless hacking methodology, IDS and honeypot evasion techniques, Evasion tools, Countermeasures	1,3	8
6	**Self-Study Topics** Hacking Web Applications, Wireless hacking tools, Wi-Fi security tools, Various cloud computing concepts, threats, attacks, and security techniques and tools, Cryptography attacks and cryptanalysis tools		
		Total	**42**

Laboratory Component

Sr. No	Title of the Experiment
1	Demonstrating Network Scanning Tools (nmap,netstat,nessus)
2	Demonstrating Enumeration tools (Metasploit,Hydra)
3	Demonstrating Packet sniffing tools (wireshark, tcpdump)
4	Demonstrating Social Engineering Toolkit
5	Demonstrating DOS and DDOS tools
6	Demonstrating SQL injection tools
7	Demonstrating Web Application Hacking (XSS and CSRF)
8	Demonstrating Mobile Hacking techniques
9	Demonstrating wireless Hacking Techniques
10	Demonstrating snort and firewall configuration

Text Books :

[1] Patrick Engebretson,"*The Basics of hacking and penetration testing*", First Edition, Syngress Press, 2011.
[2] Dafydd Stuttard, Marcus Pinto," *The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws*", Second Edition, Wiley Publication, 2011.
[3] Jon Erickson," *Hacking: the art of exploitation* ",Second edition, No Starch Press, Inc.,2008.
[4] Rafay baloch," *Ethical hacking and penetration testing guide*", First Edition, CRC press,2015.

Web References:

[5] https://www.kali.org/
[6] https://www.social-engineer.org/framework/se-tools/computer-based/social-engineer-toolkit-set/
[7] https://owasp.org/
[8] https://portswigger.net/research

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
SBC	Mobile Programming Lab	-	-	4	4	8	-	-	2	2
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
MC509		Theory		--		--		--		--
		Laboratory		100		--		100		200

Pre-requisite Course Codes, if any.	Object Oriented Programming concepts
Course Objective: To provide students with good knowledge and training about ionic framework along with databases using firebase and node.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC509.1	Install the ionic framework with all the dependencies
MC509.2	Create apps using the components of ionic framework and SASS stylesheet
MC509.3	Create apps using API's of ionic framework
MC509.4	Create apps with backend connectivity

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
MC509.1	-	-	-	-	3	-	2	-	-	-	-	-
MC509.2	-	-	2	-	3	-	1	-	-	-	-	-
MC509.3	-	-	2	-	3	-	1	-	-	-	-	-
MC509.4	-	-	2	-	3	-	1	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC509.1	-	-	-	-	1
MC509.2	-	-	-	-	3
MC509.3	-	-	-	-	3
MC509.4	-	-	-	-	3

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create ✓

Laboratory Component

Sr. No	Experiment Details	Ref.
1	To install ionic and its development environment and run the basic default application to understand the files used.	**3**
2	To create an Museum app using basic UI components and SASS [Syntactically awesome style-sheet]	**3**
3	Create an app for MCA department using Tabs Navigation.	**3**
4	Create an app to upload, download and view pdf in an image.	**5**
5	Create SPIT app using side navigation drawer and Tabs navigation.	**5**
6	Create an app for children to study numbers and alphabets.	**5**
7	Develop Camera and Calendar API integrated in one app.	**5**
8	Implement HTTP request and response (REST API) to update and retrieve data in JSON File.	**5**
9	Create an app to store student information using firebase as database	**5**
10	Create an app for feedback of students along with the ratings and store and retrieve from firebase.	**5**

Textbooks:

[1] Arvind Ravulavaru, "*Learning Ionic*", Second Edition, ISBN: 9781786466051, Packt Publishing,2017.

[2] Chris Griffith ," *Mobile App Development with Ionic, Revised Edition: Cross-Platform Apps with Ionic, Angular, and Cordova*", 1st Edition, O'Reilly Media, Inc, 2017.

[3] Rodrigo Branas, Chandermani Arora, Et al, "*Angular JS: Maintaining web applications*", Packt Publications, 2016.

References:

[4] Andreas Dormann, "*Ionic 5: Create awesome apps for iOS, Android, Desktop and Web*", First Edition, D&D Verlag, Germany,2020.

Web Reference:

[5] https://ionicframework.com/

[6] https://ionicframework.com/docs/angular/your-first-app

[7] https://sass-lang.com/

[8] https://nodejs.org/en/

[9] https://angular.io/

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
SBC	Communication & Presentation Skills	1	-	2	2	5	1	-	1	2
AS502		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
		Theory	100		--		--		100	
		Laboratory	100		--		--		100	

Pre-requisite Course Codes, if any.	
Course Objective:	
Course Outcomes (CO): ***At the End of the course students will be able to***	
AS502.1	Demonstrate persuasive skills in interviews
AS502.2	Demonstrate creative and critical thinking in Group Discussions
AS502.3	Explain research, analysis and presentation skills
AS502.4	Apply data transformation skills

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
AS502.1	-	-	-	-	-	3	2	-	3	-	1	-
AS502.2	-	-	-	-	-	3	2	-	3	-	1	-
AS502.3	-	-	-	-	-	3	2	-	3	-	1	-
AS502.4	-	-	-	-	-	3	2	-	3	-	1	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
AS502.1	-	3	-	-	-
AS502.2	-	3	-	-	-
AS502.3	-	3	-	-	-
AS502.4	-	3	-	-	-

BLOOM'S Levels Targeted (Pl. appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create

Theory Component

Module No.	Topics	Ref.	L Hrs.	P Hrs
1	**Persuasive Skills in Interviews**	1,2	4	8
	Persuasion using facial expressions, gestures, body language Persuasion using voice, verbal style, verbal content ,Interview skills			
2	**Creative and Critical Thinking**	1,2	3	6
	Different Perspectives to a situation, Group Discussion Skills , Picture based group discussions			
3	**Research, Analysis and Presentation Skills**	1,2	3	6
	What is research? Types of research, Citation styles – a glimpse, Basic Literature Review and Presentation			
4	**Data Transformation**	1,2	2	4
	Graphics to Paragraphs and vice versa, Oral interpretation of graphics, Research Paper, News Analysis			

List of ISEs

Sr. No	Title of the Experiment	Marks
1	Mock Interview	20
2	Group Discussion	20
3	Presentation	20
4	Quiz – Citation Styles	10
5	Data Transformation	20
6	Oral Interpretation of Graphics	10
	Total	100

Text Books:

[1] John Hayes, "*Interpersonal Skills at Work*", McGraw Hill Education, 2002.
[2] Ankur Malhotra, "*Campus Placement: A Comprehensive Guide*", McGraw Hill Education, 2016.

Reference Books:

[3] Alan Alda, "*If I Understood You, Would I Have This Look on My Face? My Adventures in the Art and Science of Relating and Communicating*", Random House, 2017.
[4] Harry Chambers," *Effective Communication Skills for Scientific and Technical Professionals*", Paperback Basic Books, 2000.
[5] William Issac, "*The Art of Writing Together*", Crown Business, 2008.
[6] Meenakshi Raman, Sangeeta Sharma," *Communication Skills*", Oxford, India, 2011.

Sardar Patel Institute of Technology

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Operating System	3	-	-	4	7	3	-	-	3
MC510		Examination Scheme								
		Component			ISE		MSE	ESE		Total
		Theory			75		75	150		300
		Laboratory			-		--	-		-

Pre-requisite Course Codes, if any.	
Course Objective: The course will cover an introduction on the policies for scheduling, synchronization, deadlocks, memory, filesystems and storage management.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MC510.1	Explain fundamentals of operating system design and system software
MC510.2	Apply process management and concurrency control techniques
MC510.3	Apply memory management and I/O techniques
MC510.4	Illustrate File systems and protection & security concepts

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC510.1	2	2	2	-	-	-	-	-	-	-	-	-
MC510.2	2	2	2	-	-	-	-	-	-	-	-	-
MC510.3	2	2	2	-	-	-	-	-	-	-	-	-
MC510.4	2	1	-	-	-	-	-	-	-	-	-	-

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

	PEO1	PEO2	PEO3	PSO1	PSO2
MC510.1	-	-	1	-	-
MC510.2	-	-	1	-	-
MC510.3	-	-	1	-	-
MC510.4	-	-	1	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create

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Theory Component

Module No.	Topics	Ref.	Hrs.
1	**Introduction to Operating System**	1,2	4
	Introduction to OS and System software, concept of process and threads Types of OS-Batch, multiprocessing, multitasking, timesharing, system calls ,types of System calls		
2	**CPU scheduling**	1,2	10
	CPU scheduling algorithms-FCFS, SJF, RR, Priority, Pre-emptive, Non-preemptive, Multiprocessor scheduling algorithms, Real time scheduling algorithms		
3	**Concurrency Control**	1,2	10
	Concurrency and Race Conditions, Mutual exclusion requirements, Semaphores, Monitors, Classical IPC problems and solutions, Deadlock, Characterization, Detection, Recovery, Avoidance and Prevention		
4	**Memory Management**	1,2	10
	Memory partitioning, Swapping, Paging, Demand paging, Virtual memory concepts, Page replacement algorithms, Disk scheduling, Disk management, Swap-space management, Allocation algorithms		
5	**File Systems and Protection & Security**	1,2	8
	File systems- File concept, Access methods, Allocation methods, Directory systems, File protection, Free space management, Protection & Security Goals of protection, Domain of protection, Access matrix, Implementation of access matrix		
6	**Self-Study Topics**		
	Study of different Operating, Systems(Linux, Windows, Android OS, iOS) Shell Scripting		
	Total		42

Text Books:

[1] Silberschatz and Galvin*," Operating System Concepts*", Wiley Publications,9th Edition,2008

[2] Andrew S. Tanenbaum*," Modern Operating Systems*", Pearson Education Publishers,4th Edition,2016

Reference Books:

[3] Bernard Kolman, Robert C. Busby," *Operating Systems- Internals and Design Principles*", Prentice Hall , 5th Edition,2000

[4] Gary Nutt, Nabendu Chaki, Sarmishtha Neogy," *Operating Systems*", Pearson Education,2009