M.Sc.,

COMPUTER SCIENCE

SYLLABUS

FROM THE ACADEMIC YEAR

2023 - 2024

M.Sc. Computer Science - Programme structure Affiliated Colleges

S.No	Paper Code	Courses	Title of the paper	T/P	Credits	Hours/ Week	Marks		
			I Semester				**I**	**E**	**Total**
I	23MCE1C1	Core 1	Analysis & Design of Algorithms	T	5	5	25	75	100
	23MCE1C2	Core 2	Object Oriented Analysis And Design	T	5	5	25	75	100
	23MCE1C3	Core 3	Python Programming	T	4	5	25	75	100
	23MCE1E1/ 23MCE1E2	DSE-1	Advanced Software Engineering/ Embedded systems	T	3	5	25	75	100
	23MCE1P1	Practical-I	Algorithm Lab	P	3	5	25	75	100
	23MCE1P2	Practical-II	Python Programming Lab	P	3	5	25	75	100
					23	**30**	**150**	**450**	**600**
			II Semester						
II	23MCE2C1	Core 4	Data Mining and Data Warehousing	T	5	5	25	75	100
	23MCE2C2	Core 5	Principles of Compiler Design	T	5	5	25	75	100
	23MCE2C3	Core 6	Advanced Java Programming	T	4	5	25	75	100
	23MCE2E1/ 23MCE2E2	DSE-3	Artificial Intelligence & Machine Learning / Block Chain Technologies	T	3	5	25	75	100
	23MCE2P1	Practical-III	Advanced Java Programming Lab	P	3	5	25	75	100
	23MCE2SP	SEC-1	Web Technology Lab	P	2	5	25	75	100
					22	**30**	**150**	**450**	**600**
			III Semester						
III	23MCE3C1	Core 7	Digital Image Processing	T	5	5	25	75	100
	23MCE3C2	Core 8	Cloud Computing	T	5	5	25	75	100
	23MCE3C3	Core 9	Data Science & Analytics	T	5	5	25	75	100
	23MCE3P1	Practical-IV	Digital Image Processing using MATLAB Lab	P	4	5	25	75	100
	23MCE3E1/ 23MCE3E2	DSE-5	Network Security and Cryptography /Advanced Internet of Things	T	3	5	25	75	100
	23MCE3SP	SEC-2	Data Mining using R Lab	P	2	5	25	75	100
	23MCE3I		Internship/Industrial Activity		2	-	25	75	100
					26	**30**	**175**	**525**	**700**
			IV Semester						
IV	23MCE4C1	Core 11	Distributed Operating System	T	5	5	25	75	100
	23MCE4C2	Core 12	Artificial Neural Networks	T	5	5	25	75	100
	23MCE4PR	Core 13	Project with Viva-Voce		6	10	25	75	100
	23MCE4E1/ 23MCE4E2	DSE-6	Parallel Processing / Cyber Security	T	4	5	25	75	100
	23MCE4S1	SEC-3	Robotics	T	2	5	25	75	100
	--		Extension Activity / Industrial Visit		1				
					23	**30**	**125**	**375**	**500**
			Total		**94 +EC**		**600**	**1800**	**2400**

Core Courses

DSE – Discipline Specific Elective –Give more option to the student (Choice) and it may be conducted by

parallel sessions. SEC- Skill Enhancement Course

Dissertation- Marks -Vivo-voce (50) + thesis (100) + internal (50) = 200

Internship report –Marks -Vivo-voce (25) + reports (50) + internal (25) = 100

***AEC- Ability Enhancement Courses (may be included by altering the surplus credits and hours of other courses)**

I – SEMESTER

Course code	23MCE1C1	ANALYSIS & DESIGN OF ALGORITHMS	L	T	P	C
Core/ Elective/ Supportive		Core-I	5			5
Pre-requisite		Basic Data Structures & Algorithms				

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the Elementary Data Structures and algorithms.
2. Presents an introduction to the algorithms, their analysis and design
3. DiscussvariousmethodslikeBasicTraversalAndSearchTechniques,divideandconquer method, Dynamic programming, backtracking
4. Understood the various design and analysis of the algorithms.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Get knowledge about algorithms and determines their time complexity. Demonstrate specific search and sort algorithms using divide and conquer technique.	K1,K2
2	Gain good understanding of Greedy method and its algorithm.	K2,K3
3	Able to describe about graphs using dynamic programming technique.	K3,K4
4	Demonstrate the concept of back tracking & branch and bound technique.	K5,K6
5	Explore the traversal and searching technique and apply it for trees and graphs.	K6

K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create

UNIT 1	**INTRODUCTION:** Introduction – Notion of Algorithm - Fundamentals of algorithmic problem solving – Important problem types – Fundamentals of the analysis of algorithm efficiency – analysis frame work – Asymptotic Notations and Basic Efficiency Classes- Mathematical analysis of non-recursive Algorithms – Non-recursive solution to the Matrix Multiplication - Mathematical analysis of recursive algorithms – Recursive solution to the Tower of Hanoi Puzzle.
UNIT 2	**DIVIDE AND CONQUER & GREEDY METHOD:** Divide and conquer Technique – Multiplication of large integers – Strassen's matrix multiplication – Closest pair and Convex Hull Problems - Greedy method – Prim's algorithm – Kruskal's algorithm – Dijkstra's algorithm.
UNIT 3	**DYNAMIC PROGRAMMING:** Dynamic Programming - Computing a binomi coefficient – Warshall's and Floyd' Algorithm – Application of Warshall's Algorithm to t digraph – Flyd's Algorithm for the all pairs shortest paths Problem - The Knapsack proble and Memory function.
UNIT 4	**BACKTRACKING:** Backtracking – N-Queens problem – Hamiltonian circuit problem Subset sum problem – Branch and bound – Assignment problem – Knapsack problem Traveling salesman problem.
UNIT 5	**P, NP and NP-complete problems:** P, NP and NP-complete problems – Approximation algorithms for NP-hard problems – Traveling salesman problem – Knapsack problem

Text Book:

1. Anany Levitin "Introduction to the Design and Analysis of Algorithms" Pearson Education 201 (Chapters 1.1-1.3, 2.1, 2.2, 2.3, 2.4, 4.5, 4.6, 8.2, 8.4, 9.1-9.3, 11.3, 12.1,12.2, 12.3)

Reference Books:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, “Introduction to algorithms”, Prenti Hall 1990.
2. S.K. Basu, “Design methods and Analysis of Algorithms”, Prentice Hall, 2005.

Semester – I				
Course code	**CORE II**	**T/P**	**C**	**H/W**
23MCE1C2	**OBJECT ORIENTED ANALYSIS AND DESIGN**	**T**	**5**	**5**
Objectives	➢ To describe the Object-Oriented Software Development Process, including object oriented methodologies and workflow. ➢ To explain various diagrams and models.			
UNIT 1	Introduction to Object Oriented Development – Modeling as a design technique: Modeling – Object Modeling Techniques – Object Modeling: Objects and Classes – Links and associations – Advanced Link and Association concepts – Generalisation and Inheritance – Grouping Constructs – a simple object model – Advanced object modeling: Aggregation – Abstract Classes – Generalisation as extension and restriction – Multiple Inheritance –Metadata – Candidate Keya and Constraints.			
UNIT 2	**Dynamic Modeling:** Events and States – Operations – Nested state diagram – Concurrence – Advanced dynamic modeling concepts – A simple dynamic model – Relation of object and dynamic models – functional modeling – functional models – data flow diagrams – Specifying operation – constraints – A simple functional model – relation of functional to object and dynamic models.			
UNIT 3	**Analysis:** Overview of Analysis – Problem statement – Automated Teller Machine example – Object Modeling – Dynamic Modeling – Functional Modeling – Adding Operations – Iterating the Analysis.			
UNIT 4	**System Design:** Overview of System Design – Breaking system into subsystems – Identifying Concurrency – Allocation subsystems to processes and tasks – Management of Data stores – Handling boundary condition – Setting trade-off priorities – Common Architectural frameworks –Architecture of ATM system.			
UNIT 5	**Object Design:** Overview of Object Design – Combining the three models – Designing algorithms – design optimization – Implementation of control – Adjustment of Inheritance – Design of Associations – Object Representation – Physical Packaging – Document Design Decisions.			

Text Book:

James Rumbaugh, Michael Blaha, William Premerlani, Fredrick Eddy, William Loreson, 1998,*Object Oriented Modeling Design*, PHI

Books for Reference:

Grady Booch, 2000, *Object Analysis and Design with Applications*, Addison Wesley Publishing Company.

Outcomes	➢ To analyze the requirements and generate use cases. ➢ To perform object oriented analysis.

I – SEMESTER

Course code	23MCE1C3	PYTHON PROGRAMMING	T/P	C	H
Core		Core III	T	4	5
Pre-requisite		Basics of any OO Programming Language			

Course Objectives:

The main objectives of this course are to:

1. Presents an introduction to Python, creation of web applications, network applications and working in the clouds
2. Use functions for structuring Python programs
3. Understand different Data Structures of Python
4. Represent compound data using Python lists, tuples and dictionaries

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic concepts of Python Programming	K1,K2
2	Understand File operations, Classes and Objects	K2,K3
3	Acquire Object Oriented Skills in Python	K3,K4
4	Develop web applications using Python	K5
5	Develop Client Server Networking applications	K5,K6

K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create

UNIT 1	Introduction : Fundamental ideas of Computer Science - Strings, Assignment, and Comments - Numeric Data types and Character sets – Expressions – Loops and Selection Statements: Definite iteration: the for Loop - selection: if and if-else statements - Conditional iteration: the while Loop
UNIT 2	Strings and Text Files: Accessing Characters and substrings in strings - Data encryption- Strings and Number systems- String methods – Text - Lists and Dictionaries: Lists – Dictionaries – Design with Functions: A Quick review - Problem Solving with top-Down Design - Design with recursive Functions - Managing a Program's namespace - Higher-Order Functions
UNIT 3	Design with Classes: Getting inside Objects and Classes – Data-Modeling Examples – Building a New Data Structure – The Two – Dimensional Grid - Structuring Classes with Inheritance and Polymorphism - Graphical User Interfaces - The Behavior of terminal-Based programs and GUI-Based programs - Coding Simple GUI-Based programs - Windows and Window Components - Command Buttons and responding to events.
UNIT 4	Django: Installing Django – Building an Application – Project Creation – Designing the Data Schema - Creating an administration site for models
UNIT 5	Working with QuerySets and Managers – Retrieving Objects – Building List and Detail Views

Text Books

1	K.A. Lambert, " Fundamentals of Python: first programs", Second Edition, Cengage Learning, 2018 **(Unit - I, II and III)**

2	Antonio Mele, “Django 3 By Example”, Third Edition, 2020 **(Unit –IV& V)**
Reference Books	
1	Fabio Nelli, “Python Data Analytics: With Pandas, NumPy, and Matplotlib”, Second Edition, Kindle Edition, 2018
2	SheetalTaneja,Naveen Kumar, Approach”,PearsonPublications. “Python Programming-A Modular
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.programiz.com/python-programming/
2	https://www.tutorialspoint.com/python/index.htm
3	https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	M	S	M
CO2	S	S	S	S	S	S	S	M	S	M
CO3	S	S	S	S	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	S	M
CO5	S	S	S	S	S	S	S	M	S	M

I – SEMESTER

Course code	23MCE1P1	PRACTICAL I: ALGORITHMS LAB	T/P	C	H
Core/ Elective/ Supportive		Practical-I	P	3	5
Pre-requisite		Basic Programming of C++ language			

Course Objectives:

The main objectives of this course are to:

1. This course covers the basic data structures like Stack, Queue, Tree, List.
2. This course enables the students to learn the applications of the data structures using various techniques
3. It also enable the students to understand C++ language with respect to OOAD concepts
4. Application of OOPS concepts.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concepts of object oriented with respect to C++	K1,K2
2	Able to understand and implement OOPS concepts	K3,K4
3	Implementation of data structures like Stack, Queue, Tree, List using C++	K4,K5
4	Application of the data structures for Sorting, Searching using different techniques.	K5,K6

K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create

LIST OF PROGRAMS	75hours

Implement the following Programs

1. Compute the transitive closure of any directed graph using Warshall's Algorithm.
2. Knapsack problem using backtracking
3. 0/1 knapsack problem using Dynamic programming
4. Apply the divide and conquer technique implement Strassen's matrix Multiplication Algorithm
5. Find minimum cost spanning Tree of a given undirected graph using Kruskal's Algorithm.
6. Find minimum cost spanning Tree of a given undirected graph using Prim's Algorithm.
7. All-pairs Shortest Paths algorithms
8. 8 Queen's problem using backtracking
9. Dijkstra's Algorithm using greedy technique
10. Sum of subset problem using backtracking
11. Travel sales man problem using back tracking

Expert lectures, online seminars –webinars

Total Lecture hours	75hours

Text Books

1. Goodrich, "DataStructures&AlgorithmsinJava",Wiley3rd edition.

2	Skiena,"TheAlgorithmDesignManual",SecondEdition,Springer,2008
Reference Books	
1	Anany Levith, "Introduction to the Design and Analysis of algorithm", Pearson Education Asia, 2003.
2	RobertSedgewick,PhillipeFlajolet,"AnIntroductiontotheAnalysisofAlgorithms", Addison-Wesley Publishing Company,1996.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://onlinecourses.nptel.ac.in/noc19_cs48/preview
2	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/
3	https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm

Mapping with Programming Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

I – SEMESTER

Course code	23MCE1P2	PRACTICAL II: PYTHON PROGRAMMING LAB	T/P	C	H
Core/ Elective/ Supportive		Practical-II	P	3	5
Pre-requisite		Basics of any OO Programming Language			

Course Objectives:

The main objectives of this course are to:

1. This course presents an overview of elementary data items, lists, dictionaries, sets and tuples
2. To understand and write simple Python programs
3. To Understand the OOPS concepts of Python
4. To develop web applications using Python

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Able to write programs in Python using OOPS concepts	K1,K2
2	To understand the concepts of File operations and Modules in Python	K2,K3
3	Implementation of lists, dictionaries, sets and tuples as programs	K3,K4
4	To develop web applications using Python	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

LIST OF PROGRAMS	**75hours**

Implement the following in Python:

1. Programs using elementary data items, lists, dictionaries and tuples
2. Programs using conditional branches,
3. Programs using loops.
4. Programs using functions
5. Programs using exception handling
6. Programs using inheritance
7. Programs using polymorphism
8. Programs to implement file operations.
9. Programs using modules.
10. Programs for creating dynamic and interactive web pages using forms.
11. Programs using classes and objects

Total Lecture hours	**75hours**

Text Books

1	BillLubanovic,“Introducing Python”,O’Reilly,FirstEdition-SecondRelease,2014.
2	MarkLutz,“LearningPython”, O’Reilly,FifthEdition, 2013.

ELECTIVE

Course code	23MCE1E1	ADVANCED SOFTWARE ENGINEERING	T/P	C	H
Core/ Elective/ Supportive		DSE- I A	T	4	5
Pre-requisite		Basics of Software Engineering & SPM			

Course Objectives:

The main objectives of this course are to:

1. Introduce to Software Engineering, Design, Testing and Maintenance.
2. Enable the students to learn the concepts of Software Engineering.
3. Learn about Software Project Management, Software Design & Testing.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand about Software Engineering process	K1,K2
2	Understand about Software project management skills, design and quality management	K2,K3
3	Analyze on Software Requirements and Specification	K3,K4
4	Analyze on Software Testing, Maintenance and Software Re-Engineering	K4,K5
5	Design and conduct various types and levels of software quality for a software project	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Details

UNIT 1	**INTRODUCTION:** Introduction: The Problem Domain – Software Engineering Challenges - Software Engineering Approach – Software Processes: Software Process – Characteristics of a Software Process – Software Development Process Models – Other software processes.
UNIT 2	**SOFTWARE REQUIREMENTS:** Software Requirements Analysis and Specification : Requirement engineering – Type of Requirements – Feasibility Studies – Requirements Elicitation – Requirement Analysis – Requirement Documentation – Requirement Validation – Requirement Management – SRS - Formal System Specification – Axiomatic Specification – Algebraic Specification - Case study: Student Resultmanagementsystem. SoftwareQuality Management – SoftwareQuality, Software Quality Management System, ISO 9000, SEI CMM.
UNIT 3	**PROJECT MANAGEMENT:** Software Project Management: Responsibilities of a software project manager – Project planning – Metrics for Project size estimation – Project Estimation Techniques – Empirical Estimation Techniques – COCOMO – Halstead‟s software science – Staffing level estimation – Scheduling– Organization and Team Structures – Staffing – Risk management – Software Configuration Management – Miscellaneous Plan.
UNIT 4	**SOFTWARE DESIGN:** Software Design: Outcome of a Design process – Characteristics of a good software design – Cohesion and coupling - Strategy of Design – Function Oriented Design – Object Oriented Design - Detailed Design - IEEE Recommended Practice for Software Design Descriptions.

UNIT 5	**SOFTWARE TESTING:** Software Testing: A Strategic approach to software testing – Terminologies – Functional testing– Structural testing – Levels of testing – Validation testing - Regression testing – Art of Debugging–Testingtools-Metrics-ReliabilityEstimation.SoftwareMaintenance -Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities.	
UNIT 6	**Contemporary Issues:** Expert lectures, online seminars –webinars	
	Total Lecture hours	**75hours**
Text Books		
1	An Integrated Approach to Software Engineering– Pankaj Jalote, Narosa Publishing House, Delhi, 3rd Edition.	
2	Fundamentals of Software Engineering –RajibMall, PHI Publication,3rdEdition.	
Reference Books		
1	SoftwareEngineering–K.K.AggarwalandYogeshSingh,NewAgeInternational Publishers, 3 rd edition.	
2	APractitionersApproach-SoftwareEngineering,-R.S.Pressman,McGraw Hill.	
3	Fundamentals of Software Engineering - Carlo Ghezzi, M. Jarayeri, D. Manodrioli,PHIPublication.	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]		
1	https://www.javatpoint.com/software-engineering-tutorial	
2	https://onlinecourses.swayam2.ac.in/cec20_cs07/preview	
3	https://onlinecourses.nptel.ac.in/noc19_cs69/preview	

Course code	23MCE1E2	EMBEDDED SYSTEMS	T/P	C	H
Core/Elective/Supportive		DSE-I B	T	4	5
Pre-requisite		Basics of Micro Controller			

Course Objectives:

The main objectives of this course are to:

1. Present the introduction to 8051 Micro controller Instruction Set, concepts on RTOS & Software tools.
2. Gain the knowledge about the embedded software development.
3. Learn about Micro controller and software tools in the embedded systems.

Expected Course Outcomes:

On the successful completion of the course ,student will be able to:

1	Understand theconceptof8051microcontroller	K1,K2
2	Understand the Instruction Set and Programming	K2,K3
3	Analyze the concepts of RTOS	K3,K4
4	Analyze and design various real time embedded systems using RTOS	K5
5	Debug the malfunctioning system using various debugging techniques	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**– Create

UNIT 1	**8051 MICRO CONTROLLER:** 8051Microcontroller: Introduction-8051 Architecture-Input/ Output Pins, Ports and Circuits- External Memory - Counters / Timers - Serial Data Input / Output –Interrupts
UNIT 2	**PROGRAMMING BASICS:** Instruction Set and Programming Moving Data-Addressing Modes-Logical operations- Arithmetic Operation-Jump and Call Instructions-Simple Program. Applications: Keyboard Interface- Display Interface-Pulse Measurements-DIA and AID Conversions-Multiple Interrupts.
UNIT 3	**CONCEPTS ON RTOS:** CONCEPTS ON RTOS: Introduction to RTOS-Selecting an RTOS-Task and Task states - Tasks and data- Semaphores and shared data. MORE operating systems services: Interrupt Process communication - Message Queues, Mailboxes and pipes- Timer Functions-Events - Memory Management-Interrupt Routines in an RTOS Environment.
UNIT 4	**DESIGN USING RTOS:** Basic Design using a RTOS: Principles - Encapsulating semaphores and Queues-Hard real time scheduling considerations-Saving memory space and power- introductions to RTL &QNX.
UNIT 5	**SOFTWARETOOLS:** Embedded software Development Tools: Hosts and Target Machines- Linker/Locators for Embedded software-getting Embedded software into the Target systems. Debugging Techniques: Testing on your Host machine - Instruction set simulators- The assert macro- using laboratory tools.
UNIT 6	**Contemporary Issues:** Expert lectures, online seminars –webinars
	Total Lecture hours **60Hours**

Text Books

1	David E. Simon, "An Embedded Software primer" Pearson Education Asia, 2003.
2	KennethJAyala, "The8051MicrocontrollerandArchitectureprogrammingand application", Second Edition, Penram International.

Reference Books

1	RajKamal, "Embedded Systems –Architecture, programming and design", Tata McGraw–Hill, 2003.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.nptel.ac.in/noc20_cs14/preview
2	https://www.javatpoint.com/embedded-system-tutorial
3	https://www.tutorialspoint.com/embedded_systems/index.htm

II – SEMESTER

Course code	23MCE2C1	DATAMINING AND DATA WAREHOUSING	L	T	P	C
Core/Elective/Supportive		Core-4	5			5
Pre-requisite		Basics of RDBMS & Algorithms				

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing.
2. Develop skills of using recent data mining software for solving practical problems.
3. Develop and apply critical thinking, problem-solving, and decision-making skills.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic data mining techniques and algorithms	K1,K2
2	Understand the Association rules, Clustering techniques and Data warehousing contents	K2,K3
3	Compare and evaluate different data mining techniques like classification, prediction, Clustering and association rule mining	K4,K5
4	Design data warehouse with dimensional modeling and apply OLAP operations	K5,K6
5	Identify appropriate data mining algorithms to solve real world problems	K6

K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	Data Mining And Data Preprocessing	15 hours

Data Mining And Data Preprocessing: Data Mining – Motivation – Definition – Data Mining on What kind of Data –Functionalities – Classification – Data Mining Task Primitives – Major Issues in Data Mining – Data Preprocessing – Definition – Data Clearing – Integration and Transformation – Data Reduction.

Unit:2	Data Warehousing:	15 hours

Data Warehousing: Multidimensional Data Model –Data Warehouse Architecture – Data Warehouse Implementation –From data Warehousing to Data Mining – On Line Analytical Processing - On Line Analytical Mining.

Unit:3	Frequent Patterns, Associations And Classification:	15 hours

Frequent Patterns, Associations And Classification: The Apriori Algorithm – Definition of Classification and Prediction – Classification by Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Lazy Learners – K-Nearest Neighbor – Other Classification Methods.

Unit:4	Cluster Analysis:	14 hours

Cluster Analysis: Definition – Types of data in Cluster Analysis – Categorization of major Clustering Techniques – Partitioning Methods – Hierarchical Clustering – BIRCH - ROCK – Grid Based Methods – Model Based Clustering Methods – Outlier Analysis.

Unit:5	Spatial, Multimedia, Text And Web Data:	14 hours

Spatial, Multimedia, Text And Web Data: Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web – Data Mining Applications – Trends in Data Mining.

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars –webinars		
	Total Lecture hours	**75 hours**

Text Books	
1	Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", 2nd Ed., Morgan Kaufmann Publishers, 2006.
Reference Books	
1	Margret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, 2003.
Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.mooc-list.com/tags/data-mining
2	https://www.geeksforgeeks.org/data-mining/
3	https://www.tutorialspoint.com/dwh/index.htm

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code	23MCE2C2	PRINCIPLES OF COMPILER DESIGN	L	T	P	C
Core/Elective/Supportive		Core-5	5			5
Pre-requisite		Basics of Compiler Design and techniques				

Course Objectives:

- To teach concepts of language translation and phases of compiler design
- To describe the common forms of parsers
- To demonstrate intermediate code using technique of syntax directed translation

To Illustrate the various optimization techniques for designing various optimizing compilers

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Students will be able to use compiler construction tools and	K1,K2
2	Will able to understand the Functionality of each stage of compilation process	K2,K3
3	Students will be able to construct Grammars for Natural Languages	K4,K5
4	Will able to find the Syntactical Errors/Semantic errors during the compilations using parsing techniques	K5,K6
5	Will able to know about optimization techniques.	K6

K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	Introduction	15 hours

Introduction to Compilers: Compilers and Translators – Lexical analysis – Syntax analysis – Intermediate code generation – Optimization – code generation – Bookkeeping – Error handling – compiler writing tools.

Finite Automata and Lexical Analysis: The role of the lexical analyzer – the design of the lexical analyzers – Regular expressions – Finite automata – From regular expressions to finite automata – Minimizing the number of states of a DFA – A language for specifying lexical analyzers – Implementation of a lexical analyzer

Unit:2	PARSING	15 hours

The syntactic specification of Programming Languages: Context – free grammars – Derivations and parse trees – Capabilities of context – free grammars.

Basic Parsing Techniques: Parses – Shift – reduce parsing – Operator – precedence parsing – Top-down parsing – Predictive parsers.

Automatic construction of efficient parsers: LR parsers – Constructing SLR parsing tables – Constructing LALR parsing tables.

Unit:3	TRANSLATION	15 hours

Syntax – Directed translation: Syntax Directed translation schemes – Implementation of syntax – directed translators – Intermediate code – Postfix notation – Parse trees and syntax trees – Three – address code, quadruples, and triples – Translation of assignment statements – Boolean expressions – Statements that alter the flow of control – Postfix translations – Translation with a top-down parser.

Unit:4	SYMBOL TABLES	14 hours

Symbol Tables: The contents of a symbol table – Data structures for symbol tables – Representing scope information. Run time storage administration: Implementation of a simple stack allocation scheme – Implementation of block – structured languages – Storage allocation in block – structured languages.

Error Detection and Recovery: Errors – lexical – phase errors – Syntactic phase errors – Semantic errors.

Unit:5	CODE OPTIMIZATION	14 hours
Introduction to code optimization:- The principal sources of optimization – loop optimization– The DAG Representation of basic blocks. Code generation: object programs – Problems in code generation – A machine model – A simple code generator – Register allocation and assignment – Code generation from DAG's – Peephole optimization.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars –webinars		
	Total Lecture hours	**75 hours**

	Text Books
1	Alfred V. Aho Jeffrey D, 1989 Reprint 2002 *"Principles of Compiler Design"* Ullman, Narosa Publishing House,
	Reference Books
1	Dhamdhere D. M, 1981 , "*Compiler Construction Principles and Practice",* Macmillan India.
2	Reinhard Wilhelm, Director Mauser, 1995, *"Compiler Design",* Addison Wesley.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://onlinecourses.nptel.ac.in/noc20_cs13/preview
2	https://www.geeksforgeeks.org/introduction-of-compiler-design/

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

II – SEMESTER

Course code	23MCE2C3	ADVANCED JAVA PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Core-6	5			4
Pre-requisite		Basics of Java & its Usage				

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the basic functions, principles and concepts of advanced java programming.
2. Provide knowledge on concepts needed for distributed Application Architecture.
3. Learn JDBC, Servlet packages, JQuery, Java Server Pages and JAR file format

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the advanced concepts of java Programming	K1,K2
2	Understand JDBC and RMI concepts	K2,K3
3	Apply and analyze Java in Database	K3,K4
4	Handle different event in java using the delegation event model, event listener and class	K5
5	Design interactive applications using Java Servlet, JSP and JDBC	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	BASICS OF JAVA	15 hours

JavaBasicsReview:Componentsandeventhandling–Threadingconcepts–Networkingfeatures – Media techniques

Unit:2	REMOTE METHOD INVOCATION	15 hours

Remote Method Invocation-Distributed Application Architecture- Creating stubs and skeletons-Defining Remote objects- Remote Object Activation-Object Serialization-Java Spaces

Unit:3	DATABASE	13 hours

JavainDatabases-JDBCprinciples–databaseaccess-Interacting-databasesearch–Creating multimedia databases – Database support in web applications

Unit:4	SERVLETS	15 hours

Java Servlets : Java Servlet and CGI programming- A simple java Servlet - Anatomy of a java Servlet - Reading data from a client-Reading http request header-sending data to a client and writing the http response header-working with cookies

Java Server Pages: JSP Overview-Installation-JSP tags-Components of a JSP page-Expressions-Scriptlets – Directives – Declarations - A complete example

Unit:5	ADVANCEDTECHNIQUES	15 hours

JAR file format creation–Internationalization–Swing Programming – Advanced java techniques

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	75 hours

Text Books	
1	JamieJaworski,"JavaUnleashed",SAMSTechmediaPublications,1999.
2	Campione, Walrath and Huml,"TheJavaTutorial",AddisonWesley,1999.
Reference Books	
1	JimKeogh,"TheCompleteReferenceJ2EE",Tata Mc Graw HillPublishingCompanyLtd,2010.
2	DavidSawyerMcFarland,"JavaScriptAndJQuery-TheMissingManual",Oreilly Publications, 3rd Edition,2011.
3	Deitel and Deitel, "Java How to Program", Third Edition, PHI/ Pearson Education Asia.
Related Online Contents [MOOC, SWAYAM, NPTEL,Websitesetc.]	
1	https://www.javatpoint.com/servlet-tutorial
2	https://www.tutorialspoint.com/java/index.htm
3	https://onlinecourses.nptel.ac.in/noc19_cs84/preview

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	M	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code	23MCE2E1	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	L	T	P	C
Core/Elective/Supportive		DSE- II A	5			3
Pre-requisite		Basics of AI & an Introduction about ML				

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the basic functions of AI, Heuristic Search Techniques.
2. Provide knowledge on concepts of Representations and Mappings and Predicate Logic.
3. Introduce Machine Learning with respect Data Mining, Big Data and Cloud.
4. Study about Applications & Impact of ML.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Demonstrate AI problems and techniques	K1,K2
2	Understand machine learning concepts	K2,K3
3	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning	K3,K4
4	Analyze the impact of machine learning on applications	K4,K5
5	Analyze and design a real world problem for implementation and understand the dynamic behavior of a system	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	15 hours

Introduction: AI Problems - Al techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems - Problem Characteristics - Issues in design of Search.

Unit:2	SEARCH TECHNIQUES	15 hours

Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis. Knowledge representation issues: Representations and mappings -Approaches to Knowledge representations -Issues in Knowledge representations - Frame Problem.

Unit:3	PREDICATE LOGIC	15 hours

Using Predicate logic: Representing simple facts in logic - Representing Instance and Isa relationships - Computable functions and predicates - Resolution - Natural deduction. Representing knowledge using rules: Procedural Vs Declarative knowledge- Logic programming -Forward Vs Backward reasoning -Matching- Control knowledge.

Unit:4	MACHINE LEARNING	15 hours

Understanding Machine Learning: What Is Machine Learning?-Defining Big Data – Big Data in Context with Machine Learning-The Importance of the Hybrid Cloud-Leveraging the Power of Machine Learning-The Roles of Statistics and Data Mining with Machine Learning-Putting Machine Learning in Context-Approaches to Machine Learning.

Unit:5	APPLICATIONS OF MACHINE LEARNING	13hours
Looking Inside Machine Learning: The Impact of Machine Learning on Applications-Data Preparation-The Machine Learning Cycle.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars –webinars		
	Total Lecture hours	**75 hours**

Text Books	
1	Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata Mc Graw Hill Publishers company Pvt. Ltd, Second Edition, 1991.
2	George FLuger,"ArtificialIntelligence",4th Edition, Pearson Education Publ,2002.
Reference Books	
1	Machine Learning For Dummies ®,IBM Limited Edition by Judith Hurwitz, Daniel Kirsch.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://www.ibm.com/downloads/cas/GB8ZMQZ3
2	https://www.javatpoint.com/artificial-intelligence-tutorial
3	https://nptel.ac.in/courses/106/105/106105077/

Mapping with Programming Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code	23MCE2E2	BLOCK CHAIN TECHNOLOGIES	L	T	P	C
Core/Elective/Supportive		DSE-II B	5			3
Pre-requisite		Basics of Block Chain & Crypto Currency				

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of block chain and crypto currency.
2. Understand the influence and role of block chain in various other fields.
3. Learn security features and its significance.
4. Identify problems & challenges posed by Block Chain.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Demonstrate block chain technology and crypto currency	K1,K2
2	Understand the mining mechanism in block chain	K2
3	Apply and identify security measures, and various types of services that allow people to trade and transact with bit coins	K3,K4
4	Apply and analyze Block chain in health care industry	K4,K5
5	Analyze security, privacy, and efficiency of a given Block chain system	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	15 hours

Introduction to Block chain - The big picture of the industry – size, growth, structure, players. Bit coin versus Crypto currencies versus Block chain - Distributed Ledger Technology (DLT). Strategic analysis of the space – Block chain platforms, regulators, application providers. The major application: currency, identity, chain of custody.

Unit:2	NETWORK AND SECURITY	15 hours

Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Block chain 1.0, 2.0 and 3.0 – transition, advancements and features. Privacy, Security issues in Block chain.

Unit:3	CRYPTO CURRENCY	15 hours

Crypto currency - History, Distributed Ledger, Bit coin protocols -Symmetric-key cryptography - Public-key cryptography - Digital Signatures -High and Low trust societies - Types of Trust model: Peer-to-Peer, Leviathan, and Intermediary. Application of Cryptography to Block chain

Unit:4	CRYPTO CURRENCY REGULATION	14 hours

Crypto currency Regulation-Stakeholders, Roots of Bit coin, Legal views – exchange of crypto currency –Black Market – Global Economy. Crypto economics – assets, supply and demand, inflation and deflation – Regulation.

Unit:5	CHALLENGESINBLOCKCHAIN	14 hours

Opportunities and challenges in Block Chain – Application of block chain: Industry 4.0 – machine to machine communication –Data management in industry4.0–future prospects. Block chain in Health 4.0 – Block chain properties - Healthcare Costs - Healthcare Quality - Healthcare Value - Challenges for using block chain for healthcare data

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	**75 hours**
Text Books		
1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Gold feder, "Bitcoin and Crypto currency Technologies: A Comprehensive Introduction", Princeton University Press (July 19, 2016).	
2	Antonopoulos, "Mastering Bitcoin: Unlocking Digital Crypto currencies"	
Reference Books		
1	Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System"	
2	Rodrigoda Rosa Righi, Antonio Marcos Alberti, Madhusudan Singh, "Block chain Technology for Industry 4.0" Springer 2020.	
Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.javatpoint.com/blockchain-tutorial	
2	https://www.tutorialspoint.com/blockchain/index.htm	
3	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs01/	

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code	23MCE2P1	PRACTICAL III: ADVANCED JAVA PROGRAMMING LAB	L	T	P	C
Core/Elective/Supportive		Practical-III			5	3
Pre-requisite		Basics in Java Programming				

Course Objectives:

The main objectives of this course are to:

1. To enable the students to implement the simple programs using JSP, JAR
2. To provide knowledge on using Servlets, Applets
3. To introduce JDBC and navigation of records
4. To understand RMI& its implementation
5. To introduce to Socket programming

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand to the implement concepts of Java using HTML forms, JSP&JAR	K1,K2
2	Must be capable of implementing JDBC and RMI concepts	K3,K4
3	Able to write Applets with Event handling mechanism	K4,K5
4	To Create interactive web based applications using servlets and jsp	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

LISTOF PROGRAMS	75hours

1. Display a welcome message using Servlet.
2. Design a Purchase Order form using Html form and Servlet.
3. Develop a program for calculating the percentage of marks of a student using JSP.
4. Design a Purchase Order form using Html form and JSP.
5. Prepare a Employee pay slip using JSP.
6. Write a program using JDBC for creating a table, Inserting, Deleting records and list out the records.
7. Write a program using Java servlet to handle form data.
8. Write a simple Servlet program to create a table of all the headers it receives along with their associated values.
9. Write a program in JSP by using session object.
10. Write a program to build a simple Client Server application using RMI.
11. Create an applet for a calculator application.
12. Program to send a text message to another system and receive the text message from the system (use socket programming).

Total Lecturehours	75hours

Course code	23MCE2SP	WEB TECHNOLOGY LAB		T	P	C
Core/Elective/Supportive		SEC-I			5	2
Pre-requisite		To Familiar with web designing				

Course Objectives:

The main objectives of this course are to:

- Learn how to create web pages using HTML, CSS and Javascript.
- Implement dynamic web pages using Javascript, Jquery and Angular Java script
- To create web applications using PHP and MySQL
- Create web pages using XML and Cascading Style Sheets
- Create XML documents and Schemas

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Design dynamic web pages using Javascript, Jquery and Angular Java script	**K1**
2	Develop Web pages using HTML, CSS and XML	**K2,K6**
3	Create web application using PHP and MySQL	**K3, K4**
4	Develop interactive web pages using Jquery	**K2,K3**
5	To design dynamic web pages using Angular javascript	**K4,K5**

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

1. Develop a webpage describing your department. Use paragraph and list tags.
2. Develop a web page to display your education details in a tabular format.
3. Develop a web page to display your CV on a web page.
4. Design a Homepage having three links: About Us, Our Services and Contact Us. Create separate web pages for the three links.
5. Design a web page to demonstrate the usage of inline CSS, internal CSS and external CSS.
6. Design an XML document and create a style sheet in CSS & display the document in the browser.
7. Develop a web page to Create image maps.
8. Design a web page to perform input validation using Angular Javascript.
9. Develop a web page in PHP to fetch details from the database.
10. Design a web page to hide paragraph using JQuery
11. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
12. Create a web page and add Javascript to handle mouse events and form Events.
13. Write a JavaScript program to change background color after 5 seconds of page load.
14. Write a JavaScript program to dynamically bold, italic and underline words and phrases based on user actions.
15. Write a program to design a simple calculator using JavaScript
16. Develop a college website with Image Slides using Jquery library
17. Create a web page with Forms, Inputs, and Date Time picker
18. Create a simple webpage with Bar Chart, Pie chart using Jqeuery library
19. Create a simple web page with Calculate age from DatePicker input of HTML using JS
20. Create a simple web page using JS validation Plugin that validates Mandatory, Min, Max ,string length & Age.
21. Create a simple web page using PHP to save student data in MySQL
22. Create s simple web page using PHP to display data from MySQL
23. Create a simple web page using PHP that collects student feedback & send to Professor using SMTP mail
24. Create a simple PHP program with Get & Post methods
25. Create a simple PHP for file handling concepts.
26. Create a simple PHP to implement try-catch concepts.
27. Create a simple PHP to implement namespace & import concepts.
28. Create a simple web page using PHP to implement Paging & sorting
29. Create a simple web page & PHP to implement AJAX

Total Lecture hours	**75 hours**

III -SEMESTER

Course code	23MCE3C1	DIGITAL IMAGE PROCESSING	L	T	P	C
Core/Elective/Supportive		Core-7	5			5
Pre-requisite		Basics of Image Processing				

Course Objectives:

The main objectives of this course are to:

1. Learn basic image processing techniques for solving real problems.
2. Gain knowledge in image transformation and Image enhancement techniques.
3. Learn Image compression and Segmentation procedures.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the fundamentals of Digital Image Processing	K1,K2
2	Understand the mathematical foundations for digital image representation, image acquisition, image transformation, and image enhancement	K2,K3
3	Apply, Design and Implement and get solutions for digital image processing problems	K3,K4
4	Apply the concepts of filtering and segmentation for digital image retrieval	K4,K5
5	Explore the concepts of Multi-resolution process and recognize the objects in an efficient manner	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	15 hours

Introduction: What is Digital image processing – the origin of DIP – Examples of fields that use DIP – Fundamentals steps in DIP – Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition – Image sampling and Quantization – Some Basic relationship between Pixels – Linear & Nonlinear operations.

Unit:2	IMAGE ENHANCEMENT	15 hours

Image Enhancement in the spatial domain:- Background – some basic Gray level Transformations – Histogram Processing – Enhancement using Arithmetic / Logic operations – Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.

Unit:3	IMAGE RESTORATION	15 hours

Image Restoration: A model of the Image Degradation / Restoration Process – Noise models – Restoration is the process of noise only – Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear, Portion – Invariant Degradations – Estimating the degradation function – Inverse filtering – Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.

Unit:4	IMAGE COMPRESSION	13 hours

Image Compression: Fundamentals–Image compression models–Elements of Information Theory – Error Free compression – Lossy compression – Image compression standards.

Unit:5	IMAGE SEGMENTATION	15 hours

Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars –webinars		
	Total Lecture hours	**75 hours**

Text Books	
1	Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Second Edition, PHI/Pearson Education.
2	B. Chanda, D. Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2003.
Reference Books	
1	Nick Efford, "Digital Image Processing a practical Introducing using Java", Pearson Education, 2004.
Related Online Contents [MOOC, SWAYAM, NPTEL,Websitesetc.]	
1	https://nptel.ac.in/courses/117/105/117105135/
2	https://www.tutorialspoint.com/dip/index.htm
3	https://www.javatpoint.com/digital-image-processing-tutorial

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	M	S	M	M	S
CO2	S	S	S	S	S	M	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong;M-Medium;L-Low

Course code	23MCE3C2	CLOUD COMPUTING	L	T	P	C
Core/Elective/Supportive		Core-8	5			5
Pre-requisite		Basics of Cloud & its Applications				

Course Objectives:

The main objectives of this course are to:

1. Gain knowledge on cloud computing, cloud services, architectures and applications.
2. Enable the students to learn the basics of cloud computing with real time usage
3. How to store and share, in and from cloud?

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concepts of Cloud and its services	K1,K2
2	Collaborate Cloud for Event & Project Management	K3,K4
3	Analyze on cloud in –Word Processing, Spread Sheets, Mail, Calendar, Database	K4,K5
4	Analyze cloud in social networks	K5,K6
5	Explore cloud storage and sharing	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	15 hours

INTRODUCTION Cloud Computing Introduction, From, Collaboration to cloud, Working of cloud computing, pros and cons, benefits, developing cloud computing services, Cloud service development, discovering cloud services.

Unit:2	CLOUD COMPUTING	15 hours

CLOUD COMPUTING FOR EVERYONE Centralizing email communications, cloud computing for community, collaborating on schedules, collaborating on group projects and events, cloud computing for corporation, mapping, schedules, managing projects, presenting on road.

Unit:3	CLOUD SERVICES	15 hours

USING CLOUD SERVICES Collaborating on calendars, Schedules and task management, exploring on line scheduling and planning, collaborating on event management, collaborating on contact management, collaborating on project management, collaborating on word processing, spreadsheets, and databases.

Unit:4	OUTSIDE THE CLOUD	15 hours

OUTSIDE THE CLOUD Evaluating web mail services, Evaluating instant messaging, Evaluating web conference tools, creating groups on social networks, Evaluating online groupware, collaborating via blogs and wikis.

Unit:5	STORINGAND SHARING	13 hours

STORING AND SHARING Understanding cloud storage, evaluating on line file storage, exploring on line book marking services, exploring on line photo editing applications, exploring photo sharing communities, controlling it with web based desktops.

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars –webinars		
	Total Lecture hours	75 hours

Text Books

1	Michael Miller, “Cloud Computing”, Pearson Education, New Delhi, 2009.
Reference Books	
1	Anthony T. Velte, “Cloud Computing: A Practical Approach”, 1st Edition, Tata McGraw Hill Education Private Limited, 2009.
Related Online Contents [MOOC,SWAYAM,NPTEL,Websitesetc.]	
1	https://nptel.ac.in/courses/106/105/106105167/
2	https://www.tutorialspoint.com/cloud_computing/index.htm
3	https://www.javatpoint.com/cloud-computing-tutorial

Mapping with Programming Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	L	S	M	S	M	S	M	M	M	S
CO2	M	S	M	S	S	S	M	M	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	M	S	S	S	S	S	S	S	S	S

*S-Strong;M-Medium;L-Low

Course code	23MCE3C3	DATA SCIENCE & ANALYTICS	L	T	P	C
Core/Elective/Supportive		Core-9	5			5
Pre-requisite		Basics of Data Science & its Applications				

Course Objectives:

The main objectives of this course are to:

1. Introduce the students to data science, big data & its ecosystem.
2. Learn data analytics & its life cycle.
3. To explore the programming language R, with respect to the data mining algorithms.
4. Relate the relationship between artificial intelligence, machine learning and data science.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concept of data science and its techniques	K1,K2
2	Review data analytics	K2,K3
3	Apply and determine appropriate Data Mining techniques using R to realtime applications	K3,K4
4	Analyze on clustering algorithms	K4,K5
5	Analyze on regression methods in AI	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5** -Evaluate; **K6**-Create

Unit:1	INTRODUCTION	15 hours

Data science in a big Data world- Data Science process

Unit:2	BASICS OF DATA ANALYTICS	15 hours

Machine Learning.-Data Analytics life cycle

Unit:3	DATA ANALYTICS USING R & CLUSTERING	15 hours

Basic Data Analytics using R : R Graphical User Interfaces – Data Import and Export – Attribute and Data Types –Descriptive Statistics – Exploratory Data Analysis –Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – Data Exploration Versus Presentation. Clustering :Overview of Clustering : K-means – Use Cases – Overview of the Method – Perform a K-means Analysis using R

Unit:4	CLASSIFICATION & ASSOCIATION RULES.	15 hours

Classification – Decision Trees – Overview of a Decision Tree – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Tree in R – Bayes' Theorem – Naïve Bayes Classifier – Smoothing – Naïve Bayes in R. Association rules.

Unit 5:	REGRESSION & TEXT ANALYSIS	15 hours

Linear regression-logistic regression-Additional regression methods. Text Analysis:Text Analysis steps-collecting raw text-Representing Text- Term Frequency-Inverse Document Frequency (TFIDF)- Categorizing Documents by Topics.

Text Books	
1	Introducing Data Science Davy Cielen, Arno D.B.Meysman, Mohamed Ali 2016 Manning Publication UNIT 1- (CHAPTER 1,2) UNIT 2-(CHAPTER 3)
2	Data Science & Big Data Analytics: Discovering, Analyzing,Visualizing and Presenting Data UNIT 2(CHAPTER 2) UNIT 3(CHAPTER 3 &4) UNIT 4(CHAPTER 5& 7) UNIT 5(CHAPTER 6& 9)
Reference Books	
1	A simple introduction to Data Science – Lars Nielson 2015
2	Data Science & Big Data Analytics: Discovering, Analyzing,Visualizing and Presenting Data
3	Manas A.Pathak 2014,Beginning Data Science with R.
Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/python_data_science/index.htm
2	https://www.javatpoint.com/data-science
3	https://nptel.ac.in/courses/106/106/106106179/

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong;M-Medium;L-Low

Course code	23MCE3P1	DIGITAL IMAGE PROCESSING Using MATLAB Lab	L	T	P	C
Core/Elective/Supportive		Practical-IV			5	4
Pre-requisite		Basic Programming of Image Processing & an intro to MATLAB				

Course Objectives:

The main objectives of this course are to:

1. To understand the basics of Digital Image Processing fundamentals, image enhancement and image restoration techniques
2. To enable the students to learn the fundamentals of image compression and segmentation
3. To understand Image Restoration & Filtering Techniques
4. Implementation of the above using MATLAB

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	To write programs in MATLAB for image processing using the techniques	K1,K2
2	To able to implement Image Enhancements & Restoration techniques	K2,K3
3	Capable of using Compression techniques in an Image	K3,K4
4	Must be able to manipulate the image and Segment it	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

LISTOF PROGRAMS	75 hours

1. Implement Image enhancement Technique.
2. Histogram Equalization
3. Image Restoration.
4. Implement Image Filtering.
5. Edge detection using Operators (Roberts, Prewitts and Sobels operators)
6. Implement image compression.
7. Image Subtraction
8. Boundary Extraction using morphology.
9. Image Segmentation

Total Lecture hours	75 hours

Course code	23MCE3E1	NETWORK SECURITYAND CRYPTOGRAPHY	L	T	P	C
Core/Elective/Supportive		DSE-III A	5			3
Pre-requisite		Basics of Networks & its Security				

Course Objectives:

The main objectives of this course are to:

1. Enable students to learn the Introduction to Cryptography, Web Security and Case studies in Cryptography.
2. To gain knowledge on classical encryption techniques and concepts of modular arithmetic and number theory.
3. To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms.
4. To explore the design issues and working principles of various authentication Applications and various secure communication standards including Kerberos, IPsec, and SSL/TLS and email.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the process of the crypto graphic algorithms	K1,K2
2	Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication	K2,K3
3	Apply and analyze appropriate security techniques to solve network security problem	K3,K4
4	Explore suitable cryptographic algorithms	K4,K5
5	Analyze different digital signature algorithms to achieve authentication and design secure applications	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	15 hours

Introduction to Cryptography – Security Attacks – Security Services –Security Algorithm- Stream cipher and Block cipher - Symmetric and Asymmetric-key Cryptosystem Symmetric Key Algorithms: Introduction – DES – Triple DES – AES – IDEA – Blowfish – RC5.

Unit:2	CRYPTOSYSTEM	15 hours

Public-key Cryptosystem: Introduction toNumber Theory-RSA Algorithm–Key Management -Diffie-Hellman Key exchange–Elliptic Curve Cryptography Message Authentication and Hash functions – Hash and Mac Algorithm – Digital Signatures and Authentication Protocol.

Unit:3	NETWORK SECURITY	15 hours

Network Security Practice: Authentication Applications–Kerberos–X.509Authentication services and Encryption Techniques. E-mail Security – PGP – S / MIME – IP Security.

Unit:4	WEB SECURITY	15 hours

Web Security – Secure Socket Layer – Secure Electronic Transaction. System Security - Intruders and Viruses – Firewalls– Password Security.

Unit:5	CASE STUDY	15 hours
Case Study: Implementation of Cryptographic Algorithms–RSA–DSA–ECC(C/JAVA Programming). Network Forensic – Security Audit - Other Security Mechanism: Introduction to: Stenography – Quantum Cryptography – Water Marking - DNA Cryptography		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**75 hours**

	Text Books
1	William Stallings, “Cryptography and Network Security”, PHI/Pearson Education.
2	Bruce Schneir, “Applied Cryptography”, CRC Press.
	Reference Books
1	A.Menezes, P Van Oorschot and S.Vanstone, “Hand Book of Applied Cryptography”, CRC Press, 1997
2	Ankit Fadia, ”NetworkSecurity”, MacMillan.
	Related Online Contents [MOOC,SWAYAM,NPTEL,Websitesetc.]
1	https://nptel.ac.in/courses/106/105/106105031/
2	http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html
3	https://www.tutorialspoint.com/cryptography/index.htm

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	L	S	M	S	M	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong;M-Medium;L-Low

Course code	23MCE3E2	ADVANCED INTERNET OF THINGS	L	T	P	C
Core/Elective/Supportive		DSE-III B	5			3
Pre-requisite		Basics of Sensors & its Applications				

Course Objectives:

The main objectives of this course are to:

1. About Internet of Things where various communicating entities are controlled and managed for decision making in the application domain.
2. Enable students to learn the Architecture of IoT and IoT Technologies
3. Developing IoT applications and Security in IoT, Basic Electronics for IoT, Arduino IDE, Sensors and Actuators Programming NODEMCU using Arduino IDE.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand about IoT, its Architecture and its Applications	K1,K2
2	Understand basic electronics used in IoT & its role	K2,K3
3	Develop applications with Cusing Arduino IDE	K4
4	Analyze about sensors and actuators	K5,K6
5	Design IoT in real time applications using today's internet & wireless technologies	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	15 hours

Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT– Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT

Unit:2	BASIC ELECTRONICS FOR IoT	15hours

Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage – Binary Calculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation.

Unit:3	PROGRAMMING USING ARDUINO	15 hours

Programming Fundamentals with C using Arduino IDE: Installing and Setting up the Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.

Unit:4	SENSORS AND ACTUATORS	13 hours

Sensors and Actuators: Analog and Digital Sensors – Interfacing temperature sensor, ultrasound Sensor and infrared(IR) sensor with Arduino– Interfacing LED and Buzzer with Arduino.

Unit:5	SENSOR DATA IN INTERNET	15 hours

Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (Thing Speak).

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars –webinars

	Total Lecture hours	**75 hours**
Text Books		
1	Arshdeep Bahga, Vijay Madisetti, “Internet of Things :A Hands – On Approach”,2014. ISBN: 978-0996025515	
2	Boris Adryan, Dominik Obermaier, Paul Fremantle, “The Technical Foundations of IoT”, Artech Houser Publishers, 2017.	
ReferenceBooks		
1	Michael Margolis, “Arduino Cook book”, O‟Reilly, 2011	
2	Marco Schwartz, “Internet of Things with ESP8266”, Packt Publishing, 2016.	
3	DhivyaBala,“ESP8266: Step by Step Tutorial for ESP8266IoT, Arduino NODEMCU Dev. Kit”, 2018.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.nptel.ac.in/noc20_cs66/preview	
2	https://www.javatpoint.com/iot-internet-of-things	
3	https://www.tutorialspoint.com/internet_of_things/index.htm	

Mapping with Programming Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	M	M	S	M	S	M	M	S	M
CO2	M	S	M	S	M	S	M	S	S	S
CO3	S	S	S	S	M	S	M	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong;M-Medium;L-Low

Course code	23MCE3SP	DATAMINING USING R Lab	L	T	P	C
Core/Elective/Supportive		SEC-2			5	2
Pre-requisite		Basics of DM Algorithms & R Programming				

Course Objectives:

The main objectives of this course are to:

1. To enable the students to learn the concepts of Data Mining algorithms namely classification, clustering, regression….
2. To understand & write programs using the DM algorithms
3. To apply statistical interpretations for the solutions
4. Able to use visualizations techniques for interpretations

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Able to write programs using R for Association rules, Clustering techniques	K1,K2
2	To implement data mining techniques like classification, prediction	K2,K3
3	Able to use different visualizations techniques using R	K4,K5
4	To apply different data mining algorithms to solve real world applications	K5,K6

K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create

LISTOF PROGRAMS	75 hours

1. Study of basic Syntaxes in R
2. Implementation of vector data objects operations R
3. Implementation of matrix, array and factors and perform various operations in R
4. Implementation and use of data frames in R
5. Create Sample (Dummy) Data in R and perform data manipulation with R
6. Study and implementation of various control structures in R
7. Study and implementation of Data Visualization with ggplot2
8. Implement Apriori algorithm to extract association rule of data mining.
9. Implement k-means clustering technique.
10. Implement any one Hierarchal Clustering.
11. Implement Classification algorithm.
12. Implement DecisionTree.
13. Implement Linear Regression.

Semester-III

Course Code	23MCE3I	Internship/Industrial Activity	L	T	P	C
Core/ Elective/ Supportive						2
Pre-requisite		Basic Programming Skill				

Course Objectives:

The main objectives of this course are to:

1. Gives a chance to train the future workforce as per requirements of the industry, thus reducing the investment cost for training
2. Offers challenges, suitable tasks that will assist the student in turn for achieving the industries and the student's learning goals
3. Gives potential employers an opportunity to identify prospective candidates and evaluate them for later employment
4. Provides opportunities to develop new strategies and plan of action for well-being of society

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1. Develop real-world experience in your field
2. Enhance "soft skills" such as teamwork and attendance critical to success in the workforce
3. Communicate effectively in a variety of professional contexts
4. Learn about workplace issues such as motivation, ethics, and office culture
5. Apply skills learned in courses to real-world experience in a professional setting
6. Reflect upon and document your work and its value with reports and a presentation

Guidelines for internship in Semester – II Summer Vocation

- Internship should be of minimum of **Two** weeks to **Six** weeks duration.
- A student is expected to find internship by himself or herself. However, the institution should assist their students in getting internship in good organizations.
- The home institution cannot be taken as the place of internship.
- A student is expected to devote at least 72 hours physically at the organization.
- Internship can be on any topic covered in the syllabus mentioned in the syllabus, not restricted to the specialization.
- Internship can be done, in one of the following, but not restricted to, types of organizations:
  - Software development firms
  - Hardware/ manufacturing firms
  - Any small-scale industries, service providers like banks
  - Clinics/ NGOs/professional institutions
  - Civic Depts like Ward office/post office/police station/ panchayat.
  - Research Centres/ University Depts/ College as research Assistant for research projects or similar capacities.

Guidelines for making Internship Report and Evaluation in Semester –III

A student is expected to make a report based on the internship he or she has done in an organization. It should contain the following:

- Certificate: A certificate in the prescribed Performa (given in appendix 1) from the organization where the internship done.
- Evaluation form: The form filled by the supervisor or to whom the intern was reporting, in the prescribed Performa (given in appendix 2).
- Title: A suitable title giving the idea about what work the student has performed during the internship.

- Description of the organization: A small description of 1 to 2 pages on the organization where the student has interned
- Description about the activitiesand product-based work done by the section where the intern has worked: A description about the section or cell of the organization where the intern actually worked. This should give an idea about the type of activity a new employee is expected to do in that section of the organization.
- Description of work allotted and actually done by the intern: A detailed description of the work allotted and actual work performed by the intern during the internship period. Intern may give a weekly report of the work by him or her if needed.
- Self-assessment: A self-assessment by the intern on what he or she has learnt during the internship period. It shall contain both technical as well as inter personal skills learned in the process.

Evaluation:

The internship report may be around maximum of 50 pages and this needs to be submitted to the external examiner at the time of University examination during III semester. Internal evaluation (25 marks) based on the following criteria:

- Two Reviews for the intern work – 15 marks
- Report Preparation – 5 marks
- Attendance - 5 marks

External Evaluation:

- Viva-Voce-50 marks + Report – 25 marks = 75 marks

Appendix 1

(Proforma for the certificate for internship in official letter head)

This is to certify that Mr/Ms_____ of _____College/Institution worked as an intern as part of her MSc course in Computer Science of _____(College Name)_____. The particulars of internship are given below:

Internship starting date: _____
Internship ending date: _____
Actual number of days worked: _____
Tentative number of hours worked: _____
Hours Broad area of work: _____

A small description of work done by the intern during the period:

_____
_____
_____
_____
_____
_____

Signature:
Name:
Designation:
Contact number:
Email:

(seal of the organization)

Appendix 2

(Proforma for the Evaluation of the intern by the supervisor/to whom the intern was reporting in the organization)

Professional Evaluation of intern

Name of intern:_____

College/institution:_____

[Note: Give a score in the 1-5 scale by putting √ in the respective cells]

Sr No	Particular	Excellent	Very Good	Good	Moderate	Satisfactory
1	Attendance					
2	Punctuality					
3	Adaptability					
4	Ability to shoulder responsibility					
5	Ability to work in a team					
6	Written and oral communication skills					
7	Problem solving skills					
8	Ability to grasp new concepts					
9	Ability to complete task					
10	Quality of work done					

Comments:

_____

_____

_____

Signature:
Name:
Designation:
Contact number:
Email:

(seal of the organization)

SEMESTER-IV

Course code	23MCE4C1	**Distributed Operating System**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Core-11**	5			5
Pre-requisite		To Discuss about Advanced Operating System.				

Course Objectives:

The main objectives of this course are to:

1. To provide hardware and software issues in modern distributed systems.
2. To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the fundamentals of Distributed Operating System.	K1,K2
2	Know about Encoding and Decoding, Features of Message Passing	K2,K3
3	Understand Remote procedure calss.	K4
4	To understand Distributed Shared Memory and Synchronization	K5,K6
5	To understand Distributed file System.	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	**Fundamentals**	**15 hours**

Fundamentals: What is Distributed Operating System – Evolution of Distributed Computing System – Distributed Computing System Models – Why are Distributed Computing Systems gaining popularity – What is a Distributed Computing System – Issues in Designing Distributed Computing System – Introduction to Distributed Computing Environment.

Unit:2	**Message Passing**	**15 hours**

Message Passing: Introduction – Desirable features – Issues in PC Message Passing – Synchronization – Buffering – Multi datagram Messages – Encoding and Decoding – Process Addressing – Failure Handling – Group Communication

Unit:3	**RPC**	**15 hours**

Remote Procedure Calls: Introduction – The RPC Model – Transparency of RPC – Implementing RPC Mechanism – Stub Generation – RPC Messages – Marshaling Arguments and Results – Server Management – Parameter-Passing Semantics – Call Semantics – Communication protocols for RPCs – Complicated RPCs – Client-Server Binding – Exception Handling – Security – Special Types of RPC – RPC in Heterogeneous Environment – Lightweight RPC – Optimization for Better Performance.

Unit:4	**Distributed Shared Memory and Synchronization**	**15 hours**

Distributed Shared Memory: Introduction – General Architecture of DSM system – Design and Implementation Issues of DSM – Granularity – Structure of Shared Memory – Consistency Models – Replacement Strategy – Thrasing – Other Approaches to DSM – Heterogeneous DSM – Advantages.

Synchronization: Introduction – Clock Synchronization – Event Ordering – Mutual Exclusion – Deadlock – Election Algorithm.

Unit:5	Distributed File System	13 hours
Distributed File System: Introduction – Desirable features – File Models – File Accessing Models – File Sharing Semantics – File Caching Schemes – File Replication – Fault Tolerance – Atomic Transactions – Design Principles.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**75 hours**

	Text Books
1	Pradeep K Sinha, 2014, *Distributed Operating Systems – Concepts and Design*, PHI,
	Reference Books
1	Andrew S Tanenbaum , *Distributed Operating Systems 1e*, , PHI.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.mooc-list.com/tags/distributed-systems
2	https://www.javatpoint.com/distributed-operating-system
3	https://www.geeksforgeeks.org/what-is-a-distributed-system/

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong;M-Medium;L-Low

Course code	23MCE4C2	Artificial Neural Networks	L	T	P	C
Core/Elective/Supportive		Core-12	5			5
Pre-requisite		To Know about ANN				

Course Objectives:

The main objectives of this course are to:

1. To understand the concepts of ANN
2. To learn about Perceptrons, SOM, Statistical mechanics and SVM.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Students will able to understand the concept of ANN	K1,K2
2	Students will able to understand various algorithms related to ANN	K2,K3
3	Students will able to understand Learning Process, Perceptrons	K4
4	Students will able to understand Statistical mechanics	K5,K6
5	Students will able to understand SVM and Principal component analysis	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	Introduction	15 hours

Introduction : Neural Network Definition – Human Brain - Models of a Neuron - Neural Networks Viewed As Directed Graphs - Network Architectures - Knowledge Representation, Artificial Intelligence and Neural Networks – **Learning Process** : Error Correction Learning - Memory Based Learning - Hebbian Learning – Competitive Learning - Boltzmann Learning – Learning With a Teacher – Learning Without Teacher – Memory – Adaption - Statistical Nature Of the Learning Process.

Unit:2	Perceptrons	15 hours

Single Layer Perceptrons : Adaptive Filtering Problem - Unconstrained Optimization Techniques - Linear Least-Square Filters - Least-Mean-Square Algorithm- Learning Curves - Learning Rate Annealing Techniques - Perception Convergence Theorem - **Multilayer Perceptrons :** Back Propagation Algorithm - XOR Problem - Heuristics for Making the Back-Propagation Algorithm Perform Better - Output Representation and Decision Rule

Unit:3	Self-Organization Maps	15 hours

Multilayer Perceptrons : Feature Detection - Hessian Matrix – Generalization – Cross-Validation - Virtues and Limitations Of Back-Propagation Learning.

Self-Organization Maps : Two Basic Feature-Mapping Models - Self Organization Map - SOM Algorithm - Properties of the Feature Map - Computer Simulations - Learning Vector Quantization - Adaptive Patter Classification - Hierarchal Vector Quantization - , Contextual Maps.

Unit:4	Statistical Mechanics and Neurodynamics	15 hours

Statistical Mechanics : Simulated Annealing – Gibbs Sampling – Boltzmann Machine – **Neurodynamics :** Dynamical Systems - Stability of Equilibrium States - Attractors - Neurodynamical Models - Manipulation of Attractors as a Recurrent Network Paradigm – Hopfield Models – Experiments.

Unit:5	SVM and Principal Component Analysis	13 hours
Support Vector Machines : Introduction – Optimal Hyperplane for Linearly Separable Patterns and Non separable Patterns – SVM for Pattern Recognition and Non Linear Regression – **Principal Components Analysis** : Introduction – PCA - Hebbian Based Maximum Eigen filter - Hebbian-Based PCA – Adaptive PCA - Classes of PCA Algorithms – Kernel-Based PCA.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**75 hours**

	Text Books
1	Simon Haykin, 2004, *Neural networks : A comprehensive foundation*, Pearson Education, 2nd Edition.
	Reference Books
1	*Artificial neural networks* - B.Vegnanarayana Prentice Halll of India P Ltd 2005.
2	*Neural networks in Computer intelligence*, Li Min Fu TMH 2003.
3	*Neural networks* James A Freeman David M S kapura Pearson Education 2004.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.mooc-list.com/tags/artificial-neural-networks
2	https://www.javatpoint.com/artificial-neural-network
3	https://www.geeksforgeeks.org/artificial-neural-networks-and-its-applications/

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong;M-Medium;L-Low

Course code	23MCE4PR	Project with Viva-Voce	L	T	P	C
Core/Elective/Supportive		Core-13			10	6
Pre-requisite		To gain knowledge about technological components				

Course Objectives:

The students will be allowed to work on any project based on the concepts studied in core/elective courses.
The project work should be compulsorily done in the college only under the supervision of the department staff.
The Individual project shall be undertaken by the student.
Each Project should be equally assigned to existing Staff members.
The following list of parameters taken into account for the evaluation of Project work and Viva-voce. Total Marks: 200 (Internal: 50 marks, External: 150 Marks)

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
CO1	be able to recognize the technological recent trends of computer science.	PO1
CO2	Students will gain knowledge about technological components of the softwares	PO1, PO2

Contents	No. of Hours

Parameters:

For Internal Marks:

Two review meetings -	2 × 10 = 20 Marks
Execution	= 20 Marks
Outcome Presentation	= 10 Marks
Total	= 50 Marks

For External Marks:

Project Report	= 50 Marks
Project demo &Presentation	= 50 Marks
Viva-Voce	= 50 Marks
Total	= 150 Marks

Total	150 hours

Course code	23MCE4E1	Parallel Processing	L	T	P	C
Core/Elective/Supportive		DSE-IV A	5			4
Pre-requisite		To Discuss about Parallel Processing				

Course Objectives:

The main objectives of this course are to:

1. To familiarize students with the fundamental concepts, techniques and tools of parallel computing.
2. To expose students to basic techniques of parallel algorithm development and programming on different parallel platform

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand about Basics of Parallel Processing	K1,K2
2	Understand about Architectures	K2,K3
3	Understand about Parallel Programming	K4
4	Understand about Parallel Programming design	K5,K6
5	Understand about Memory multiprocessor system	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	Introduction	15 hours

Introduction: Computational demands of Parallel Processing – Mechanisms of implementing parallel processing – parallel processing terminologies – Major issues in parallel processing

Unit:2	Parallel Architectures	15 hours

Parallel Architectures: Loosely Coupled systems – tightly coupled systems – Interconnection networks – Linear and Ring, Shuffle Exchange, Two Dimensional Mesh, Hybercube.

Unit:3	Parallel Programming	15 hours

Principles of Parallel Programming: Precedence Graph of a process – Data, control, Temporal Parallelism – Message passing versus shared address space – Mapping Granularity.

Unit:4	Principles of Parallel Algorithm design	15 hours

Principles of Parallel Algorithm design: Design approaches – design issues – performance measures and analysis – Complexities – Anomalies in parallel Algorithms, case study – parallel search algorithms.

Unit:5	Shared memory multiprocessor systems:	13 hours

Shared memory multiprocessor systems: Shared bus, Cross bar, Multiport memory – memory contention and Arbitration Techniques – Cache Coherance, Handling shared variables.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	75 hours

Text Books	
1	Seyed H Roosta, 2001 , "*Parallel Programming and Parallel Algorithms"* Springer Series New York
Reference Books	
1	Barry Wilkinson, 2002 , "*Parallel Programming"* Pearson Education USA.
2	Kai Hwang and Feye A Briggs 2001, *"Computer Architecture and Parallel Processing "* Tata McGraw Hill, New Delhi
3	Michael J Quinn, 2003, "*Parallel Computing Theory and Practice"* McGraw Hill Second Edition Singapore
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.mooc-list.com/tags/parallel-computing
2	https://www.javatpoint.com/parallel-processing
3	https://www.geeksforgeeks.org/what-is-parallel-processing/

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong;M-Medium;L-Low

Course code	23MCE4E2	Cyber Security	L	T	P	C
Core/Elective/Supportive		DSE-IV B	5			4
Pre-requisite		To Discuss about Cyber Security and their standards				

Course Objectives:

The main objectives of this course are to:

- To understand the basics of Cybercrime and Computer forensics with protecting mechanism
- To explore the working principles of WLAN, Email and Smartphone along with securi mechanism and guidelines
- To gain the ability to understand the importance of cyber investigations with its functioni role and learn the basics of Wi Fi and its security measures
- To understand and learn the method of seize the digital evidence
- To learn and analyze the concepts of digital forensics with cybercrime prevention techniques

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	To understand the basics of Cybercrime and Computer forensics with protecting mechanism	K1,K2
2	To explore the working principles of WLAN, Email and Smartphone along with security mechanism and guidelines	K2,K3
3	To gain the ability to understand the importance of cyber investigations with its functioning role and learn the basics of Wi Fi and its security measures	K4
4	To understand and learn the method of seize the digital evidence	K5,K6
5	To learn and analyze the concepts of digital forensics with cybercrime prevention techniques	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	Introduction to cybercrime	15 hours

Introduction to cybercrime: Classification of cybercrimes – reasons for commission of cybercrime malware and its type – kinds of cybercrime – authentication – encryption – digital signatures antivirus – firewall – steganography – computer forensics – why should we report cybercrime introduction counter cyber security initiatives in India – generating secure password – usi password manager-enabling two-step verification – security computer using free antivirus.

Unit:2	Tips for buying online	15 hours

Tips for buying online: Clearing cache for browsers – wireless LAN-major issues with WLAN-sa browsing guidelines for social networking sites – email security tips – introduction-smart pho security guidelines – purses, wallets, smart phones – platforms, setup and installation-communicati securely with a smart phone.

Unit:3	Cyber investigation roles	15 hours

Cyber investigation roles**:** Introduction – role as a cybercrime investigator – the role of la enforcement officers – the role of the prosecuting attorney – incident response: introduction-po mortem versus live forensics – computer analysis for the hacker defender program-network analys

– legal issues of intercepting Wi-Fi transmission – Wi-Fi technology – Wi-Fi RF-scanning RF eavesdropping on Wi-Fi – fourth amendment expectation of privacy in WLAN.		
Unit:4	**Seizure of digital information**	**15 hours**
Seizure of digital information: introduction – defining digital evidence – digital evidence seizu methodology – factors limiting the wholesale seizure of hardware – other options for seizing digit evidence – common threads within digital evidence seizure – determining the most appropria seizure method– conducting cyber investigations–demystifying computer/cyber crime – IP address – the explosion of networking – interpersonal communication.		
Unit:5	**Digital forensics and analyzing data**	**13 hours**
Digital forensics and analyzing data: introduction – the evolution of computer forensics–phases digital forensics-collection – examination-analysis – reporting – Cyber crime preventio Introduction – crime targeted at a government agency.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**75 hours**

Text Books	
1	Dr.JeetendraPande, **"**Introduction to Cyber Security" Published by Uttarakhand Ope University, 2017.(Chapter: 1.2-6.4,9.3-12.
2	Anthony reyes, Kevin o'shea, Jim steele, Jon R. Hansen, Captain Benjamin R. Jean Thom Ralph, "Cyber-crime investigations" - bridging the gaps between security professionals, la enforcement, and prosecutors, 2007.(Chapter: 4, 5, 6, 7, 8, 9,10)
Reference Books	
1	Sebastian Klipper, "Cyber Security" EinEinblickfur Wirtschafts wissens chaftler Fachmedien Wiesbaden,2015
2	John G.Voller Black and Veatch, "Cyber Security" Published by John Wiley & Sons, Inc., Hoboken, New Jersey Published simultaneously in Canada ©2014.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.mooc-list.com/tags/cybersecurity
2	https://www.javatpoint.com/cyber-security-tutorial
3	https://www.geeksforgeeks.org/cyber-security-tutorial/

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong;M-Medium;L-Low

Course code	23MCE4S1	Robotics	L	T	P	C
Core/Elective/Supportive		SEC-3	5			2
Pre-requisite		To know about basic concepts of Robotics				

Course Objectives:

The main objectives of this course are to:

1. understand the robotics fundamentals
2. understand the sensors and matrix methods
3. understand the Localization: Self-localizations and mapping
4. study about the concept of Path Planning, Vision system
5. To learn about the concept of robot artificial intelligence

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Describe the different physical forms of robot architectures.	K1,K2
2	Kinematically model simple manipulator and mobile robots.	K2,K3
3	Mathematically describe a kinematic robot system	K4
4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	K5,K6
5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty.	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	Introduction	15 hours

Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.

Unit:2	Actuators and sensors & Kinematics	15 hours

Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors

Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot

Unit:3	Localization	15 hours

Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.

Unit:4	Path Planning and Vision System	15 hours

Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies

Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations

Unit:5	Applications	13 hours
Application: Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning-etc.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**75 hours**

	Text Books
1	Richared D.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001
2	Saeed B.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011
	Reference Books
1	Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008
2	Robotics technology and flexible automation by S.R.Deb, THH-2009
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
3	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm
	https://www.geeksforgeeks.org/robotics-introduction/

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong;M-Medium;L-Low