SRI MEENAKSHI GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS)
MADURAI – 625 002.

PG AND RESEARCH DEPARTMENT OF COMPUTER SCIENCE

M.Sc. COMPUTER SCIENCE

SYLLABUS TO BE INTRODUCED FROM THE ACADEMIC YEAR 2023 – 2024 (UNDER C.B.C.S)

M.Sc., Computer Science

Course Code	Title of the Course	Credits	Hours	Maximum Marks		
				CIA	ESE	Total
FIRST SEMESTER						
P23CS1	Analysis & Design of Algorithms	6	6	25	75	100
P23CS2	Object Oriented Analysis and Design & C++	6	6	25	75	100
P23CS3P	Algorithms And OOPS Lab	4	6	25	75	100
P23DS01P	Python Programming Lab	3	6	25	75	100
P23DS02	Python Programming	3	6	25	75	100
	Total	22	30	-	-	-

Course Code	Title of the Course	Credits	Hours	Maximum Marks		
				CIA	ESE	Total
SECOND SEMESTER						
P23CS4	Data Mining And Warehousing	5	6	25	75	100
P23CS5	Advanced Java Programming	5	6	25	75	100
P23CS6P	Advanced Java Programming Lab	4	6	25	75	100
P23DS03	Artificial Intelligence and Machine Learning	3	5	25	75	100
P23DS04	Advanced OS	3	5	25	75	100
P23SES1P	VB.NET Lab	2	2	25	75	100
	Total	22	30	-	-	-

Course Code	Title of the Course	Credits	Hours	Maximum Marks		
				CIA	ESE	Total
THIRD SEMESTER						
P23CS7	Cloud Computing	5	6	25	75	100
P23CS8	Digital Image Processing	5	6	25	75	100
P23CS9P	Digital Image	4	6	25	75	100

Course Code	Title of the Course	Credits	Hours	CIA	ESA	Total
	Processing using MATLAB Lab					
P23CS10	Statistical Computing	3	5	25	75	100
P23DS05	Network Security and Cryptography	3	5	25	75	100
P23SES2P	Multimedia Tools Lab	2	2	25	75	100
P23SIS1	Internship / Industrial Activity	2	-			100
Total		24	30	-	-	-

Course Code	Title of the Course	Credits	Hours	Maximum Marks		
				CIA	ESA	Total
FOURTH SEMESTER						
P23CS11	Data Science & Analytics	5	6	25	75	100
P23CS12	Internet of Things	5	6	25	75	100
P23SPW	Project work and Viva-Voce	7	10	60	40	100
P23DS06P	Data Analytics with R, Mongodb & Technical Documentation using Latex Lab	3	5	25	75	100
P23SES3 P23SES4 P23SES5	NET / UGC - CSIR/ SET/TRB Competitive Examinations [OR] General Studies for UPSC / TNPSC / Other Competitive Examinations [OR] Advanced Research Studies on Computer Science	2	3	25	75	100
P23EAS	Extension Activity	1	-	-	-	-
Total		23	30	-	-	-
Grand Total		91				

COURSE STRUCTURE ABSTRACT

For M.A./M.Com./M.Sc./MCA

Courses	Total No. of Courses	Hours	Credits	Marks
Core Courses	12	69	57	1200
Core Project with Vivavoce	1	10	7	100
Generic Elective Course/ Discipline Specific Elective Courses	6	30	18	600
Skill Enhancement Courses	3	7	6	300
Internship/IndustrialActivity	1	--	2	100
ExtensionActivity	1	--	1	100
Total	**24**	**120**	**91**	**2400**

M.SC COMPUTER SCIENCE

EVALUATION PATTERN FOR PG PROGRAMME

Theory Paper:

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	50%	50%
UNDERSTANDING	30%	30%
APPLY	20%	20%

Internal Evaluation:

Test Average of Best Two Internals Model Exam	10 10
Quiz/Assignment/Seminar	5
Total	25

INTERNAL EVALUATION :25
EXTERNAL EVALUATION :75
TOTAL : 100

INTERNAL : NO MINIMUM
EXTERNAL : 45% OF 75 = 34
INTERNAL&EXTERNAL : 50%

Question paper pattern for External Examination :

Section A	**(Internal choice - either/or)** 5 x 5 = 25	25
Section B	**(Internal choice - either/ or)** 5 x 10 = 50	50
	Total	75

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PG AND RESEARCH DEPARTMENT OF COMPUTER

SCIENCE M.SC COMPUTER SCIENCE

EVALUATION PATTERN FOR PG PROGRAMME

Practical Paper :

Internal Evaluation :

Record	5
Viva-Voce	5
Internal Practical Exam	10
Model Exam	5
Total	25

INTERNAL EVALUATION - 25
EXTERNAL EVALUATION - 75
        TOTAL -100

INTERNAL : NO MINIMUM
EXTERNAL : 45% OF 60 = 27
INTERNAL& EXTERNAL TOGETHER : 50%

Project Paper :

Internal	60
External - Viva-Voce	40
Total	100

1. Evaluation Pattern for Project shall be as follows:

The 60 marks for internals can be given for three reviews of 20 marks each.

Review 1

Problem Selection/	Methodology/ Technology used	Effective content delivery	Interaction/ Answering questions	Total

Choice of the Topic				
5	5	5	5	20

Review- II

Work Progress	Development of ideas	Effective content delivery	Interaction/ Answering questions	Total
5	5	5	5	20

Review- III

Final outcome of the project	Implementation & execution	Effective content delivery	Interaction/ Answering questions	Total
5	5	5	5	20

Evaluation criteria for External (40 marks):

Organisation of ideas	Effective content delivery	Report	Total
10	10	20	40

List of Elective Courses

1. **MULTIMEDIA AND ITS APPLICATIONS**

2. **EMBEDDED SYSTEMS**

3. **INTERNET OF THINGS**

4. **CRITICAL THINKING, DESIGN THINKING AND PROBLEM SOLVING**

5. **MOBILE COMPUTING WEB SERVICES**

6. **BLOCK CHAIN TECHNOLOGY**

7. **WEB SERVICES**

8. **ROBOTIC PROCESS AUTOMATION FOR BUSINESS**

	CC1	ANALYSIS & DESIGN OF ALGORITHMS	L	T	P	C
Course code						
Core/Elective/Supportive		Core	6	-	-	6
Pre-requisite		Basic Data Structures & Algorithms	CIA 25		ESE 75	

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. Discuss various methods like Basic Traversal And Search Techniques, divide and conquer 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 backtracking & 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	15hours

Introduction: - Algorithm Definition and Specification – Space complexity-Time Complexity-Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree - Binary Search Tree - Heap – Heapsort- Graph.

Unit:2	TRAVERSAL AND SEARCH TECHNIQUES	15hours

Basic Traversal And Search Techniques: Techniques for Binary Trees-Techniques for Graphs -Divide and Conquer: - General Method – Binary Search – Merge Sort – Quick Sort.

Unit:3	GREEDY METHOD	15hours

TheGreedyMethod:-GeneralMethod–KnapsackProblem–MinimumCostSpanningTree– Single Source Shortest Path.

Unit:4	DYNAMIC PROGRAMMING	15hours

DynamicProgramming-GeneralMethod–MultistageGraphs–AllPairShortestPath–Optimal Binary Search Trees – 0/1 Knapsacks – Traveling Salesman Problem – Flow Shop Scheduling.

Unit:5	BACKTRACKING	13hours

Backtracking:-GeneralMethod–8-QueensProblem–SumOfSubsets–GraphColoring– Hamiltonian Cycles – Branch And Bound: - The Method – Traveling Salesperson.

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

Version

	Total Lecture hours	75hours

Text Books

1	Ellis Horowitz,"Computer Algorithms",Galgotia Publications.
2	AlfredV.Aho,JohnE.Hopcroft,JeffreyD.Ullman,"DataStructuresandAlgorithms".

Reference Books

1	Goodrich,"DataStructures&AlgorithmsinJava",Wiley3rd edition.
2	Skiena,"TheAlgorithmDesignManual",SecondEdition,Springer,2008
3	AnanyLevith,"IntroductiontotheDesignandAnalysisofalgorithm",PearsonEducation Asia, 2003.
4	Robert Sedgewick,Phillipe Flajolet,"AnIntroductiontotheAnalysisofAlgorithms", Addison-Wesley Publishing Company,1996.

Related Online Contents [MOOC,SWAYAM,NPTEL,Websitesetc.]

1	https://nptel.ac.in/courses/106/106/106106131/
2	https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
3	https://www.javatpoint.com/daa-tutorial

Mapping with Programming Outcomes

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

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

I – SEMESTER

Course code	CC2	OBJECT ORIENTED ANALYSIS AND DESIGN & C++	L	T	P	C
Core/Elective/Supportive		Core	6	-	-	6
Pre-requisite		Basics of C++ and Object Oriented Concepts	CIA 25		ESE 75	

Course Objectives:

The main objectives of this course are to:

1. Present the object model, classes and objects, object orientation, machine view and model management view.
2. Enables the students to learn the basic functions, principles and concepts of object oriented analysis and design.
3. Enable the students to understand C++ language with respect to OOAD

Expected Course Outcomes:

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

1	Understand the concept of Object-Oriented development and modeling techniques	K1,K2
2	Gain knowledge about the various steps performed during object design	K2,K3
3	Abstract object-based views for generic software systems	K3
4	Link OOAD with C++ language	K4,K5
5	Apply the basic concept of OOPs and familiarize to write C++ program	K5,K6

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

Unit:1	OBJECTMODEL	15hours

The Object Model: The Evolution of the Object Model – Elements of the Object Model – Applying the Object Model. Classes and Objects: The Nature of an Object – Relationship among Objects**.**

Unit:2	CLASSESANDOBJECTS	15hours

Classes and Object: Nature of Class – Relationship Among classes – The Interplay of classes and Objects. Classification: The importance of Proper Classification –identifying classes and objects –Key Abstractions and Mechanism.

Unit:3	C++INTRODUCTION	15hours

IntroductiontoC++-InputandoutputstatementsinC++-Declarations-controlstructures– Functions in C++.

Unit:4	INHERITANCEANDOVERLOADING	13hours

ClassesandObjects–ConstructorsandDestructors–operatorsoverloading–Type Conversion-Inheritance – Pointers and Arrays.

Unit:5	POLYMORPHISMANDFILES	15hours

MemoryManagementOperators-Polymorphism–Virtualfunctions–Files–Exception Handling – String Handling -Templates.

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

Text Books	
1	"Object Oriented Analysis and Design with Applications", Grady Booch, Second Edition, Pearson Education.
2	"Object-OrientedProgrammingwithANSI&TurboC++",AshokN.Kamthane,First Indian Print -2003, Pearson Education.
Reference Books	
1	Balagurusamy"ObjectOrientedProgrammingwithC++",TMH,SecondEdition,2003.
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	S	M	S	M	S	M	S	S
CO2	S	S	S	M	S	M	S	M	S	S
CO3	S	S	S	M	S	M	S	M	S	S
CO4	S	S	S	M	S	M	S	M	S	S
CO5	S	S	S	M	S	M	S	M	S	S

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

Course code	CC3(P)	**ALGORITHMS AND OOPS LAB**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		Elective	-	-	6	4
Pre-requisite		Basic Programming of C++language	**CIA 25**		**ESE 75**	

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

LISTOF PROGRAMS	**75hours**

1) Write a program to solve the tower of Hanoi using recursion.

2) Write a program to traverse through binary search tree using traversals.

3) Write a program to perform various operations on stack using linked list.

4) Write a program to perform various operation in circular queue.

5) Write a program to sort an array of an elements using quick sort.

6) Write a program to solve number of elements in ascending order using heap sort.

7) Write a program to solve the knapsack problem using greedy method

8) Write a program to search for an element in a tree using divide& conquer strategy.

9) Write a program to place the 8 queens on an8X8 matrix so that no two queens Attack.

10) Write a C++ program to perform Virtual Function

11) Write a C++ program to perform Parameterized constructor

12) Write a C++ program to perform Friend Function

13) Write a C++ program to perform Function Overloading

14) Write a C++ program to perform Single Inheritance

15) Write a C++ program to perform Employee Details using files.

	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

Course code	GEC/ DSEC1	**PYTHON PROGRAMMING LAB**	L	T	P	C
Core/Elective/Supportive		**Core**			6	3
Pre-requisite		Basics of any OOP Programming Language	**CIA 25**		**ESE 75**	

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	

LISTOF PROGRAMS	75 hours

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.

	Total Lecture hours	75hours

Text Books

1	BillLubanovic,"Introducing Python",O'Reilly,FirstEdition-SecondRelease,2014.
2	MarkLutz,"Learning Python", O'Reilly,FifthEdition, 2013.

Reference Books

1	David M. Beazley,"Python Reference", Developer's Library, Fourth Essential Edition,2009.
2	SheetalTaneja,Naveen Kumar, "Python Programming-A Modular Approach",PearsonPublications.

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

Where T-Theory and L-Lab

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

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

Coursecode	GEC/DSEC2	PYTHONPROGRAMMING	L	T	P	C
Core/Elective/Supportive		**Elective**	6			3
Pre-requisite		BasicsofanyOOProgrammingLanguage				

CourseObjectives:

Themain objectivesof thiscourseareto:

1. PresentsanintroductiontoPython,creationofwebapplications,networkapplicationsand working in the clouds
2. UsefunctionsforstructuringPython programs
3. UnderstanddifferentDataStructuresofPython
4. RepresentcompounddatausingPythonlists,tuplesanddictionaries

ExpectedCourseOutcomes:

	Onthesuccessfulcompletionofthecourse,studentwillbeableto:	
1	UnderstandthebasicconceptsofPythonProgramming	K1,K2
2	UnderstandFileoperations,Classesand Objects	K2,K3
3	AcquireObject OrientedSkills inPython	K3,K4
4	Developweb applicationsusingPython	K5
5	DevelopClientServerNetworking applications	K5,K6

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

Unit:1	INTRODUCTION	15hours

Python: Introduction–Numbers–Strings–Variables–Lists–Tuples–Dictionaries–Sets– Comparison.

Unit:2	CODESTRUCTURES	15hours

Code Structures: if, elif, and else – Repeat with while – Iterate with for – Comprehensions – Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try and except – User Exceptions.

Unit:3	MODULES,PACKAGESANDCLASSES	15hours

Modules, Packages, and Programs: Standalone Programs – Command-Line Arguments – Modules and the import Statement – The Python Standard Library. **Objects and Classes:** Define a Class with class – Inheritance – Override a Method – Add a Method – Get Help from Parent withsuper–InselfDefense –GetandSetAttributeValueswithProperties –NameManglingfor Privacy – Method Types – Duck Typing – Special Methods –Composition.

Unit:4	DATATYPESANDWEB	13hours

DataTypes: TextStrings–BinaryData.**StoringandRetrievingData:**FileInput/Output– Structured Text Files – Structured Binary Files - Relational Databases – NoSQL Data Stores.

Web: WebClients –Web Servers–WebServicesand Automation

Unit:5	SYSTEMSANDNETWORKS	15hours

Systems: Files–Directories–ProgramsandProcesses–CalendarsandClocks.

Concurrency: Queues– Processes–Threads–GreenThreadsandevent–twisted–Redis.

Networks: Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – ZeroMQ –Internet Services – Web Services and APIs – Remote Processing – Big Fat Data and MapReduce – Working in the Clouds.

Unit:6	ContemporaryIssues	2 hours
	Expertlectures,onlineseminars –webinars	

	TotalLecturehours	**75hours**

Text Books

1	BillLubanovic,"IntroducingPython",O'Reilly,FirstEdition-SecondRelease,2014.
2	MarkLutz,"LearningPython", O'Reilly,FifthEdition, 2013.

ReferenceBooks

1	David M. Beazley,"Python Reference", Developer's Library, Fourth Essential Edition,2009.
2	SheetalTaneja,Naveen Kumar, "Python Programming-A Modular Approach",PearsonPublications.

RelatedOnlineContents[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

MappingwithProgrammingOutcomes										
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

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

II – SEMESTER

Course code	CC4	DATAMINING AND WAREHOUSING	L	T	P	C
Core/Elective/Supportive		Core	6	-	-	5
Pre-requisite		Basics of RDBMS &Algorithms	**CIA 25**		**ESE 75**	

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 ware house 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	**BASICSANDTECHNIQUES**	**15 hours**

Basic data mining tasks – data mining versus knowledge discovery in databases – data mining issues – data mining metrics – social implications of data mining – data mining from a database perspective.

Data mining techniques: Introduction – a statistical perspective on data mining – similarity measures – decision trees – neural networks – genetic algorithms.

Unit:2	**ALGORITHMS**	**13 hours**

Classification: Introduction –Statistical –based algorithms -distance–based algorithms-decision tree-basedalgorithms-neuralnetwork–basedalgorithms–rule-basedalgorithms–combining techniques.

Unit:3	**CLUSTERING AND ASSOCIATION**	**15 hours**

Clustering: Introduction–Similarity and Distance Measures–Outliers–Hierarchical Algorithms -Partitional Algorithms.

Association rules: Introduction - large item sets - basic algorithms – parallel &distributed algorithms – comparing approaches- incremental rules – advanced association rules techniques – measuring the quality of rules.

Unit:4	DATA WAREHOUSING AND MODELING	15 hours
Data ware housing: introduction- characteristics of a data ware house– data marts–other aspects		

Of data mart. Online analytical processing: introduction –OLTP & OLAP systems

Data modeling –star schema for multidimensional view –data modeling – multifact star schema or snow flake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.

Unit:5	APPLICATIONSOFDATA WAREHOUSE	15 Hours
Developing a data WAREHOUSE: why and how to build a data warehouse –data warehouse architectural strategies and organization issues - design consideration – data content – metadata distribution of data – tools for data warehousing – performance considerations – crucial decisions in designing a data warehouse. Applications of data warehousing and data mining in government: Introduction - national data warehouses – other areas for data warehousing and data mining.		

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

	Total Lecture hours	**75 hours**

Text Books

1	MargaretH.Dunham,"DataMining:IntroductoryandAdvancedTopics",Pearson education,2003.
2	C.S.R. Prabhu, "Data Warehousing Concepts, Techniques, Products and Applications", PHI, Second Edition.

Reference Books

1	ArunK.Pujari,"Data Mining Techniques", Universities Press(India)Pvt. Ltd.,2003.
2	AlexBerson,StephenJ.Smith,"DataWarehousing,DataMiningandOLAP",TMCH, 2001.
3	Jiawei Han & Micheline Kamber, "Data Mining Concepts &Techniques", 2001, Academic press.

Related Online Contents[MOOC,SWAYAM,NPTEL,Websitesetc.]

1	https://www.javatpoint.com/data-warehouse
2	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/
3	https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html

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	CC5	ADVANCED JAVA PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Core	6	-	-	5
Pre-requisite		Basics of Java & its Usage	CIA 25		ESE 75	

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	BASICSOFJAVA	15 hours

JavaBasicsReview:Componentsandeventhandling–Threadingconcepts–Networkingfeatures – Media techniques

Unit:2	REMOTEMETHOD 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	15 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	13 hours

JARfileformatcreation–Internationalization–SwingProgramming–Advancedjava		
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",TataMcGrawHillPublishingCompanyLtd,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	**CC6(P)**	**ADVANCED JAVA POGRAMMNING LAB**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		Core	-	-	6	4
Pre-requisite		Basics in Java Programming	**CIA 25**		**ESE 75**	
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	**75 hours**

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 calculate or application.
12. Programtosendatextmessagetoanothersystemandreceivethetextmessagefromthe system (use socket programming).

Expert lectures, online seminars –webinars

Total Lecture hours	**75 hours**

	Text Books
1	Jamie Jaworski,"Java Unleashed",SAMSTechmediaPublications,1999.
2	Campione, Walrath and Huml,"TheJavaTutorial",AddisonWesley,1999.

	Reference Books
1	Jim Keogh,"The Complete Reference J2EE",Tata McGraw Hill Publishing Company Ltd,2010.
2	DavidSawyerMcFarland,"JavaScriptAndJQuery-TheMissingManual",Oreilly Publications, 3rd Edition,2011.

	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	M	S	S	S	M	M	S	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S

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

Course code	GEC/DSEC6	ARTIFICIALINTELLIGENCE& MACHINE LEARNING	L	T	P	C
Core/Elective/Supportive		**Elective**	5	-	-	3
Pre-requisite		Basics of AI & an Introduction about ML	**CIA 25**		**ESE 75**	

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	**SEARCHTECHNIQUES**	**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	**PREDICATELOGIC**	**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**

UnderstandingMachineLearning:WhatIsMachineLearning?-DefiningBigData-BigDatain ContextwithMachineLearning-TheImportanceoftheHybridCloud-LeveragingthePowerof 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**	**13 hours**

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 Richand Kevin Knight," Artificial Intelligence", Tata McGraw Hill Publishers company Pvt Ltd, Second Edition, 1991.
2	GeorgeFLuger,"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	GEC/DSEC 4	ADVANCED OPERATING SYSTEMS	L	T	P	C
Core/Elective/Supportive		Elective	5	-	-	3
Pre-requisite		Basics of OS & its functioning	CIA 25		ESE 75	

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the different types of operating systems and their functioning.
2. Gain knowledge on Distributed Operating Systems
3. Gain insight into the components and management aspects of real time and mobile operating systems.
4. Learn case studies in Linux Operating Systems

Expected Course Outcomes:

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

1	Understand the design issues associated with operating systems	K1,K2
2	Master various process management concepts including scheduling, deadlocks and distributed file systems	K3,K4
3	Prepare Real Time Task Scheduling	K4,K5
4	Analyze Operating Systems for Handheld Systems	K5
5	Analyze Operating Systems like LINUX and iOS	K5,K6

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

Unit:1	BASICSOFOPERATINGSYSTEMS	18 hours

Basics of Operating Systems: What is an Operating System? – Main frame Systems –Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems –Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments -Process Scheduling – Cooperating Processes – Inter Process Communication- Deadlocks –Prevention – Avoidance – Detection – Recovery.

Unit:2	DISTRIBUTEDOPERATINGSYSTEMS	15 hours

Distributed Operating Systems: Issues – Communication Primitives – Lamport‟s Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues – Case studies – The Sun Network File System-Coda.

Unit:3	REALTIMEOPERATINGSYSTEM	15 hours

Realtime Operating Systems : Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling

Unit:4	HANDHELDSYSTEM	15 hours

OperatingSystemsforHandheldSystems:Requirements–TechnologyOverview–Handheld
OperatingSystems–PalmOS-SymbianOperatingSystem-Android–Architectureofandroid–

Securinghandheld systems	

Unit:5	CASE STUDIES	10 hours

Case Studies : Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS : Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

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

	Text Books
1	AbrahamSilberschatz;PeterBaerGalvin;GregGagne,"OperatingSystemConcepts", Seventh Edition, John Wiley & Sons, 2004.
2	Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems –Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.

	Reference Books
1	RajibMall,"Real-Time Systems:TheoryandPractice",PearsonEducationIndia,2006.
2	Pramod Chandra P.Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.
3	Daniel.P.Bovet&MarcoCesati,"UnderstandingtheLinuxkernel",3rdedition,O"Reilly,2005
4	NeilSmyth,"iPhoneiOS4DevelopmentEssentials–Xcode",FourthEdition,Payload media, 2011.

	Related Online Contents [MOOC,SWAYAM,NPTEL,Websitesetc.]
1	https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2	https://www.udacity.com/course/advanced-operating-systems--ud189
3	https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf

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	M	S	S	S	S	S	M	S	M
CO3	S	M	S	S	S	S	S	M	S	M
CO4	S	M	S	S	S	S	S	M	S	M
CO5	S	M	S	S	S	S	S	M	S	M

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

Course code	SEC 2	VB.NET LAB	L	T	P	C
Core/Elective/Supportive		**Skill Enhancement course**	-	-	2	2
Pre-requisite			**Int 25**		**Ext 75**	

Course Objectives:

The main objectives of this course are to:
1. On completion of this course, students will
2. To create web applications and implement various controls
3. Create web pages in Rich control.
4. Develop knowledge about file handling operations
5. To develop a software to solve real-world problems using VB.NET

Expected Course Outcomes:

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

1	To learn BasicOperations	K1,K2
2	To able to know WorkingwithHOTSPOT images	K2,K3
3	To able to know Workingwith files	K4
4	To able to know Workingwith AJAX	K4,K5
5	Workingwithcookies in real time application	K5,K6

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

	LIST OF PROGRAMS	**45 hours**

WORKING WITH WEB CONTROLS
1. Creation of online shopping website using label, list, combo, text and table web controls

WORKING WITH HOT SPOT
2. Creating HOT SPOT in image and linking an image with many web pages

WORKING WITH DATA BASE
3. Student Mark list processing
4. Employee Pay roll processing
5. Working with disconnected data model

DATA BINDING CONCEPT
6. Working with repeated data binding concept

WORKING WITH FILES
7. Working with file & directory supporting concepts

WORKING WITH XML
8. Creation of XML, Searching for a tag & binding XML data in data grid

WEB SERVICES
9. Arithmetic operations
10. Temperature conversion

Working with AJAX and adrotator contol
11. Illustrate the use of AJAX in showing advertisements in repeated way based on weightage assigned to each advertisement.

WORKING with Validator controls
12. Validating values entered by the user in bio-data form

WORKING WITH STATE MANAGEMENT SUPPORT OF .NET
13. Creation and using cookies in banking application
14. Transferring information and preparing ticket in flight reservation system.
15. Creating session for every user and maintains his state information.

		Total Lecture hours	**45 hours**

Text Books
1	SvetlinNakov, VeselinKolev& Co, Fundamentals of Computer Programming with C#, Faber publication,2019.

Related Online Contents [MOOC,SWAYAM,NPTEL,Websitesetc.]
1	Herbert Schildt, The Complete Reference C#.NET, TataMcGraw-Hill,2017.
2	Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dreamtech pres,2013.
3	Anne Boehm, Joel Murach, Murach's C# 2015, Mike Murach& Associates Inc.2016.

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	M	S	M	M	M	S
CO2	S	S	S	S	M	S	M	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	CC7	CLOUD COMPUTING	L	T	P	C
Core/Elective/Supportive		**Core**	6	-	-	5
Pre-requisite		Basics of Cloud & its Applications	**CIA 25**		**ESE 75**	

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	CLOUDCOMPUTING	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	CLOUDSERVICES	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	OUTSIDETHECLOUD	15 hours

OUT SIDE 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	CC8	DIGITAL IMAGE PROCESSING	L	T	P	C
Core/Elective/Supportive		Core	6	-	-	5
Pre-requisite		Basics of Image Processing	CIA 25		ESE 75	

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

Overview of Image Processing - Nature of Image Processing - Digital Image Representation-Types of Images-Based on Nature - Based on Attributes - Based on Colour - Based on Dimensions-Based on Data Types - Domain Specific Images- Digital Image Processing Operations - Fundamental Steps In Image Processing - Image Enhancement - Image Restoration - Image Compression - Image Analysis – Image Synthesis. **Digital Imaging Systems**: Overview of Digital Imaging Systems-Image Sensors-Image Storage-Image processors - Output Devices-Networking Components - Image Processing Software - Physical Aspects of Image Acquisition-Nature of Light-Simple Image Model - Colour Fundamentals -Lighting System Design-Simple Image Formation Process - Biological Aspects of Image Acquisition - Human Visual System - Properties of Human Visual System - Monochrome and Colour Image - Review of Digital Cameras-Sampling and Quantization - Sampling - Resampling - Image Quantization - Image Display Devices and Device Resolution - Digital Halftone Process - Random Dithering - Ordered Dithering - Non - periodic Dithering - Image Storage and File Formats - Need for File Formats -Types of File Formats - Structures of File Formats.

Unit:2	DIGITAL IMAGE PROCESSING OPERATIONS	17 hours

Basic Relationships and Distance Metrics - Image Coordinate System - Image Topology - Connectivity - Relations - Distance Measures - Important Image Characteristics - Classification of Image Processing Operations - Arithmetic Operations. Logical Operations - Geometrical Operations - Image Interpolation Techniques - Set Operations. **Digital Image Transforms:**Need for Image Transforms - Spatial Frequencies in Image Processing - Introduction to Fourier Transform - Discrete Fourier Transform - Fast Fourier Transform - Discrete Cosine Transform.

Unit:3	IMAGE ENHANCEMENT	18 hours

Image Quality and Need for Image Enhancement - Image Quality Factors - Image Quality Assessment Toll - Image Quality Metrics - Image Enhancement operations - Image Enhancement in Spatial Domain - Linear Point Transformations - Non - Linear Transformations –Square Function - Square root - Logarithmic Function –Exponential Function - Power Function - Gamma Correction - Histogram - Based techniques - Histogram Stretching –Histogram Sliding - Histogram Equalization - Histogram Specification - Local and Adaptive Contrast Enhancement - Spatial Filtering Concepts - Image Smoothing Spatial Filters - Box Filters - Gaussian Filters - Image Sharpening Spatial Filters - Gradient and Laplacian Filters - High - boost Filters - Unsharp Masking. **Image Restoration**: Introduction to Degradation - Types of Image Degradations - Image Degradation Model - Noise Modelling - Noise Categories Based on Distribution - Noise Categories Based on Correlation - Noise Categories Based on Nature - Noise Categories Based on Source - Estimation by Observation - Estimation by Experimentation - Estimation by Modelling - Image Restoration Techniques - Unconstrained Method - Inverse Filters - Wiener Filters.

Unit:4	IMAGE COMPRESSION	10 hours

Image Compression Model - Compression - Measures - Compression Algorithm and itsTypes –
Entropy Coding - Predictive Coding - Transform Coding - Layered Coding - Types of Redundancy - Coding Redundancy - Interpixel Redundancy - Psychovisual Redundancy - Chromatic Redundancy - Lossless Compression Algorithms - Run - length Coding - Huffman Coding - Bit planeCoding - Arithmetic Coding - Dictionary - based Coding - Lossless Predictive Coding - Lossy Predictive Coding - Vector Quantization –Codebook design –Generalized Lloyd algorithm.

Unit:5	IMAGE SEGMENTATION	13 hours

Introduction - Formal Definition of Image Segmentation-Classification of Image Segmentation Algorithms - Detection of Discontinuities –Point Detection-Line Detection - Edge Detection - Stages in Edge Detection - Types of Edge detectors - First order Edge Detection - Edge operator performance - Edge linking Algorithms - Principle of Thresholding - Principle of Region – growing. **Image Morphology:** Need for Morphological Processing - Morphological Operators - Dilation Operation - Erosion operation - Approaches to dilation and Erosion Operations - Opening and Closing Operations - Hit or Miss Transform - Basic Morphological Algorithms - Bountary extraction - Noise Removal - Thinning - Thickening - Convex Hull - Skeletonization - distance Transform - Region filling Extraction of connected component - Pruning.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars –webinars

	Total Lecture hours	75 hours

Text Books

1	DIGITAL IMAGE PROCESSING, S.Sridhar, Second Edition, OXFPRD University Press 2016

Reference Books

1	NickEfford,"DigitalImageProcessingapracticalintroducingusingJava",Pearson Education, 2004.

		2. RafaelC.Gonzalez,RichardE.Woods," Digital Image Processing", Second Edition, PHI/Pearson Education.
		3. B.Chanda,D.Dutta Majumder,"Digital Image Processing and Analysis",PHI, 2003.
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	CC9(P)	DIGITAL IMAGE PROCESSING LAB USING MATLAB	L	T	P	C
			-	-	6	4
Core/Elective/Supportive		Core	-	-	6	4
Pre-requisite		Basic Programming of Image Processing& an intro to MATLAB	**CIA 25**		**ESE 75**	

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,PrewittsandSobelsoperators) 6. Implement image compression. 7. Image Subtraction 8. Boundary Extraction using morphology. 9. Image Segmentation	
Total Lecture hours	**75 hours**
Text Books	
1 RafaelC.Gonzalez,RichardE.Woods,"Digital Image Processing",Second Edition,	

	PHI/PearsonEducation.
2	B.Chanda,D.DuttaMajumder,"DigitalImageProcessingandAnalysis",PHI, 2003.

	Reference Books
1	NickEfford,"DigitalImageProcessingapracticalintroducingusingJava",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	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

Course code	CC10	Statistical Computing		L	T	P	C
Core/Elective/Supportive		Core industry Module		5	-	-	3
Pre-requisite		Basic knowledge of statistical concepts		CIA 25		ESE 75	

Course Objectives:

The main objectives of this course are to:
1. To understand the applications of various correlation methods
2. To study and model the sampling concepts
3. To acquire knowledge on Hypotheses test

Expected Course Outcomes:

	On the successful completion of the course, student will be able to:	
1	To understand the concepts of Correlation	K1,K2
2	To able to know the Regression Analysis	K2,K3
3	To make understand the Probability Distribution and mathematical Expectation	K3,K4
4	To know the Sampling and Sampling Distributions	K4,K5
5	To understand the Statistical Inference	K6

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

Unit:1		15 hours

Correlation - Definition of Correlation- Scatter Diagram- Kari Pearson's Coefficient of Linear Correlation- Coefficient of Correlation and Probable Error of r- Coefficient of Determination - Merits and Limitations of Coefficient of Correlation- Spearman's Rank Correlation(7.1-7.9.4).		
Unit:2		**15 hours**
Regression Analysis - Regression and Correlation(Intro)- Difference between Correlation and Regression Analysis- Linear Regression Equations -Least Square Method- Regression Lines- Properties of Regression Coefficients- Standard Error of Estimate.(8.1-8.8)		
Unit:3		**15 hours**
Probability Distribution and mathematical Expectation- Random Variable- Defined - Probability Distribution a Random VariableExpectation of Random Variable- Properties of Expected Value and Variance(12.2-12.4).		
Unit:4		**15 hours**
Sampling and Sampling Distributions - Data Collection- Sampling and Non-Sampling Errors – Principles of Sampling-- Merits and Limitations of Sampling- Methods of Sampling- Parameter and Statistic- Sampling Distribution of a Statistic- Examples of Sampling Distributions- Standard Normal, Student's t, Chi-Square (x2) and Snedecor's F- Distributions(14.1-14.16).		
Unit:5		**13 hours**
Statistical Inference- Estimation and Testing of Hypothesis - Statistical Inference- Estimation- Point and interval- Confidence interval using normal, t and x2Distributions- Testing of HypothesisSignificance of a mean - Using t Distribution(15.1-15.10.2).		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars –webinars		
	Total Lecture hours	**75 hours**

Text Books

1	K.L. Sehgal, "Quantitative Techniques and Statistics", First Edition, Himalaya Publishing House, 2011.

Reference Books

1	N. P. Bali, P. N. Gupta, C. P. Gandhi, "A Textbook of Quantitative Techniques", First Edition, Laxmi Publications, 2008.
2	U. K. Srivastava, G. V. Shenoy, S. C. Sharma, "Quantitative Techniques for Managerial Decisions", Second Edition, New Age International Publishers, 2005.
3	David Makinson, "Sets, Logic and Maths for Computing", Springer, 2011.
4	Christopher Chatfield,"Statistics for Technology- A Course in Applied Statistics, Third Edition", CRC Press, 2015.

Related Online Contents [MOOC,SWAYAM,NPTEL,Websitesetc.]	
1	Web resources from NDL Library, E-content from open-source libraries

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	M
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	M	S	S

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

Course code	DEC/GSEC5	NETWORK SECURITY AND CRYPTOGRAPHY	L	T	P	C
Core/Elective/Supportive		Elective	5	-	-	3
Pre-requisite		Basics of Networks & its Security	CIA 25		ESE 75	

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. Togainknowledgeonclassicalencryptiontechniquesandconceptsofmodulararithmeticand 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 cryptographic algorithms	K1,K2
2	Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication	K2,K3
3	Applyandanalyzeappropriatesecuritytechniquestosolvenetworksecurity 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**	**18 hours**
Public-keyCryptosystem:IntroductiontoNumberTheory-RSAAlgorithm–KeyManagement -Diffie-HellmanKeyexchange–EllipticCurveCryptographyMessageAuthenticationand 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**	**10 hours**
WebSecurity-SecureSocketLayer–SecureElectronicTransaction.SystemSecurity-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,"Network Security",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	SEC 2	Multimedia Tools Lab	L	T	P	C
Core/Elective/Supportive		Skill Enhancement Course/NME	-	-	2	2
Pre-requisite		Basic Programming using animation and Photoshop	INT :25		EXT- 75	

Course Objectives:

The main objectives of this course are to:

1. To know the Basic tools used in PageMaker

2. To know the basic knowledge of Adobeflash

3. UnderstandingCorel DRAW

4. UnderstandingPhotoshop

5. To Design an image by applying Text and Transform Tool.

Expected Course Outcomes:

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

1	To understand the basic functionalities of pagemaker	K1,K2
2	To Learningand working with coral DRAW	K3,K4
3	To Learningand understanding the concept of the flash	K4,K5
4	Learning and understanding the concept of the Photoshop	K5,K6

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

LIST OF PROGRAMS	45 hours

PageMaker 6.5/7

● Editing Text ,Formatting Text ,Tracking – Kerning ,Leading ,Importing Style

● Master Page ,Creating Master Page ,Applying working with graphics and objects

- Managing and printing a publication.

CorelDRAW 9/10

- Drawing Basic Geometric Figures , Saving a file – Closing a file
- Opening and Exiting CorelDRAW9/10 ,Views – The View Manager
- Drawing and Selecting: Getting familiar with the toolbar
- Getting started with the project
- Working with text: The text tool – Getting started with the Book Cover
- Converting from one text type to another,Formatting text ,The Text Editor
- Working with Images: Bitmap and Vector Images
- Importing Image – Resizing, Rotating and Skewing Images
- Cropping an Image,Exporting Images to other Applications.

Flash

- Basic tools used in Flash.Develop a Flash application using motion tween.
- Develop a Flash application using shape tween.
- Develop a Flash application for ball bouncing using motion guide path.
- Develop a Flash application for masking effect.
- Develop a Flash application using layer based animation.
- Develop a Flash application to represent the growing moon
- Write action script to play and stop an animation.
- Create an appealing animation movie of your choice combining both Motion tweening and Shape tweening. Also add appropriate sound effects.

Photoshop 6/7

- Getting started with Photoshop 6/7,Opening existing file,Guidelines for working with tool bar
- Creating a new file. Working with images and colors: Bitmap and vector images
- Opening recently used files,Image size ,Editing Photographs for own Album
- Editing Images ,Color Modes

Total Lecture hours	45 hours

REFERENCE BOOK	
1	Vikas Gupta, Comdex – Desktop Publishing Course Kit, Dreamtech, New Delhi, 2008.
2	Shalini Gupta and Adity Gupta, Photoshop C82 in Simple Steps, Dreamtech, New Delhi, 2008
3	"CorelDraw 2019 Windows user guide
4	"CorelDRAW Graphics Suite 2019 Quick Start Guide
5	https://www.entheosweb.com/tutorials/coreldraw/default.asp
6	https://www.insidegraphics.com/category/coreldraw-tools/

Related Online Contents [MOOC,SWAYAM,NPTEL,Websitesetc.]

1	https://www.geeksforgeeks.org/types-of-animations-in-flash/
2	https://www.wikihow.com/Create-a-Flash-Animation
3	https://darvideo.tv/dictionary/flash-animation/
4	https://adobe-photoshop.en.softonic.com/

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

Course code	CC11	DataScience& Analytics	L	T	P	C
Core/Elective/Supportive		**Core**	6	-	-	5
Pre-requisite		Basics of Data Analytics& its Applications	**CIA 25**		**ESE 75**	

Course Objectives:

The main objectives of this course are to:
1. To study the basic technologies that forms the foundations of Big Data.

2. To study the programming aspects of cloud computing with a view to rapid

   prototyping of complex applications.

3. To understand the specialized aspects of big data including big data application,

   and big data analytics.

4. To study different types Case studies on the current research and applications of the Hadoop and big data in industry.

Expected Course Outcomes:

	On the successful completion of the course, student will be able to:	
1	understand the building blocks of Big Data	K1,K2
2	articulate the programming aspects of cloud computing(map Reduce etc)	K2,K3
3	understand the specialized aspects of big data with the help of different big data applications	K3,K4
4	represent the analytical aspects of Big Data	K4,K5
5	know the recent research trends related to Hadoop File System, MapReduce and Google File System etc	K6
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5** -Evaluate; **K6**-Create		

Unit:1	Data Explosion and Big Data Analytics	15 hours

An Overview: Introduction, Evolution of Database Technology and Big Data, Elements of Big Data, Big Data System Components, Big Data Analytics – Data Analytics. Types of Big Data Analytics, Applications of Big Data Technology, Challenges and Skills required with Big Data Technology. Introduction about Classification Algorithms, Regression Techniques, Domain Specific Analytic Techniques: Time Series Analysis, In Database Analytics, Text Analytics.

Case Study: An Application of Analytics in Agriculture field, Anticipating the Market Price.

Unit:2	Real – Time Analysis	15 hours

Introduction: Real-time System, Types of Real-time System, Types of Popular Real-time Operating systems - Advantages and Disadvantages of Real-time Operating Systems, Characteristics of Real-time Systems, Real-time Processing Systems for Big Data: Data Processing and Analytics, Big Data Engine-Hadoop, Real-time System Architecture, Real-time Platforms for Processing Big Data, Real-time Data Analytics.
Big Data: Hardware, Technology Foundations: Introduction, Big Data Stack, Virtualization and Big Data.

Understanding NoSQL and Hadoop Ecosystem: Introduction, NoSQL:CouchDB, MongoDB, Hadoop Ecosystem – HDFS, HBase, Yarn.

Unit:3	High Dimensional Data and Information Retrieval	15 hours

High Dimensional Data: A Big Data Perspective: Introduction – What is Dimensionality?, Challenges in High Dimensional Data Handling – Curse of Dimensionality, Large Scale Optimization, Spurious Correlation – Endogenity, Dimensionality Reduction – Approaches for Dimensionality Reduction, Dimensionality Reduction Techniques.

Information Retrieval: B**ig Data Integration and Processing**: Big Data Integration and Processing: Introduction, Components of Information Retrieval System, User Interface and Visualization – Desirable Properties, Visualization Techniques, Text Operations, Query Operations, Indexing and Ranking.

Unit:4	R Programming and Case Study	15 hours

R Programming: Introduction, Data Types, Data Structures and Operators – Basic Data Types in R, R Operators, Vectors, List, Factor, Arrays and Matrix, Data Frame, R Programming Structure – Control statements of R: if, if-else, if-else ladder, switch-case, return, Loops and Loop Control Statements, Input / Output: Import and Export Data, Handling Missing Values, Statistical Functions and Models of R, R Graphics and Data Visualization.

Case Study: Association Rule Mining Algorithm Implementations, K Means Clustering Algorithm Implementations, Decision Tree Algorithm Implementations, Naïve Bayes Classification Algorithm Implementation, Build the Regression Models, Construct Directed Graph using Adjacency Matrix.

Unit:5	Mongo/DB with R Programming and Case Study	13 hours

Mongo/DB with R Programming: Introduction – Document, Collections / Views / On-Demand Materialized Views, Key Features, Document Structure of MongoDB, Datatypes in MogoDB, MongoDB Curd Operations – Basics of MongoDB CURD Operations, Detailed Discussion of MongoDB CURD Operations with examples, MongoDB with R – Import/Export SCV/JSON file at

MongoDB, Interfacing R and MongoDB, GridFS.

Case Study: Access GridFS files and show them using any front end support, Develop a solution using MongoDB and R for any application domain of your choice, Develop the coding to retrieve the content from GridFS.

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

Text Books

1	Big Data Analytics – Concepts, Techniques, Tools and Technologies – First Edition, M. Thangaraj, S. Suguna, G. Sudha, PHI Learning Private Limited, Delhi,2022.
	
	 Unit I : Chapter 1, Chapter 2 (2.2.2. 2.2.4, 2.3)
	 Unit II : Chapter 3 (3.1 – 3.4)
	                    Chapter 4 (4.1 – 4.3)
	                    Chapter 5 (5.1, 5.2, 5.3.1 - 5.3.3)
	 Unit III : Chapter 6 & Chapter 7
	 Unit IV : Chapter 8
	 Unit V : Chapter 9

Reference Books

1	Data Mining Concepts and Techniques – Jiawei Han, MichelineKamber& Jain Pei, Morgan Kaufmann Publishers, Third edition 2012.
2	Introduction to Data Mining with Case Studies, G. K. Gupta, Easter Economy Edition, Prentice Hall of India, 2006.
3	DT Editorial Services, *Big Data Black Book: Covers Hadoop 2, MapReduce, Hive, Yarn, Pig, R and Data Visualization,* Publisher: Dreamtech Press India Pvt. Ltd, January 2016
4	Ricardo Baeza – Yates, BerthierRiberio-Neto, *Modern Information Retrieval*, 1st Edition, Publisher: ACM Press, New York, Addison-Wesley, 1999.
5	Christopher D. Manning, PrabhakarRaghavan, HinrichSchutze, *An Introduction to Information Retrieval*, 1st Edition, Publisher: Cambridge University Press, Cambridge, England, April 1, 2009.
6	Peter Ingwersen*, Information Retrieval Interaction* [www.db.dk/pi/iri], 1st Edition, Publisher: Taylor Graham Publishing, United Kingdom, USA (ISBN: 0 947568549), November 1992.
7	The MongoDB 4.2 Manual - *https://docs.mongodb.com › manual.*
8	Krishna Rungta (R-tutorial), *Learn R Programming in 1 Day (Complete Guide for Beginners),* 1st Edition, 2019.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
Web resources from NDL Library, E-content from open-source libraries

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	CC12	**INTERNET OF THINGS**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**CORE**	6	-	-	5
Pre-requisite		Basics of Sensors & its Applications	**CIA 25**		**ESE 75**	

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**	**15 hours**

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**	**18 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	12 hours

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

Unit:5	SENSORDATAININTERNET	13 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,VijayMadisetti,"Internet of Things:AHands-OnApproach",2014. ISBN: 978-0996025515
2. Boris Adryan, Dominik Obermaier, Paul Fremantle, "The Technical Foundations of IoT", Artech Houser Publishers, 2017.

Reference Books

1. MichaelMargolis,"ArduinoCookbook",O"Reilly,2011
2. MarcoSchwartz, "InternetofThingswithESP8266",PacktPublishing, 2016.
3. DhivyaBala,"ESP8266:StepbyStepTutorialforESP8266IoT,ArduinoNODEMCU 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	GEC/DSEC3	Data Analytics with R, Mongodb & Technical Documentation using Latex	L	T	P	C

Core/Elective/Supportive	Elective			-	-	5	3
Pre-requisite	Basics of Data Mining concepts			**CIA 25**		**ESE 75**	

Course Objectives:

The main objectives of this course are to:

1. This course presents an overview of concepts of data mining algorithms
2. To understand the preprocessing concepts in weka programs
3. To Understand the Association rule mining, classification and clustering using weka
4. To implement the basic programs of R
5. To import CSV data into R

Expected Course Outcomes:

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

1	Able to implement using data mining concepts	K1,K2
2	To understand the concepts of preprocessing.	K2,K3
3	Implementation of association rule mining, classification and clustering	K3,K4
4	To implement the basic programs of R	K4,K5
5	To import CSV data into R	K5,K6

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

	LIST OF PROGRAMS	**75 hours**

Using R-Tool :

1. Find Sum, Mean and Product of Vector in R

2. R Program to sample from a Population

3. R Program to Sort a Vector.

4. To combine the matrix using rbind and cbind methods.

5. Use seq() to create sequence.

6. Write a program to convert the table data into data frame.

7. Calculate student mark list and output it in data frame.

8. R Program to Check Prime Number

9. R Program to Check for Leap Year.

10. R Program to Check if a Number is Odd or Even in R

11. R Program to Find the Sum of Natural Numbers

12. Convert Decimal into Binary using Recursion in R

13. R program to Find the Factorial of a Number Using Recursion

14. R Program to Make a Simple Calculator

15. Write a R Program to import CSV data into R.

16. Write a R Program to move the result data from R to CSV.

17. Draw the Line Graph for Student Data.

18. Draw the Pie-Chart for Employee Data.

19. Create a Table from the existing data set in R and draw the chart.

20. Apply K-Means Algorithm for IRIS data set and output it in graph

21. Get some input from mtcar data set and perform analysis

LATEX

1. BasicOperations:LineSpacing,intent,nointent,includingspaceinthe sentenceafterdot,singlequote anddoublequote,dashes

2. Workingwithsampledocument(includingcentrealignmentfortitle,.75cmaftertitle,nointent forcontent,rightalignmentfordisplayingthecontentwriterdetails)

3. HandlingdifferentStylesandFontsindocuments.

4. Handlingdifferentpagenumberingstyles(alphabets,roman,Arabic),pagestyle,setthelength oflineinthepage,printthetitleandauthordetails.

5. Workingwithdocuments:displaytableofcontents,listoffigures,listoftables,differentheadin glevels(chapter,section,subsection,subsubsection,paragraph),listofitems.

6. WorkingwithBibliography.

7. WorkingwithFigures.

8. Working withsimpleformofTables.

Note: The above are sample problems; Instructor can add more exercises based on their requirements and the current technology

		Total Lecture hours	**75 hours**

Reference Books

1.	R Programming – An approach to Data Analytics – Dr. Sudhamathy & Dr. Jothi Venkateshwaran, MJP Publishers, 2018
2.	Statistical Programming in R - K G Srinivasa , G M Siddesh, Chetan Shety, B.J Sowmya, - Oxford University Press, 2017
3	Design and Implementation of Data Mining Tools – M.Awad, Latifur Khan, Bhavani Thirissingham, Lei Wang – CRC Press, Taylor & Francis Group, 2015.

Related Online Contents [MOOC,SWAYAM,NPTEL,Websitesetc.]

1	https://cobweb.cs.uga.edu/~khaled/DMcourse/Weka-Tutorial-Exercises.pdf
2	https://ppawar.github.io/Spring2020/CSE351-S20/Exercises/Weka%20activity%20-%201%20April%2020.pdf

| 3 | http://datamininglabexercises.blogspot.com/p/exercises-from-weka-textbook.html |

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