M.Sc. Information Technology

Syllabus

AFFILIATED COLLEGES

Program Code: 36J

2025 – 2026 onwards

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A++" Grade by NAAC, Ranked 21st among Indian Universities by MHRD-NIRF)

Coimbatore - 641 046, Tamil Nadu, India

Program Educational Objectives (PEOs)
The M. Sc.IT program describe accomplishments that graduates are expected to attain within five to seven years after graduation

PEO1	Empower students to critically analyze current trends and learn future issues from a system perspective at multiple levels of detail and abstraction.
PEO2	Acquire higher degree of technical skills in problem solving and application development
PEO3	Exhibit continuous learning and research for the societal upliftment with human values and ethics

Program Specific Outcomes (PSOs)	
After the successful completion of M.Sc. IT program, the students are expected to	
PSO1	Able to work out effective and efficient real time solutions using acquired knowledge in the computer science domain including theory, programming, algorithms, databases and web development.
PSO2	Motivate students to pursue lifelong learning and to do research as computing experts and scientists to meet the requirement of corporate world and Industry standard to provide solutions to industry, society and business.
PSO3	Acquire professional skills in software design process and practical competence in a broad range of open-source programming languages to withstand technological change and provide solutions to new ideas and innovations.
PSO4	Acquire the knowledge of advanced programming skills and distributed environmental needs for sustainable development.
PSO5	Able to pursue careers in IT industry/ consultancy/ research and development, teaching and allied areas related to Information Technology.

Program Outcomes (POs)	
On successful completion of the M.Sc. IT program	
PO1	Develop creativity and problem-solving skills with the knowledge of computing and mathematics.
PO2	Ability to develop and carry out experiments, interpret and infer data
PO3	Design algorithms and develop software to aid solutions to industry and governments.
PO4	Review the latest technology and tool handling mechanism.
PO5	Analyze the outcome to solve global environment related issues.
PO6	Apply the knowledge in a lifelong learning journey to equip themselves.
PO7	Identify the perspective of business practices, risks and limitations.
PO8	Work with professional and ethical values.
PO9	Formulate the responsibilities of human rights and entrepreneurial spirit.
PO10	Understand the methods to communicate effectively and work collectively

BHARATHIAR UNIVERSITY, COIMBATORE 641 046
M.Sc. INFORMATION TECHNOLOGY (Affiliated Colleges)
REVISED SCHEME OF EXAMINATIONS – CBCS PATTERN
(For the students admitted during the academic year 2025 – 2026 onwards)

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
13A	Paper I: Object Oriented Analysis and Design	4	5	-	25	75	100
13B	Paper II: Advanced Database Management Systems	4	5	-	25	75	100
13C	Paper III: Advanced Java Programming	4	5	-	25	75	100
13D	Paper IV: Python Programming	4	5	-	25	75	100
13P	Practical I: Advanced Java Lab	4		5	40	60	100
13Q	Practical II: Python Programming Lab	4		5	40	60	100
	Total	**24**	**20**	**10**			**600**
SECOND SEMESTER							
23A	Paper V: Data Mining and Warehousing	4	4	-	25	75	100
23B	Paper VI: Cyber Security	4	4	-	25	75	100
23C	Paper VII: Artificial Intelligence and Machine Learning	4	4	-	25	75	100
23D	Paper VIII: Internet of Things	4	4	-	25	75	100
2EA/2EB /2EC/2ED	Elective I	4	4	-	25	75	100
23P	Practical III: Data Mining using R	4	-	5	40	60	100
23Q	Practical IV: Artificial Intelligence and Machine Learning Lab	4	-	5	40	60	100
	Total	**28**	**20**	**10**			**700**
THIRD SEMESTER							
33A	Paper IX: Digital Image Processing	4	4	-	25	75	100
33B	Paper X: Big Data Analytics	4	4	-	25	75	100
33C	Paper XI: Cloud Computing	4	4	-	25	75	100
33D	Paper XII: Web Technologies	4	4	-	25	75	100

3EA/3EB /3EC/3ED	Elective II	4	4	-	25	75	100
33P	Practical V: Digital Image Processing Lab	4	-	4	40	60	100
33Q	Practical VI: Big Data Analytics Lab	4	-	3	40	60	100
33R	Practical VII: Web Application development & hosting	1	-	2	25	25	50
	Health and Wellness	1	-	1	100	-	100
	Total	**30**	**20**	**10**			**850**
	FOURTH SEMESTER						
47V	Project and Viva-voce*	8	-	-	50	150	200
* Project evaluation – 100 marks | Viva-voce – 50 marks in ESE							

 # During II or III Semester (Optional)
List of Electives -ELECTIVE – I

E.No.	Sub. Code	Name of the Elective Course
1.1	2EA	Multimedia and its Applications
1.2	2EB	Mobile Application Development
1.3	2EC	Software Testing
1.4	2ED	Web Services

ELECTIVE – II

E.No.	Sub. Code	Name of the Elective Course
2.1	3EA	Soft Computing
2.2	3EB	Embedded systems
2.3	3EC	Block Chain Technology
2.4	3ED	Critical Thinking, Design Thinking and Problem Solving

HEALTH AND WELLNESS- Split up for CIA Marks 100

DESCRIPTION	MARKS
Report	40
Attendance	20
Activities (Observation During Practice)	40

First Semester

Course code	13A	**PAPER I: OBJECT ORIENTED ANALYSIS AND DESIGN**	L	T	P	C
Core/Elective/ Supportive		**Core**	5	5		4
Pre-requisite		Able to understand the basis of programming languages, paradigms and designing tools	**Syllabus Version**		**2021-22**	

Course Objectives:

The main objectives of this course are to:
1. Presents the object model, classes and objects, object orientation, machine view and model management view.
2. Enable the students to learn the basic functions, principles and concepts of object-oriented analysis and design.
3. Enable the students to learn the UML design and diagrams and be exposed to the various testing techniques

Expected Course Outcomes:

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

1	Remember the basic knowledge on design technique	K1,K2
2	Understand the object-oriented system development and case models	K2,K3
3	Analyze on class diagrams used for UML.	K4,K5
4	Apply and analyze different testing techniques for various applications	K3,K4
5	Analyze Design and Implement projects using OO Concepts	K5,K6

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

Unit:1	**INTRODUCTION OF OBJECTS**	**15 hours**

Object Orientation – System Development – Review of Objects – Inheritance – Object Relationships – Dynamic binding – OOSD life cycle – Process – Analysis- Design –Prototyping - Implementation – Testing – Overview of Methodologies

Unit:2	**METHODOLOGIES**	**15 hours**

OMT – Booch methodology, Jacobson – Methodology – patterns – Unified approach – UML – Class Diagrams – Dynamic Modeling

Unit:3	**CASE MODELS**	**15 hours**

Using Case model – Creation of classes – Noun Phrase approach – responsibilities – Collaborators and relationships – Super – Sub class – Aggregation

Unit:4	**CLASS**	**15 hours**

OO Design axioms – Class visibility – refining attributes- Methods – Access layer – OODBMS – Class mapping view layer

Unit:5	**TESTING**	**13 hours**

Quality Assurance testing – Inheritance and testing - Test Plan – Usability testing – User Satisfaction testing

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	L	M	M	M	S	L	M
CO2	S	S	S	M	S	M	M	M	M	S
CO3	M	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	13B	PAPER II: ADVANCED DATABASE MANAGEMENT SYSTEMS	L	T	P	C
Core/Elective/Supportive		Core	5	5		4
Pre-requisite		Students should have a basic understanding of RDBMS, SQL querying, database design	Syllabus Version		2025-2026	

Course Objectives:

The main objectives of this course are to:
1. To understand the concepts of DBMS, Data Model and Normal forms.
2. To understand the concepts of concurrency control and Recovery.
3. To understand basics of SQL and NoSQL databases.
4. To understand and apply MongoDB (NoSQL) for Data Analysis using CURD and User Management, and to impart knowledge on Graph Databases

Expected Course Outcomes:

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

1	Understand the structure and model of the relational database management systems.	K2
2	Understand the concepts of transaction management and SQL, NoSQL database models	K3
3	Understand and create database models using MongoDB and Graph Database	K4
4	Apply MongoDB operators to retrieve data from document data stores	K3
5	Understand and apply concepts of data management indexing techniques for specific applications	K5, K6

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

Unit:1	Database Overview	10 hours

Introduction - Database concepts, Basic components of DBMS, sources of data - data models – hierarchical – network – XML and Stores - Relational Database Design: Anomalies in a Database– Functional Dependency – Lossless Join and Dependency – Preserving Decomposition – Third Normal Form– Boyce Codd Normal Form – Multi-valued Dependency – Fourth Normal Form – Join Dependency – Project Join Normal Form –Domain Key Normal Form - SQL: Data Definition – Data Manipulation – Integrity Constraints–Views–PL/SQL.

Unit:2	NoSQL	12 hours

Indexing and Hashing – Query Processing – Transaction Processing – Concurrency Control and Recovery - Advanced Database Concepts and Emerging Applications: Distributed Databases – Object Oriented Databases - Object Relational Databases- SQL–NoSQL Tradeoffs–CAP Theorem– Eventual Consistency - NoSQL–database types – Document Oriented – Columnar – Graph – Key-Value Pair - NoSQL database, design for performance / quality parameters, documents and information retrieval.

Unit:3	MongoDB Introduction	12 hours

MongoDB- Introduction – MongoDB – Need – MongoDB Vs. RDBMS – MongoDB - MongoDB Server Configuration – Import and Export –- Data Extraction Fundamentals - Intro to Tabular Formats - Parsing CSV - Parsing XLS with XLRD-Parsing XML - Intro to JSON - MongoDB-CURD Operations – MongoDB Operators - Query Document - Pipeline - Aggregation Operators -

Unit:4	Advanced MongoDB	12 hours
User Management – MongoDB Data Replication in Servers – Data Sharding – MongoDB Indexes – Create – Find – Drop – Backup – MongoDB – Relationships – Analyzing Queries – MongoDB Objectid – Advanced MongoDB: MapReduce – MongoDB - Text Processing - Regular Expression.		
Unit: 5	Graph Database	12 hours
Introduction to graphs – Graph Database – Indexes – Graph – Nodes – Properties –Relationships – Traversal – Path - Graph Compute Engines – The power of graph databases –Performance – Flexibility – Agility - Graph Data Modeling – Types of Graphs – Non directed graphs – Directed Graphs – Weighted Graphs - Labeled Property - Graph Model – Querying Graphs – Cypher – Comparison of Relational and Graph Modeling – Building graph database application –Graph storage databases – Graph store –: Neo4j – Hyperbase – DB – InfoGrid -Graphs in the real world.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	60-- hours

Text Book(s)

1	Abraham Silberchatz, Henry K.Forth, Sudharshan, **“Database system Concepts”**, 7th edition, McGraw Hill, 2020.
2	Prabu C.S.R, **“Object-Oriented Database Systems: Approaches and Architectures”** 3rd Edition, PHI, 2011.
3	Kristina Chodorow , **“MongoDB: The Definitive Guide”**, 3rd Edition , O'Reilly Media, ISBN: 9781491954461, 2019.
4	Guy Harrison, **“Next Generation Databases: NoSQL, NewSQL, and Big Data”**,Apress, 2016.

Reference Books :EBooks

1	ShamkantB.Navathe, RamezElamsri**"Fundamentals of Database Systems"**, 7th Edition, Pearson Education Limited, 2017.
2	David Hows , Peter Membrey , EelcoPlugge , Timm Hawkins , **“The Definitive Guide to MongoDB”**, 3rd Edition, Apress, 2015.
3	GauravVaish ,**“Getting Started with NoSQL”**Packt Publishing, 2013.
4	Ian Robinson, Jim Webber & Emil Eifrem, “Graph Databases New Opportunities for Connected Data”,2ndEdition, O’Reilly publication.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	Course Title	Duration	Provider
1.	Database Management System	12 Weeks	Swayam
2.	Database Management System	8 Weeks	NPTEL
3.	NoSQL Systems	4 Weeks	Coursera
4.	Introduction to MongoDB	3 Weeks	Coursera

Web link		
1. https://www.w3schools.in/dbms/		
2. https://www.guru99.com/nosql-tutorial.html		
3. https://www.tutorialspoint.com/mongodb/index.htm		
Course Designed by:		

Mapping with Programme Outcomes

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

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

Course code	13C	PAPER III: ADVANCED JAVA PROGRAMMING	L	T	P	C
Core/Elective/ Supportive		Core	5	5		4
Pre-requisite		Students should able to know the concept of Java Fundamentals, Applet, Swings, JDBC, JavaBeans.	**Syllabus Version**	**2021-22**		

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	K4,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

Java Basics Review: Components and event handling – Threading concepts – Networking features – 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	15 hours

Java in Databases- JDBC principles – database access- Interacting- database search – 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-Readingdata 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	ADVANCED CONCEPTS	13 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	Jamie Jaworski, "Java Unleashed", SAMS Techmedia Publications,1999.
2	Campione, Walrath and Huml, "The Java Tutorial", AddisonWesley,1999.
3	Jim Keogh," The Complete Reference J2EE", Tata McGrawHill Publishing Company Ltd,2010.

	Reference Books
1	David Sawyer McFarland, "JavaScript And JQuery- The Missing Manual", Oreilly Publications, 3rd Edition,2011.
2	Deitel and Deitel, "Java How to Program", Third Edition, PHI/Pearson Education Asia.

	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.javatpoint.com/servlet-tutorial
2	https://www.tutorialspoint.com/java/index.htm
3	https://onlinecourses.nptel.ac.in/noc19_cs84/preview
	Course Designed By:

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	13D	PAPER IV: PYTHON PROGRAMMING	L	T	P	C
Core/Elective/Supportive	Core		5	5		4
Pre-requisite	Able to understand the concept of C, C++ and Java		Syllabus Version		2021-22	

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	15 hours

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

Unit:2	CONTROL STRUCTURES	15 hours

Code Structures: if, elseif, 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	CLASSES, MODULES AND PACKAGES	15 hours

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 with super – In self Defense – Get and Set Attribute Values with Properties – Name Mangling for Privacy – Method Types – Duck Typing – Special Methods –Composition.

Unit:4	DATA, FILES AND WEB	13 hours

Data Types: Text Strings – Binary Data. **Storing and Retrieving Data:** File Input/output – Structured Text Files – Structured Binary Files - Relational Databases – NoSQL Data Stores. Web: Web Clients – Web Servers – Web Services and Automation

Unit:5	SYSTEMS, THREADS AND NETWORKS	15 hours

Systems: Files –Directories – Programs and Processes – Calendars and Clocks.
Concurrency: Queues – Processes – Threads – Green Threads and gevent – 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	Contemporary Issues	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	**75 hours**

Text Books

1	Bill Lubanovic, "Introducing Python", O'Reilly, First Edition-Second Release, 2014.
2	Mark Lutz, "Learning Python", O'Reilly, Fifth Edition, 2013.

Reference Books

1	David M. Beazley,"Python Essential Reference", Developer's Fourth Edition,2009. Library
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

Course Designed By:

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

Course code	13P	**PRACTICAL I: ADVANCED JAVA LAB**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Core**	5		5	4
Pre-requisite		The basic understanding of core java, JSP and HTML.	**Syllabus Version**			**2021-22**

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
3. To Introduce JDBC and navigation of records
4. To Understand the RMI & its implementation, Introduce 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

LIST OF 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 usingJSP.

4. Design a Purchase Order form using Html form andJSP.

5. Prepare a Employee pay slip usingJSP.

6. Write a program using JDBC for creating a table, Inserting, Deleting records and listout therecords.

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 theirassociatedvalues.

9. Write a program in JSP by using session object.

10. Write a program to build a simple Client Server application usingRMI.

Expert lectures, online seminars – webinars

Total Lecture hours	**75 hours**

Text Books	
1	Jamie Jaworski, "Java Unleashed", SAMS Techmedia Publications,1999.
2	Campione, Walrath and Huml, "The Java Tutorial", AddisonWesley,1999.
Reference Books	
1	Jim Keogh," The Complete Reference J2EE", Tata McGrawHill Publishing Company Ltd,2010.
2	David Sawyer McFarland, "JavaScript And JQuery- The Missing Manual", Oreilly Publications, 3rd Edition,2011.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.javatpoint.com/servlet-tutorial
2	https://www.tutorialspoint.com/java/index.htm
3	https://onlinecourses.nptel.ac.in/noc19_cs84/preview
Course Designed By:	

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	M
CO4	S	S	S	S	S	S	S	M	S	S

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

Course code	13Q	PRACTICAL II: PYTHON PROGRMMING LAB	L	T	P	C
Core/Elective/Supportive		Core Lab	5		5	4
Pre-requisite		Students must comfortable with variables, linear equations, graphs of functions, histograms, and statistical means.	Syllabus Version		2021-22	

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	75 hours
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.	
Total Lecture hours	**75 hours**

Text Books

1	Bill Lubanovic, "Introducing Python", O'Reilly, First Edition-Second Release, 2014.
2	Mark Lutz, "Learning Python", O'Reilly, Fifth Edition, 2013.

	Reference Books
1	David M. Beazley,"Python Essential Reference", Developer's Fourth Edition,2009. Library ,
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
	Course Designed By:

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	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

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

Second Semester

Course code	23A	PAPER V:DATA MINING AND WAREHOUSING	L	T	P	C
Core/Elective/Supportive	Core		4	4		4
Pre-requisite		Able to know extract useful data from a sea of un-amassed data and the understanding of data analysis.	**Syllabus Version**		**2021-22**	

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
5	Identify appropriate data mining algorithms to solve real world problems	K5,K6

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

Unit:1	INTRODUCTION	12 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	CLASSIFICATION	12 hours

Classification: Introduction – Statistical – based algorithms - distance – based algorithms- decision tree - based algorithms - neural network – based algorithms –rule - based algorithms – combining techniques.

Unit:3	CLUSTERING	12 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	10 hours

Data warehousing: an introduction - characteristics of a data warehouse – data marts – other aspects of data mart. Online analytical processing: introduction - OLTP & OLAP systems - Datamodelling –star schema for multidimensional view –data modelling – multifactstar schema or snow flake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.

Unit:5	APPLICATIONS OF DATA WAREHOUSE	12 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	60 hours

Text Books

1	Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson education,2003.
2	C.S.R. Prabhu, "Data Warehousing Concepts,Techniques, Productsand Applications", PHI, Second Edition.

Reference Books

1	ArunK.Pujari, "Data Mining Techniques", Universities Press (India) Pvt. Ltd.,2003.
2	Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining and OLAP", TMCH, 2001.
3	Jiawei Han&MichelineKamber, "Data Mining Concepts & Techniques", 2001, Academicpress.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

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

Course Designed By:

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	23B	PAPER VI: CYBER SECURITY	L	T	P	C
			4	4		4
Course Title: Core/Elective		Core	Syllabus Version		2025-26	

Course Objectives:

1. To understand of the basic Mathematical tools for cryptography concepts.
2. To learn the concept of AES, Blowfish algorithm and its applications.
3. To recognize the concept of public key cryptosystems.
4. To understand the concept of Digital Signature Algorithms
5. To learn about Firewall and its applications

Expected Course Outcomes:

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

1	Understanding basic Mathematical tools for cryptography concepts	K1&K2
2	Understanding the concept of AES, Blowfish algorithm and its applications.	K1&K2
3	Analyzing the concept of public key cryptosystems.	K4
4	Understanding the concept of Digital Signature Algorithms	K2&K3
5	Understanding the concept of and Firewall and its applications	K2&K3

K1–Recall, remember; K2–Understand; K3–Apply; K4–Analyze

Unit:1	**INTRODUCTION AND DATA ENCRYPTION STANDARDS**	**12 Hours**

Introduction–Data Encryption Techniques–Substitution Ciphers – Transposition Ciphers–Steganography–Data Encryption Standards: Block ciphers, Block Cipher Modes of Operation– Feistel Ciphers–Data Encryption Stand -Triple DES–DES Design Criteria.

Unit:2	**ADVANCED ENCRYPTION STANDARD AND SYMMETRIC CIPHERS**	**12 Hours**

Introduction, Advanced Encryption Standard–Overview of Rijndael – Advantages and limitations of Rijndael, Comparison of AES with other ciphers– Blowfish Encryption Algorithm-RC5–RC4–RC6–Comparison Between RC6 and RC5–IDEA.

Unit:3	**PUBLIC KEY CRYPTOSYSTEMS, KEY MANAGEMENT AND AUTHENTICATION**	**10 Hours**

Introduction, Public key Cryptosystems–The RSA algorithm–Timing Attacks–Key Distribution, Diffie -Hellman Key Exchange–Elliptic Curve Arithmetic–Elliptic Curve Cryptography–Elliptic Curve Security and Efficiency, Zero Knowledge Proof–Authentication: Introduction, authentication methods–Message Digest–Kerberos–X.509 Authentication Service.

Unit:4	**DIGITAL SIGNATURES, ELECTRONIC MAIL SECURITY AND WEB SECURITY**	**12 Hours**

Introduction, Digital Signature Algorithms–Digital Signature Standards (DSS)–Authentication Protocols–Pretty Good Privacy (PGP) VPN Tunnel–AAA Authentication–IP Sec–SSL–TSL-HTTP&HTTPs Standard ACL–Extended ACL

Unit:5	**MALICIOUS SOFTWARE AND FIREWALL**	**10 Hours**

Malicious Code, viruses–Worms–Trojans–Spyware Best Practices–Digital Immune System–Attacks–Introduction, Packet Filters–Application level gateways-Circuit level gateways–Firewall Architectures–Trusted System–Access Control.

Unit:6	CONTEMPORARY ISSUES	4 Hours
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops on Cyber Security/tools			

Text Books	
1	V.K.Pachghare, Cryptography and Information Security, PHI, 2015.
2	Cisco Network Academy, CCNA–Routing and Switching Module, Cisco Press

Reference Books	
1	William Stalling, Cryptography and Network Security, 4th Edition, PHI, 2005.
2	Schneier and Bruce, Applied Cryptography: Protocols & Algorithms, 1st Edition, MGH, 2011.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://medium.com/@vixentael/how-to-start-learning-cryptography
2	https://www.geeksforgeeks.org/cryptography-introduction/
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

Coursecode	23C	**PAPER VII: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		Core	4	4		4
Pre-requisite		Basics of AI & Introduction about ML	**Syllabus Version**	2025-26		

CourseObjectives:

The main objectives of this course are to:
1. Enable the students to learn the basic functions of AI,HeuristicSearchTechniques.
2. Provide knowledge on concepts of Representations and Mappings and PredicateLogic.
3. Introduce Machine Learning with respect DataMining ,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 world problemfor 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**	**12hours**

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**	**12hours**

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**	**12hours**

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**	**12 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	10 hours
Looking Inside Machine Learning:TheImpact 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	60 hours

TextBooks

1	Elaine Richand KevinKnight,"Artificial Intelligence",TataMcGrawHill Publishers company Pvt Ltd, Second Edition, 1991.
2	GeorgeFLuger,"ArtificialIntelligence",4thEdition,Pearson Education Publ, 2002.

ReferenceBooks

1	Machine Learning For Dummies®,IBM Limited Edition by Judith Hurwitz, DanielKirsch.

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/

Course Designed By:

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

Course code	23D	**PAPER VIII: INTERNET OF THINGS**	L	T	P	C
Core/Elective/Supportive		Core	4	4		4
Pre-requisite		Aware to know the Machine learning concepts and able to collect, analyze and handling huge amount of data.	**Syllabus Version**		**2021-22**	

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 C using 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**	12 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	**ELECTRONICS FOR IoT**	12 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	**FUNDAMENTALS OF PROGRAMMING**	12 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**	10 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 OVER INTERNET**	**12 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 (ThingSpeak).

Unit:6	**Contemporary Issues**	**2 hours**

Expert lectures, online seminars – webinars

	Total Lecture hours	**60 hours**

Text Books

1	ArshdeepBahga, Vijay Madisetti, "Internet of Things: A Hands-On Approach", 2014. ISBN: 978-0996025515
2	Boris Adryan, DominikObermaier, Paul Fremantle, "The Technical Foundations of IoT", Artech Houser Publishers, 2017.
3	Michael Margolis, "Arduino Cookbook", O"Reilly, 2011

Reference Books

1	Marco Schwartz, "Internet of Things with ESP8266", Packt Publishing, 2016.
2	DhivyaBala, "ESP8266: Step by Step Tutorial for ESP8266 IoT, 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

Course Designed By:

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	23P	PRACTICAL III: DATA MINING USING R	L	T	P	C
Core/Elective/Supportive	Core Lab		4		4	4
Pre-requisite		Able to know extraction of data, statistical analysis of data, graphs for data representation.	Syllabus Version		2021-22	

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 algorithms
3. To apply statistical interpretations for the solutions
4. Able to use visualizations techniques

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 understand different data mining algorithms to solve real world applications	K5,K6

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

LIST OF PROGRAMS	75 hours
1. Implement Apriori algorithm to extract association rule of datamining. 2. Implement k-means clusteringtechnique. 3. Implement any one HierarchalClustering. 4. Implement Classificationalgorithm. 5. Implement DecisionTree. 6. LinearRegression. 7. DataVisualization.	
Total Lecture hours	**75 hours**

Text Books

1	Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson education,2003.
2	C.S.R. Prabhu, "Data Warehousing Concepts,Techniques, Productsand Applications", PHI, Second Edition

Reference Books

1	ArunK.Pujari, "Data Mining Techniques", Universities Press (India) Pvt. Ltd.,2003.
2	Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining and OLAP", TMCH, 2001.

	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
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
	Course Designed By:

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

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

Course code	23Q	PRACTICAL IV: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING LAB	L	T	P	C
Core/Elective/Supportive	Core		4		4	4
Pre-requisite		Basics of Machine Learning	Syllabus Version		2025-2026	

CourseObjectives:

The main objectives of this course are to:
1.   Build models using classification algorithm for real world problems
2.   Build models using clustering algorithm for real world problems
3. Create classification and clustering models
4. Test and evaluate the models

Expected Course Outcomes:

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

1	Understand the various supervised learning techniques	K2
2	Understand the theoretical concepts of linear methods	K2
3	Apply Supervised,Unsupervised and Semi Supervised learning algorithm	K4
4	Understand and apply the concept of DeepLearning	K5,K6

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

LIST OF PROGRAMS

Implementthe following inPython:
1. Exercise to manipulate data using different queries.
2. Exercise to extract features from datasets.
3.. Exercises to Build adatapipeline
4. Write a Program to Implement Tower of Hanoi
5. Implement k-nearest neighbours classification
6. Implement linear regression
7. Implement naive baye's theorem to classify the english text
8. Implement an algorithm to demonstrate the significance of genetic algorithm
9. Implement the finite words classification system using Back-propagation algorithm

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

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

Third

Semester

Course code	33A	PAPER IX: DIGITAL IMAGE PROCESSING	L	T	P	C
Core/Elective/Supportive	Core		4	4		4
Pre-requisite		It requires some of the basic programming skills, know about signals and system with calculus and probability.	Syllabus Version		2021-22	

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	K6

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

Unit:1	INTRODUCTION	12 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	12 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	12 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	10 hours

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

Unit:5	IMAGE SEGMENTATION	12 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	60 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, Websites etc.]

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

Course Designed By:

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	M	S	M	M	S	S
CO2	M	S	S	M	M	S	M	S	S	S
CO3	S	S	S	S	M	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	33B	**PAPER X: BIG DATA ANALYTICS**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Core**	4	4		4
Pre-requisite		Students should able to handle large datasets with required market of the business.	**Syllabus Version**		**2025-26**	

Course Objectives:

The main objectives of this course are to:
1. Present the Importance of Big Data, Hadoop, PIG.
2. Learn big data handling concepts, Map Reduce and Hadoop based analytics.
3. Learn HDFS architecture.

Expected Course Outcomes:

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

1	Understand about the Big Data evaluation	K1,K2
2	Installation of Hadoop	K3,K4
3	Apply MapReduce concepts to process big data	K4,K5
4	Design big data applications using Hadoop components and PIG	K6

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

Unit:1	**NEED OF BIG DATA**	**12 hours**

Importance of Big Data: A Flood of Mythic "Start-Up" Proportions- A convergence of Key Trends- A Wider Variety of Data – The Expanding Universe of Unstructured Data. Industry Examples of Data: Digital Marketing and the Non - line World – Database Marketers, Pioneers of Big Data – Big Data and the New School of Marketing.

Unit:2	**BASICS OF HADOOP**	**12 hours**

Installing Hadoop - Understanding different Hadoop modes - Understanding Hadoop installation steps - Installing Hadoop on Linux, Ubuntu flavor (single node cluster) - Installing Hadoop on Linux, Ubuntu flavor (multimode cluster) - Installing Cloudera. Hadoop on Ubuntu- Understanding Hadoop features - Understanding HDFS - Understanding MapReduce -Learning the HDFS and MapReduce architecture

Unit:3	**CONCEPTS OF HADOOP**	**12 hours**

Understanding the HDFS architecture - Understanding HDFS components - Understanding the MapReduce architecture - Understanding MapReduce components - Understanding the HDFS and MapReduce architecture by plot - Understanding Hadoop subprojects

Unit:4	**PIG & ARCHITECTURE**	**10 hours**

Pig Introduction: Overview of Pig - Pig Architecture - Pig Execution modes, Pig Grunt shell and Shell - commands. Pig Latin Basis: Data model, Data Types, Operator - Pig Latin Commands - Load & Store, Diagnostic Operators, Grouping, Cogroup, Joining, Filtering, Sorting, Splitting

Unit:5	PIG: MAPREDUCE	12 hours
Functions in Pig:nBuilt-In Functions, User define functions. - Pig Execution Modes – Batch Mode – Embedded Mode – Pig Execution in Batch Mode– Embedding Pig in Python – Use cases - Map Reduce programs with Pig – Pig Vs SQL		

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

	Total Lecture hours	60 hours

Text Books	
1	Michael Minelli, Michele Chambers, AmbigaDhiraj, "BIG DATA BIG ANALYTICS", Wiley Publications, Indian Reprint, 2014.
2	Alan Gates, "**Programming Pig**", O'Reilly Media; 1st Edition,October, 2011

Reference Books	
1	VigneshPrajapathi, "Big Data Analytics with R and Hadoop", PACKT Publishing,2013.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/big_data_analytics/index.htm
2	https://hadoop.apache.org/docs/r1.2.1/mapred_tutorial.html
3	https://hadoop.apache.org/docs/current/hadoop-mapreduce-client/hadoop-mapreduce-client- core/MapReduceTutorial.html

Course Designed By:	

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	S	S	M	S	M	S	M	S
CO2	M	S	S	S	M	S	M	S	M	S
CO3	M	M	S	S	M	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	33C	**PAPER XI: CLOUD COMPUTING**		**L**	**T**	**P**	**C**
Core/Elective/Supportive	Core			4	4		4
Pre-requisite		Basic Knowledge to store data with handling of operating systems.		**Syllabus Version**		**2021-22**	

Course Objectives:

The main objectives of this course are to:
1. Understand the cloud computing architectures, applications and challenges.
2. Know how the data is stored in the cloud and the various services offered by the cloud.
3. Develop the skills in Web Application Development using cloud technologies.

Expected Course Outcomes:	
On the successful completion of the course, student will be able to:	
1 Understand the basic knowledge on virtualization	K1,K2
2 Understand the concept of cloud computing services and its business value	K2,K3
3 Analyze various web based applications for collaborating everyone in cloud computing	K4,K5
4 Assess various industrial platforms for the developments	K5,K6
5 Analyze on cloud mobility and governance	K6

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

Unit:1	INTRODUCTION	12 hours

Introduction – Essentials – Benefits – Why cloud – Business and IT perspective – cloud and virtualization – cloud service requirements – dynamic cloud infrastructure – cloud computing characteristics – cloud adoption – cloud rudiments. Cloud deployment models: introduction – cloud characteristics – measured service accounting – cloud deployment models – security in a public cloud – public versus private clouds – cloud infrastructure self-service.

Unit:2	SERVICES AND SOLUTIONS	12 hours

Cloud as a service: introduction – gamut of cloud solutions – principal technologies- cloud strategy – cloud design and implementation using SOA – conceptual cloud model – cloud service defined. Cloud solutions: introduction – cloud ecosystem – cloud business process management – cloud service management – on premise cloud orchestration and provisioning engine – computing on demand.

Unit:3	VIRTUALIZATION	12 hours

Cloud offerings: Introduction – introduction storage, retrieval archive and protection-cloud analytics – testing under cloud – information security – virtual desktop infrastructure-storage cloud. Cloud Management: Introduction – resiliency – provisioning – asset management-cloud governance – high availability and disaster recovery – charging models – usage reporting, and metering. Cloud Virtualization Technology: Introduction – virtualization demand – virtualization benefits – server virtualization – virtualization for x86 architecture – hypervisor management software – virtual infrastructure requirements.

Unit:4	INFRASTRUCTURE	12 hours
Cloud Infrastructure: Introduction – storage virtualization – storage area networks-network-attached storage – cloud server virtualization – networking essential to the cloud. Cloud and SOA: Introduction – SOA Journey to Infrastructure – SOA and the cloud – SOA Defined – SOA and infrastructure as a service – SOA based cloud infrastructure steps – SOA Business and IT services.		
Unit:5	MOBILITY	10 hours
Cloud Mobility: Introduction – the business problem – mobile enterprise application platforms – mobile application architecture overview. Cloud Governance: Introduction – service level agreement and compliance – data privacy and protection risks – enterprise governance – risk management – third party management – information management.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	60 hours

Text Books

1	Dr. Kumar Saurabh "Cloud Computing-Unleashing Next Gen Infrastructure to Application", 3rd Edition, Wiley India Pvt Ltd, 2014.
2	RajkumarBuyya, James Broberg, AndrzejGoscinski , "Cloud computing principles and paradigms", Wiley India, 2014.

Reference Books

1	Michael Miller, "Cloud computing web based application that change the way you work & collaborate online", Pearson Education, 2013.
2	Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business"

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

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

Course Designed By:

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	33D	**PAPER XII: WEB TECHNOLOGIES**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		Core Lab	4	4		4
Pre-requisite		Basic knowledge of programming, HTML, CSS, JavaScript, and client-server basics.	**Syllabus Version**		**2025-26**	

Course Objectives:
The main objectives of this course are to:

1. Learn the basics of web technologies like HTML5, CSS3, and JavaScript.
2. Build dynamic websites using PHP, Java Servlets, and XML.
3. Get introduced to modern tools like AngularJS, Node.js, Firebase, React, and Docker.

Expected Course Outcomes:	
On the successful completion of the course, student will be able to:	
1	Understand the fundamentals of web communication, HTML5 structure, and styling with CSS3 and Bootstrap.	K1,K2
2	Apply client-side scripting using JavaScript and JSON to enhance web interactivity and data manipulation.	K2,K3
3	Develop dynamic server-side applications using PHP, Java Servlets, and connect them with databases.	K3
4	Design, validate, and query XML documents using XML Schema, XPath, and XQuery.	K4,K5
5	Analyze modern web frameworks and build modular applications using AngularJS and other emerging tools.	K4

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

Unit:1	**WEBSITE BASICS**	**12 hours**

Web Essentials : Clients, Servers and Communication - The Internet - World wide web - HTTP Request Message - HTTP Response Message - Web Clients - Web Servers - HTML5 - Tables - Lists - Image - HTML5 control elements - Drag and Drop - Audio - Video controls - CSS3 - Inline, embedded and external style sheets - Rule cascading - Inheritance - Backgrounds - Border Images - Colors - Shadows - Text - Transformations - Transitions - Animations. Bootstrap Framework.

Unit:2	**CLIENT SIDE PROGRAMMING**	**12 hours**

Java Script : An introduction to JavaScript - JavaScript DOM Model - Exception Handling - Validation- Built-in objects - Event Handling - DHTML with JavaScript - JSON introduction - Syntax - Function Files.

Unit:3	**SERVER SIDE PROGRAMMING**	**12 hours**

Servlets : Java Servlet Architecture - Servlet Life Cycle - Form GET and POST actions - Session Handling and State Management - Servlet Filters and Listeners-Database Connectivity : JDBC

Unit:4	PHP and XML	12 hours
An introduction to PHP : PHP- Using PHP- Variables - Program control - Built-in functions - Form Validation. XML : Basic XML - Document Type Definition - XML Schema, XML Parsers and Validation, XSL.		

Unit:5	INTRODUCTION TO ANGULAR and WEB APPLICATIONS FRAMEWORKS	10 hours
Introduction to AngularJS, MVC Architecture, Understanding ng attributes, Expressions and data binding, Conditional Directives, Style Directives, Controllers, Filters, Forms, Routers, Modules, Services; Web Applications Frameworks and Tools - Firebase- Docker - Node JS - React - Django - UI & UX.		

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	60 hours

Text Books

1	**Achyut Godbole & Atul Kahate**, *Web Technologies: TCP/IP to Internet Application Architectures*, Tata McGraw Hill, 2011.
2	**Jon Duckett**, *HTML and CSS: Design and Build Websites*, Wiley, 2011.

Reference Books

1	PHP6 and MySQL6 Bible – Steve Svehring.
2	**Robert W. Sebesta**, *Programming the World Wide Web*, Pearson Education, 7th Edition, 2014.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.tutorialspoint.com/php/index.htm
2	https://www.javatpoint.com/php-tutorial
3	http://www.nptelvideos.com/video.php?id=2138&c=27

Mapping with Programming Outcomes

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

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

Course code	33P	PRACTICAL V: DIGITAL IMAGE PROCESSING LAB	L	T	P	C
Core/Elective/Supportive	Core Lab		4		4	4
Pre-requisite		Able to understand the concept of computer Graphics also familiar with programming languages, such as C or C++ or Java.	**Syllabus Version**		2020-21 Onwards	

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

LIST OF PROGRAMS	60 hours

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

Total Lecture hours	60 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, Websites etc.]	
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
Course Designed By:	

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

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

Course code	33Q	PRACTICAL VI : BIG DATA ANALYTICS LAB		L	T	P	C
Core/Elective/Supportive		Core Lab		4		4	4
Pre-requisite		Basics of Programming		Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

    Learn how to install and set up Hadoop and Pig in a Big Data environment.

    Understand the basics of MapReduce programming for processing large data.

    Write Pig scripts to sort, filter, join, and group data.

    Work with structured and semi-structured data using Pig.

    Learn how to import and export data between databases and Hadoop using Sqoop.

Expected Course Outcomes:

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

1	Set up and use Hadoop and Pig for big data processing.	K1,K2
2	Write and run basic MapReduce programs like Word Count and Matrix Multiplication	K2,K3
3	Create Pig Latin scripts to sort, filter, group, and join data.	K3,K4
4	Import and export data between databases	K5,K6

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

LIST OF PROGRAMS	60 hours

1. Installation of Hadoop and Pig

2. Implement of Matrix Multiplication with Hadoop Map Reduce

3. Word Count Map Reduce program to understand Map Reduce Paradigm

4. Pig Latin scripts to sort, group, join for Sales Data

5. Pig Latin scripts to project, and filter your Sales data

6. Analyse sales data to find top-performing regions

7. Practice importing and exporting data from various databases using Sqoop and analyze with Pig

Total Lecture hours	60 hours

	Text Books
1	**Hadoop: The Definitive Guide** – Tom White, O'Reilly Media, 4th Edition
2	**Programming Pig** – Alan Gates, O'Reilly Media
	Reference Books
3	**Hadoop in Practice – Alex Holmes, Manning Publications**
4	**MapReduce Design Patterns** – Donald Miner & Adam Shook, O'Reilly Media
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://hadoop.apache.org/docs/
2	https://pig.apache.org/docs/r0.17.0/
3	https://swayam.gov.in/nd2_cec20_cs10/preview
	Course Designed By:

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	M
CO4	S	S	S	S	S	S	S	M	S	S

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

Course code	33R	PRACTICAL VII: WEB APPLICATION DEVELOPMENT AND HOSTING	L	T	P	C
Core/Elective/Supportive	Core Lab		2		2	2
Pre-requisite		Students should able to know basic html,CSS and php concepts.	Syllabus Version		2021-22	

Course Objectives:

The main objectives of this course are to:

1.Able to design a web page using HTML tags

2.To enable the students to use Frame sets, hyper links and different formatting features of HTML tags

3.Enable the students to use Forms & other controls in a web page

4.To create interactive applications using PHP

Expected Course Outcomes:

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

1	Understand & implement the basic HTML tags to create static web pages	K1,K2
2	Capable of using hyperlinks, frames , images, tables, in a web page	K2,K3
3	Able to write dynamic web applications using HTML forms	K4,K5
4	Must be able to write dynamic web applications in PHP & HTML tags using XAMPP.	K5,K6

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

LIST OF PROGRAMS	30 hours

1. Develop a website for your college using advanced tags of HTML.

2. Write names of several countries in a paragraph and store it as an HTML document, world.html. Each country name must be a hot text. When you click India (for example), it must open india.html and it should provide a brief introduction about India.

3. Develop a HTML document to i)display Text with Bullets / Numbers - Using Lists ii) to display the Table Format Data.

4. Develop a Complete Web Page using Frames and Frame sets which gives the Information about a Hospital using HTML.

5.   Develop a HTML document to print your Bio-Data in a neat format using several components

6. Develop a Registration Form for an inter-collegiate function and validate using Java Script.

7.Develop and display customer details using XML with XSL transformation and validate the document using DTD or XSD

8. Develop and display student personal details in XML format.

	Total Lecture hours	30 hours

Text Books	
1	Ivan Bayross, "Web Enabled Commercial Applications Development Using HTML, JavaScript, DHTML and PHP", BPB Publications, 4th Revised Edition, 2010.
Reference Books	
2	A.K.Saini and SumintTuli, "Mastering XML", First Edition, New Delhi, 2002.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/xml/index.htm
2	https://www.tutorialspoint.com/internet_technologies/websites_development.htm
3	https://www.youtube.com/watch?v=PlxWf493en4
Course Designed By:	

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	M
CO4	S	S	S	S	S	S	S	M	S	S

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

Elective Courses

Course code	2EA	MULTIMEDIA AND ITS APPLICATIONS	L	T	P	C
Core/Elective/Supportive		Elective-I	4	4		4
Pre-requisite		Able to understand the basic hardware of keyboard, mouse, monitor, input, output, primary memory and secondary memory etc.	Syllabus Version		2021-22	

Course Objectives:

The main objectives of this course are to:
1. To introduce the students the concepts of Multimedia, Images & Animation.
2. To introduce Multimedia authoring tools
3. To understand the role of Multimedia in Internet
4. To know about High Definition Television and Desktop Computing – Knowledge based Multimedia systems

Expected Course Outcomes:

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

1	Understand the basic concepts of Multimedia	K1,K2
2	Demonstrate Multimedia authoring tools	K2,K3
3	Analyze the concepts of Sound, Images, Video & Animation	K3,K4
4	Apply and Analyze the role of Multimedia in Internet and real time applications	K4,K5
5	Analyze multimedia applications using HDTV	K6

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

Unit:1	INTRODUCTION	12 hours

What is Multimedia? – Introduction to making Multimedia – Macintosh and Windows Production platforms – Basic Software tools.

Unit:2	TOOLS OF MULTIMEDIA	12 hours

Making Instant Multimedia – Multimedia authoring tools – Multimedia building blocks – Text – Sound.

Unit:3	ANIMATION	12 hours

Images – Animation – Video.

Unit:4	INTERNET	12 hours

Multimedia and the Internet – The Internet and how it works – Tools for World Wide Web – Designing for the World Wide Web.

Unit:5	MULTIMEDIA SYSTEMS	10 hours
High Definition Television and Desktop Computing – Knowledge based Multimedia systems.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	60 hours

Text Books	
1	Tay Vaughan, "Multimedia making it work", Fifth Edition, Tata McGrawHill.
2	John F. KoegelBufford, "Multimedia Systems", PearsonEducation.
Reference Books	
1	Judith Jeffloate, "Multimedia in Practice (Technology and Applications)", PHI,2003.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/multimedia/index.htm
2	https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm
3	https://nptel.ac.in/courses/117/105/117105083/
Course Designed By:	

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	2EB	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
Core/Elective/Supportive		Elective-I	4	4	-	4
Pre-requisite		Basics about the Networking, TCP/IP and Programming Skills	Syllabus Version		2025-26	

Course Objectives:
The main objectives of this course are to:

1. To understand the User Interface Design, Back end databases, other services for mobile applications.
2. To get a job using mobile application development skills
3. To get exposure to Android and IOS development environment

Expected Course Outcomes:	
On the successful completion of the course, student will be able to:	
1	Understand the principles of Mobile networks	K2
2	Understand the different mobile network technology	K2
3	Get familiar with Android and IOS environment	K3
4	Design and develop Mobile application using Android and IOS.	K6
5	Get a job with their own skills.	K6

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

UNIT:1	Mobile Communication and Technology	12 HOURS

Mobile Communication - Mobile Computing - Mobile Computing Architecture
Mobile Communication and Technologies :GSM - CDMA - Bluetooth –ZigBee - IrDA - RFID – IEEE 802.11 – GPS – NFC

UNIT:2	4G/5G Communication Technology	12 HOURS

4G – LTE - 5G System Concepts – 5G Architecture – Functional Architecture – Machine type Communication – Device to Device Communication - 4G to 5G upgradation

UNIT:3	User Interface Design and Files/Directories	12 HOURS

User Interface Design: Fundamental - Views - Layouts – Drawable Resources - Resolution and Density Independence - Creating and Using Menus- Intents – Adapters - Internet Resources - Dialogs
Files and Directories: Files - Saving – retrieving – file Management - Databases – SQLite - Cursors and Content –Values – Working with SQlite.

UNIT:4	Networking, Location-Based Services and Multimedia Services	12 HOURS

Networking and Emailing services - Maps – Geocoding – Location - Based Services – Alarm – service – Toast – Threads – using sensors – Graphics – Media Player – Camera – Video – Working with Bluetooth, NFC and WiFi – Handling Telephony and SMS – Email.

UNIT:5	Android and IOS	10 HOURS

 Android: Development Tools – Architecture - Manifest - Application Life Cycle - Application Priority and Process States

IOS: iPhone Developer - Apple Developer Connection - Memory Management - Fundamental iPhone Design Patterns – Tables and Views	

UNIT:6	Contemporary Issues	2 HOURS
Expert lectures, online seminars – webinars		

	Total Lecture hours	60 HOURS

Text Book(s)

1	William Lee, Mobile Communications Engineering: Theory and Applications, Willey, 2017
2	Ajit Singh 5G Simplified, SPD,299
3	Neil Smith, Android Studio 3.0 Development Essentials - Android 8 Edition,Payload Media, Inc. 207
4	Ahmad Sahar , Craig Clayton, iOS 15 Programming for Beginners - Sixth Edition, Packt 2021
5	Afif Osseiran, Jose F. Monserrat, Pathick Marsch, 5G Mobile Wireless Communication, Cambridge University Press, 2016

Reference Books

1	Pradeep Kothari, "Android Application Development" Dream tech Press, 2015
2	Matt Neuburg, Programming IOS 13 : Dive Deep into Views, View Controllers and Frame works, Orelly, 2019.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://onlinecourses.nptel.ac.in/noc16_cs13

Course Designed By: **Dr. T.RAMESH.**

Mapping with Programme Outcomes

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

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

Course code	2EC	SOFTWARE TESTING	L	T	P	C
Core/Elective/Supportive	Elective-I		4	4		4
Pre-requisite		Able to know the concept of SDLC concepts with Manual and Automated Testing Tools.	Syllabus Version		2021-22	

Course Objectives:

The main objectives of this course are to:
1. Provides principles of Software Testing and tools.
2. Enable the students to learn about the principle and tools of Software testing.
3. Improve knowledge in software testingtools.

Expected Course Outcomes:

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

1	Understand the fundamentals of software testing	K1,K2
2	Gain software testing experience by applying software testing knowledge and methods to practice-oriented software testing projects	K2,K3
3	Analyze path testing concept	K4
4	Analyze state testing concept	K4,K5
5	Execute programs and test data in Client-Server Architecture	K5,K6

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

Unit:1	INTRODUCTION	12 hours

Purpose of Software testing – Some Dichotomies – a model for testing – Playing pool and consulting oracles – Is complete testing possible – The Consequence of bugs – Taxonomy of Bugs.

Unit:2	TESTING FUNDAMENTALS	12 hours

Software testing Fundamentals – Test case Design – Introduction of Black Box Testing and White Box testing – Flow Graphs and Path testing – Path testing Basics - Predicates, Path Predicates and Achievable Paths - Path Sensitizing – Path Instrumentation – Implementation and Application of Path Testing.

Unit:3	TRANSACTION FLOW TESTING	12 hours

Transaction Flow testing – Transaction Flows – techniques – Implementation Comments – Data Flow Testing – Basics – Strategies – Applications, Tools and effectiveness – Syntax Testing – Why, What, How – Grammar for formats – Implementation – Tips.

Unit:4	LOGIC BASED TESTING	12 hours

Logic Based Testing – Motivational Overview – Decision tables – Path Expressions – KV Charts – Specifications – States, State Graphs and transition Testing – State Graphs – Good & bad states – state testing Metrics and Complexity.

Unit:5	TYPES OF TESTING	10 hours
Testing GUIs – Testing Client – Server Architecture – Testing for Real-time System – A Strategic Approach to Software testing – issues – unit testing – Integration Testing – Validation testing – System testing – The art of Debugging.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	60 hours

Text Books	
1	Boris Beizer, Software testing techniques, DreamTech Press, Second Edition – 2003.
2	Myers and Glenford.J., The Art of Software Testing, John-Wiley & Sons,1979.
Reference Books	
1	Roger.S.Pressman, Software Engineering – A Practitioner's Approach,McGraw Hill, 5th edition, 2001.
2	Marnie.L. Hutcheson, Software Testing Fundamentals, Wiley-India,2007.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/software_testing/index.htm
2	https://www.guru99.com/software-testing-introduction-importance.html
3	https://nptel.ac.in/courses/106/105/106105150/
Course Designed By:	

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	M	M	M	S	L	M	S	M
CO2	M	S	S	S	S	S	M	S	S	S
CO3	M	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	2ED	WEB SERVICES		L	T	P	C
Core/Elective/Supportive		Elective-I		4	4		4
Pre-requisite		Able to know the request/response services of Client and Server.		**Syllabus Version**		**2021-22**	

Course Objectives:
The main objectives of this course are to:

1. Present the Web Services , Building real world Enterprise applications using Web Services with Technologies XML, SOAP , WSDL , UDDI
2. Get overview of Distributed Computing, XML, and its technologies
3. Update with QoS and its features
4. Develop Standards and future of Web Services

Expected Course Outcomes:	
On the successful completion of the course, student will be able to:	
1	Understand web services and its related technologies	K1,K2
2	Understand XML concepts	K2,K3
3	Analyze on SOAP and UDDI model	K3,K4
4	Demonstrate the road map for the standards and future of web services	K4,K5
5	Analyze QoS enabled applications in web services	K6

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

Unit:1		INTRODUCTION		12 hours

Introduction to web services – Overview of Distributed Computing- Evolution and importance of web services-Industry standards, Technologies and concepts underlying web services-Web services and enterprises-web services standards organization-web services platforms.

Unit:2		XML FUNDAMENTALS		12 hours

XML Fundamentals – XML documents - XML Namespaces- XML Schema –Processing XML.

Unit:3		SOAP AND WSDL		12 hours

SOAP: The SOAP model- SOAP messages-SOAP encoding- WSDL: WSDL structure-interfacedefinitions-bindings-services-Using SOAP and WSDL-UDDI: About UDDI- UDDI registrySpecification- Core data structures-Accessing UDDI

Unit:4		ADVANCEDTECHNOLOGIES		12 hours

Advanced web services technologies and standards: Conversations overview-web services conversation language-WSCL interface components. Workflow: business process management-workflows and workflow management systems Security: Basics-data handling and forwarding- data storage-errors-Web services security issues.

Unit:5	QUALITY OF SERVICE	10 hours
Quality of Service: Importance of QoS for web services-QoS metrics-holes-design patterns-QoSenabled web services-QoS enabled applications. Web services management-web services standards and future trends.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	60 hours

Text Books		
1	Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services: An Architects Guide", Prentice Hall, Nov 2003.	
2	Keith Ballinger, "NET Web services: Architecture and Implementation with .Net", Pearson Education, First Education Feb 2003.	
Reference Books		
1	Ramesh Nagappan, Developing Java Web Services: Architecting and developing secure Web Services Using Java", John Wiley and Sons, first Edition Feb 2003.	
2	Eric A Marks and Mark J Werrell, "Executive Guide to Web services", John Wiley and sons, March 2003.	
3	Anne Thomas Manes, "Web Services: A managers Guide" Addison Wesley, June 2003.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.tutorialspoint.com/webservices/index.htm	
2	https://www.javatpoint.com/web-services-tutorial	
3	https://www.btechguru.com/training--programming--xml--web-services--web-services-part- 1-video-lecture--11801--24--147.html	
Course Designed By:		

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	S	M	M	M	S
CO2	S	S	S	M	M	S	M	S	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	S	S	S	S	S	S	S	S	S	S

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

Course code	3EA	SOFT COMPUTING	L	T	P	C
Core/Elective/Supportive	Elective-II		4	4		4
Pre-requisite		Able to build algorithms, know the programming skills with critical thinking.	Syllabus Version		2021-22	

Course Objectives:

The main objectives of this course are to:
1. Present the introduction to the basic neuron, Kohenen self- organizing network, hop field networks, associative memory, fuzzy.
2. Learn the pattern classification in Neural Networks.
3. Gain knowledge on the fuzzy relation and fuzzylogic.

Expected Course Outcomes:

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

1	Understand about soft computing techniques and their applications	K1,K2
2	Understand the pattern classification in Neural Networks	K2,K3
3	Analyze various neural network architectures	K3,K4
4	Analyze fuzzy relation and fuzzy logic & its applications	K5
5	Apply and analyze fuzzy logic in real time applications	K5,K6

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

Unit:1	PATTERN CLASSIFICATION	12 hours

Pattern classification - Learning and Generalization - Structure of neural networks - ADA line, Delta rule - input output value - perceptions - Linear separability - Back propagation - XOR Function - Introduction to Boolean neural networks.

Unit:2	NETWORK	12 hours

Hopfield Networks - Energy - The Hamming Network - RAM -Boltzmann machine - Instar, outstar network - ART - Kohonen's Network Recognition.

Unit:3	FUZZY LOGIC	10 hours

Fuzzy relation - Member function - Fuzzy matrices - Fuzzy entropy - Fuzzy operation - Fuzzy composition.

Unit:4	FUZZY VARIABLES	12 hours

Fuzzy variables - Linguistic variables - Measure of fuzziness - Transition Matrix - Concept of Defuzzication and Applications

Unit:5	CASE STUDY	12 hours

CASE STUDY: Application of Neural Networks in character recognition, drug discovery, speech recognition; Application of Fuzzy logic concepts in Fuzzy controller design and Fuzzy querying in Relational databasemodel

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	P.D.Wasserman, "Neural computing and practice", Van Nostran Reinhold, New York, 1991.
2	LiminFu,"NeuralNetworkinComputerIntelligence",McGrawHill, International editions, 1994.
Reference Books	
1	B Kosko, "Neural Network and Fuzzy systems", Prentice Hall,1996.
2	Klir& Yuan, "Fuzzy sets and Fuzzy logic", Theory and Applications, Prentice Hall of India, 1996.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://www.myreaders.info/html/soft_computing.html
2	https://www.youtube.com/watch?v=mlfM4SGOAgo
3	https://nptel.ac.in/courses/106/105/106105173/
Course Designed By:	

Mapping with Programming Outcomes									
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	S	S	S	M	S	M	M	M	S
CO2	M	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	3EB	EMBEDDED SYSTEMS	L	T	P	C
Core/Elective/Supportive		Elective-II	4	4		4
Pre-requisite		Able to know the basics of Hardware systems with understand the concept of basic processor like 8085, 8085 etc	Syllabus Version		2021-22	

Course Objectives:

The main objectives of this course are to:
1. Present the introduction to 8051 Microcontroller Instruction Set, concepts on RTOS & Software tools.
2. Gain the knowledge about the embedded software development.
3. Learn about Microcontroller and software tools in the embedded systems.

Expected Course Outcomes:		
On the successful completion of the course, student will be able to:		
1	Understand the concept of 8051 microcontroller	K1,K2
2	Understand the Instruction Set and Programming	K2,K3
3	Analyze the concepts of RTOS	K4,K5
4	Analyze and design various real time embedded systems using RTOS	K5,K6
5	Debug the malfunctioning system using various debugging techniques	K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create		

Unit:1	8051 MICROCONTROLLER	12 hours

8051 Microcontroller: Introduction - 8051 Architecture-Input/Output Pins, Ports and Circuits - External Memory - Counters / Timers - Serial Data Input / Output –Interrupts

Unit:2	BASICS OF PROGRAMMING	12 hours

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	RTOS CONCEPTS	12 hours

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	10 hours

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	SOFTWARE TOOLS	12 hours
SOFTWARE TOOLS: 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	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	60 hours

Text Books		
1	David E. Simon, "An Embedded Software primer" Pearson Education Asia, 2003.	
2	Kenneth J Ayala, "The 8051 Microcontroller and Architecture programming and application", Second Edition, Penram International.	
Reference Books		
1	Raj Kamal, "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	
Course Designed By:		

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	L	L	L	S	M	S	S	M	M	S
CO2	M	M	S	S	M	S	M	S	S	S
CO3	M	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	3EC	**BLOCK CHAIN TECHNOLOGY**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Elective II**	4	4		4
Pre-requisite		Basics of Block Chain & Crypto Currency	**Syllabus**		**2025-26**	

Course Objectives:

The main objectives of this course are to:

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

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

Unit:1	INTRODUCTION	12 hours

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

Unit:2	NETWORK AND SECURITY	12 hours

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

Unit:3	CRYPTOCURRENCY	12 hours

Cryptocurrency - History, Distributed Ledger, Bitcoin 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 Blockchain

Unit:4	CRYPTOCURRENCY REGULATION	11 hours

Cryptocurrency Regulation - Stakeholders, Roots of Bit coin, Legal views - exchange of cryptocurrency - Black Market - Global Economy. Cyrptoeconomics – assets, supply and

demand, inflation and deflation – Regulation.

Unit:5	**CHALLENGES IN BLOCK CHAIN**	11 hours

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

Unit:6	**Contemporary Issues**	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	60 hours

Text Books

1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press (July 19, 2016).
2	Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies"

Reference Books

1	Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System"
2	Rodrigo da Rosa Righi, Antonio Marcos Alberti, Madhusudan Singh, "Blockchain 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/

Course Designed By:

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	3ED	**CRITICAL THINKING, DESIGN THINKING AND PROBLEM SOLVING**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		Elective-II	4	4		4
Pre-requisite		Students should able to learn problem solving pattern, reasoning and designing tools for the need of the requirement.	**Syllabus Version**		**2021-22**	

Course Objectives:

The main objectives of this course are to:

1. Learn critical thinking and its related concepts
2. Learn design thinking and its related concepts
3. Develop Thinking patterns, Problem solving & Reasoning

Expected Course Outcomes:

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

1.Understand the concepts of Critical thinking and its related technology	K1,K2
2.Focus on the explicit development of critical thinking and problem solving skills	K2,K3
3.Apply design thinking in problems	K3,K4
4.Make a decision and take actions based on analysis	K5
5.Analyze the concepts of Thinking patterns, Problem solving & Reasoning in real time applications	K5,K6

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

Unit:1	**CRITICAL THINKING**	**12 Hours**

Critical Thinking: Definition, Conclusions and Decisions, Beliefs and Claims, Evidence – finding, evaluation, Inferences, Facts – opinion, probable truth, probably false, Venn diagram. Applied critical thinking: Inference, Explanation, Evidence, Credibility, Two Case Studies, critical thinking and science, critical evaluation, self assessment.

Unit:2	**DESIGN THINKING**	**12 hours**

Design Thinking: Introduction, Need of Design Thinking, problem to question - design thinking process, Traditional Problem Solving versus Design Thinking, phases of Design Thinking, problem exploration, Stake holder assessment, design thinking for manufacturers, smart Idea to implementation.

Unit:3	**TOOLS FOR THINKING**	**12 hours**

Thinking to confidence, fear management, duty Vs passion, Team management, Tools for Thinking, prototype design, Relevance of Design and Design Thinking in engineering, human centered design, case study: apply design thinking in problem.

Unit:4	SOLVE PROBLEMS	12 hours
Problem solving: problem definition, problem solving methods, selecting and using information,data processing, solution methods, solving problems by searching, recognizing patterns, spatial reasoning, necessity and sufficiency, choosing and using models, making choices and decisions.		

Unit:5	REASONING	10 hours
Reasoning: Deductive and hypothetical reasoning, computational problem solving; generating, implementing, and evaluating solutions, interpersonal problem solving. Advanced problem solving: Combining skills – using imagination, developing models, Carrying out investigations, Data analysis and inference. Graphical methods of solution, Probability, tree diagrams and decision trees		

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	60 hours

Text Books

1	John Butterworth and Geoff Thwaites, Thinking skills: Critical Thinking and Problem Solving, Cambridge University Press, 2013.
2	H. S. Fogler and S. E. LeBlanc, Strategies for Creative Problem Solving, 2nd edition, Pearson, Upper Saddle River, NJ, 2008.
3	A. Whimbey and J. Lochhead, Problem Solving & Comprehension, 6th edition, Lawrence Erlbaum, Mahwah, NJ, 1999.

Reference Books

1	M. Levine, Effective Problem Solving, 2nd edition, Prentice Hall, Upper Saddle River, NJ, 1994.
2	Michael Baker, The Basic of Critical Thinking, The Critical Thinking Co press, 2015.
3	David Kelley and Tom Kelley, Creative Confidence, 2013.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.tutorialspoint.com/critical_thinking/index.htm
2	https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm
3	https://nptel.ac.in/courses/109/104/109104109/
	Course Designed By:

Mapping with Programming Outcomes

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