M. Sc. Information Technology

Syllabus

AFFILIATED COLLEGES

Program Code: 36J

2020 – 2021 onwards

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A" Grade by NAAC,
Ranked 13th among Indian Universities by MHRD-NIRF,
World Ranking: Times -801-1000,Shanghai -901-1000, URAP - 982)

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 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 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 need 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 solvingskills 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 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)*

(For the students admitted during the academic year 2020 – 2021 onwards)

SCHEME OF EXAMINATIONS – CBCS PATTERNS

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
	Paper I : Object Oriented Analysis and Design	4	5		25	75	100
	Paper II : Advanced Operating Systems	4	5		25	75	100
	Paper III : Advanced Java Programming	4	5		25	75	100
	Paper IV : Python Programming	4	5		25	75	100
	Practical I : Advanced Java Lab	4		5	40	60	100
	Practical II : Python Programming Lab	4		5	40	60	100
	Total	24	20	10			
SECOND SEMESTER							
	Paper V : Data Mining and Warehousing	4	4		25	75	100
	Paper VI : Network Security and Cryptography	4	4		25	75	100
	Paper VII : .NET Programming	4	4		25	75	100
	Paper VIII : Software Project Management	4	4		25	75	100
	Elective – I	4	4		25	75	100
	Practical III: Data Mining using R	4		5	40	60	100
	Practical IV: .NET Programming Lab	4		5	40	60	100
	Total	28	20	10			
THIRD SEMESTER							
	Paper IX : Digital Image Processing	4	4		25	75	100
	Paper X : Big Data Analytics	4	4		25	75	100
	Paper XI: Cloud Computing	4	4		25	75	100
	Paper XII : PHP Programming	4	4		25	75	100
	Elective – II	4	4		25	75	100
	Practical V: Digital Image	4		4	40	60	100

	Processing using MATLAB						
	Practical VI : PHP Programming Lab	4		4	40	60	100
	Practical VII : Web Application Development and Hosting	**2**		**2**	**20**	**30**	**50**
	Total	30	20	10			
FOURTH SEMESTER							
	Project work and Viva-voce	**8**					**200**
	Total	8					200
	Grand Total	90					2250
ONLINE COURSES							
1.	**#SWAYAM / MOOC**	2					
2.	**#Job oriented Certificate course**	2					

***** Project Report – 160 marks & Viva Voce – 40 marks

During II or III Semester (Optional)

ELECTIVE – I

1.1. Multimedia and its Applications

1.2. Mobile Computing

1.3. Software Testing

1.4.Web Services

ELECTIVE – II

2.1. Soft Computing

2.2. Embedded Systems

2.3. Internet of Things

2.4.Critical Thinking, Design Thinking and Problem Solving

Course code		OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Able to understand the basis of programming languages, paradigms and designing tools	Syllabus Version		2020-21 Onwards	

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 casemodels	K2,K3
3	Analyze on class diagrams used for UML.	K4,K5
4	Apply and analyze different testing techniques for various applications	K3,K4, K5
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

Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**75 hours**
Text Books		
1	Ali Brahmi , "Object Oriented System Development" , TMH IntlEdition.	
2	Grady Booch, "Object-Oriented Analysis and Design", Addison –Wesley	
Reference Books		
1	James Rumbaugh ,MichealBlaha, "Object Oriented Modeling and Design", Prentice Hall	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.nptel.ac.in/noc19_cs48/preview	
2	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/	
3	https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm	
Course Designed By:		

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		ADVANCED OPERATING SYSTEMS	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Students should able to know the basic of operating system, structuring, multithreading and synchronization systems issues	Syllabus Version		2020-21 Onwards	

Course Objectives:

The main objectives of this course are to:

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

Expected Course Outcomes:

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

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

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

Unit:1	FUNDAMENTALS OF OPERATING SYSTEM	15 hours

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

Unit:2	DISTRIBUTED OPERATING SYSTEM	15 hours

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

Unit:3	REALTIME OPERATING SYSTEM	13 hours

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

Unit:4	HANDHELD OPERATING SYSTEM	15 hours

Operating Systems for Handheld Systems: Requirements – Technology Overview –Handheld Operating Systems – PalmOS-Symbian Operating System- Android –Architecture of android – Securing handheld systems

Unit:5	**LINUX SYSTEM**	**15 hours**
Case Studies : Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS : Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**75 hours**

Text Books

1	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2004.
2	MukeshSinghal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.
3	Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.

Reference Books

1	Pramod Chandra P.Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.
2	Daniel.P.Bovet& Marco Cesati,"Understanding the Linux kernel",3rd edition,O"Reilly, 2005
3	Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload media, 2011.

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

1	https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2	https://www.udacity.com/course/advanced-operating-systems--ud189
3	https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf

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

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

Course code		ADVANCED JAVA PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Students should able to know the concept of Java Fundamentals, Applet, Swings,JDBC, JavaBeans.	Syllabus Version		2020-21 Onwards	

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		PYTHON PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Able to understand the concept of C, C++ and Java	Syllabus Version		2020-21 Onwards	

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 Library, Fourth Edition,2009.
2	SheetalTaneja,Naveen Kumar, "Python Programming-A Modular Approach",PearsonPublications.

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

1	https://www.programiz.com/python-programming/
2	https://www.tutorialspoint.com/python/index.htm
3	https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

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		**PRACTICAL I : ADVANCED JAVA LAB**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Core Lab**			4	4
Pre-requisite		The basic understanding of core java, JSP and HTML.	**Syllabus Version**		2020-21 Onwards	

Course Objectives:

The main objectives of this course are to:

To enable the students to implement the simple programs using JSP, JAR
To provide knowledge on using Servlets, Applets

To introduce JDBC and navigation of records
To understand RMI & its implementation
To introduce to Socket programming

Expected Course Outcomes:

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

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

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

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		PRACTICAL II :PYTHON PROGRMMING LAB	L	T	P	C
Core/Elective/Supportive		Core Lab			4	4
Pre-requisite		Students must comfortable with variables, linear equations, graphs of functions, histograms, and statistical means.	Syllabus Version		2020-21 Onwards	

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 Library, Fourth Edition,2009.
2	SheetalTaneja,Naveen Kumar, "Python Programming-A Modular Approach",PearsonPublications.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.programiz.com/python-programming/
2	https://www.tutorialspoint.com/python/index.htm
3	https://onlinecourses.swayam2.ac.in/aic20_sp33/preview
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

Course code		DATA MINING AND WAREHOUSING	L	T	P	C
Core/Elective/Supportive		Core	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		2020-21 Onwards	

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		NETWORK SECURITY AND CRYPTOGRAPHY	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		It requires basic knowledge of Computer Networks, algorithms, encryption and decryption techniques	Syllabus Version	2020-21 Onwards		

Course Objectives:

The main objectives of this course are to:

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

Expected Course Outcomes:

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

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

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

Unit:1	CRYPTOGRAPHY ALGORITHMS	12 hours

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

Unit:2	CRYPTOSYSTEM	12 hours

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

Unit:3	NETWORK SECURITY	12 hours

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

Unit:4	WEB SECURITY	10 hours

Web Security - Secure Socket Layer – Secure Electronic Transaction. System Security - Intruders

and Viruses – Firewalls– Password Security.		
Unit:5	**CASE STUDY**	**12 hours**
Case Study: Implementation of Cryptographic Algorithms – RSA – DSA – ECC (C / JAVA Programming). Network Forensic – Security Audit - Other Security Mechanism: Introduction to: Stenography – Quantum Cryptography – Water Marking - DNA Cryptography		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**
Text Books		
1	William Stallings, "Cryptography and Network Security", PHI/PearsonEducation.	
2	Bruce Schneir, "Applied Cryptography", CRC Press.	
Reference Books		
1	A.Menezes, P Van Oorschot and S.Vanstone, "Hand Book ofApplied Cryptography", CRC Press, 1997	
2	AnkitFadia, "Network Security",MacMillan.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/106/105/106105031/	
2	http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html	
3	https://www.tutorialspoint.com/cryptography/index.htm	
Course Designed By:		

Mapping with Programming Outcomes

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

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

Course code		.NET Programming	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Students should able to know the basic programming knowledge with IDEs	Syllabus Version		2020-21 Onwards	

Course Objectives:

The main objectives of this course are to:

1. This course presents the practical aspects of application development using .Net framework.
2. It also covers the Common Language Runtime (CLR), .Net framework classes, C#, and ADO.net Programming

Expected Course Outcomes:

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

1	Understand the concepts of .NET Framework Technology	K1,K2
2	Apply error handling techniques in .NET	K3
3	Demonstrates the c# console applications	K3,K4
4	Design and develop the Web applications using c#	K5
5	Design and develop the distributed data driven applications using .NET framework	K5,K6

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

Unit:1	WEB DEVELOPMENT	12 hours

Evolution of Web Development: HTML Forms-Server Side and Client Side Programming. Developing ASP.Net Applications – Visual Studio: Creating Websites- Designing a Webpage- The anatomy of a Web form – Writing Code. Web Form Fundamentals: The anatomy of an ASP.Net application – Introducing Server Controls – Improving the Currency Converter – A Deeper Look at HTML Control Classes – The Page Class. Web Controls: Steeping up to Web Controls – Web Control Classes – List Controls – Table Controls – Web Control Events and AutoPostBack

Unit:2	STATE MANAGEMENT	12 hours

State Management: The problem of State – View State – Transferring Information between Pages – Cookies – Session State – Session State Configuration. Error Handling, Logging, and Tracing: Common Errors – Exception Handling – Handling Exceptions – Throwing Your Own Exceptions – Logging Exceptions – Error Pages – Page Tracing. Deploying ASP.Net Applications: ASP.Net Applications and the Web Server – Internet Information Services(IIS) – Managing Websites with IIS Manager – Deploying a Simple Site – Deploying with Visual Studio.

Unit:3	BASICS OF C#	10 hours

C# Language: C# Languages Basics – Variables and Data Types – Variable operations – Object based manipulation – Conditional Logic – Loops – Methods. Types, Objects and Namespaces: Classes – Value types and reference types – Understanding namespaces and assemblies.

Unit:4	C# CONCEPTS	12 hours

C#: Enumerators and Iterators – Exceptions – Serializing objects - Deep serialization-XML based

serialization - Multithreading – Interfaces and Structures - Delegates and Events – Indexers and Properties.		
Unit:5	**DATABASES**	**12 hours**
ADO.NET Fundamentals: Understanding Data Management – Configure database – SQL Basics - ADO.Net basics – Direct Data Access – Disconnect Data Access. Data Binding: Single-Value data binding		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**
Text Books		
1	Matthew MacDonald (2008), Beginning ASP.NET 3.5 in C#, 2/e; A press Berkeley.	
2	Jesse Liberty (2003), Programming Visual Basic .NET, 2/e; O'Reilly, Shroff Publishers and Distributors Pvt. Ltd.	
3	Bill Evjen, Jason Beres (2009), Visual Basic .Net Bible, Hungry Minds Inc.	
Reference Books		
1	Herbert Schildt (2010), Complete Reference C#, Tata McGraw-Hill.	
2	Joe Duffy(2010), Professional .Net Framework 2.0l, Wiley India.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.tutorialspoint.com/asp.net/index.htm	
2	https://www.javatpoint.com/net-framework	
3	https://www.btechguru.com/training--dot-net--c-sharp-dot-net--framework--microsoft-net-framework-part-1-video-lecture--11280--27--139.html	
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	S	S	S
CO2	S	M	M	S	S	S	M	M	S	S
CO3	M	S	S	M	S	M	S	S	M	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	M	S	M	S	M	M	L	M	S	M

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

Course code		SOFTWARE PROJECT MANAGEMENT	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		The need of SPM is to deliver a quality product, keeping the cost within the clients budget and deliver the project as per schedule	Syllabus Version	2020-21 Onwards		

Course Objectives:

The main objectives of this course are to:

1. This course presents a deep insight to software project management concepts.
2. To understand the software project, Analyze project Characteristics, estimate efforts, project evaluation, and selection of process model, software effort estimation, risk management and managing contracts.

Expected Course Outcomes:

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

1	Understand the basic concepts of Software Project Management	K1,K2
2	Identify the different project contexts and suggest an appropriate management strategy	K2,K3
3	Demonstrate through application, knowledge of the key project management skills, such as product and work break-down structure, schedule, governance including progress reporting, risk and quality management	K4,K5
4	Analyze a comparison on Product Versus Process Quality Management	K4,K5
5	Perform case studies on cost estimation models like COCOMO	K5,K6

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

Unit:1	INTRODUCTION	12 hours

Introduction: Software Project Management - Software Project Versus Other Project – Requirement Specification – Information and Control in Organization – Introduction to step wise Project Planning – Select – Identify Scope and Objectives - Identify Project Infrastructure – Analyze Project Characteristics – Products and Activities – Estimate Effort for each Activity – Identify Activity Risks – Allocate Resources - Review / Publicize Plan – Execute Plan and Lower Levels of Planning.

Unit:2	PROJECT EVALUATION	12 hours

Project Evaluation : Introduction – Strategic Assessment – Technical Assessment – Cost Benefit Analysis – Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation – Selection of an Appropriate Project App roach – Choosing Technologies – Choice of Process Models – Structured Methods – Rap id Application Development – Waterfall Model – VProcess Model – Spiral Model – Software Prototyping – Ways of Categorizing Prototypes – Tools – Incremental Delivery – Selection Process Model.

Unit:3	SOFTWARE EFFORT ESTIMATION	12 hours

Software Effort Estimation : Introduction – Problem s with Over and Under Estimates – Basis for Software Estimating – Software Effort Estimation Technique – Albrecht Function Point Analysis – Function Points – Object Points – Procedural Code Oriented Approach – COCOMO – Activity Planning – Project Schedules - Projects and activities – Sequencing and Scheduling Activities – Network Planning Models – Formulating a Network Planning – Adding Time Dimension –

Forward Pass – Backward Pas s – Identifying the Critical Path – Activity Float - Shortening Project Duration – Identifying Critical Activities – Precedence Networks.

Unit:4	RISK MANAGEMENT	11 hours

Risk Management : Introduction – Nature of Risk Man aging Identification – Analysis – Reducing – Evaluating – Z values – Resource Allocation – Nature of Resources – Requirements – Scheduling – Critical Paths – Counting the Cost – Resource Schedule – Cost Schedule – Scheduling Sequence – Monitoring and Control – Creating the Frame Work - Collecting the Data – Visualizing the Progress – Cost Monitoring – Prioritizing Monitoring – Change Control.

Unit:5	CONTRACTS AND QUALITY	11 hours

Managing Contracts : Introduction – Types of Contract – Stages in Contract Placement – Terms of Contract – Contract Management – Acceptance – Managing People and Organizing Teams – Organizational Behavior Background – Selecting the Right Person for the Job – Instruction in the Best Methods – Motivation – Decision Making – Leadership – Organizational Structures – Software Quality – Importance – Practical Measures – Product Versus Process Quality Management – External Standards – Techniques to Help Enhance Software Quality.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	60 hours

Text Books

1	Bob Hughes and Mike Cottrell, “Software Project Management”, McGraw Hill, Second Edition.
2	Walker Royce, “Software Project Management”, Addition Wesley.

Reference Books

1	DerrelInce, H. Sharp and M. Woodman, “Introduction to Software Project Management and Quality Assurance”, Tata McGraw Hill, 1995.

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

1	https://www.tutorialspoint.com/software_engineering/software_project_management.htm
2	https://www.javatpoint.com/software-project-management
3	https://onlinecourses.nptel.ac.in/noc19_cs70/preview

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	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	M	M	S	S	S	S	S	S	S	S
CO5	M	M	S	S	S	S	S	S	S	S

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

Course code		PRACTICAL III : DATA MINING USING R	L	T	P	C
Core/Elective/Supportive		Core Lab			4	4
Pre-requisite		Able to know extraction of data, statistical analysis of data, graphs for data representation.	Syllabus Version		2020-21 Onwards	

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		PRACTICAL IV :.NET PROGRAMMING LAB (Effective for the candidates admitted from the academic Year 2020-2021)	L	T	P	C
Core/Elective/Supportive		Core Lab			4	4
Pre-requisite		Students should able to understand the concept of C, C++, C#, ASP and VB concepts.	Syllabus Version		2020-21 Onwards	

Course Objectives:

The main objectives of this course are to:

- To Understand & write web applications using ASP.NET
- To implement OOPS concepts using C#
- To Develop the Web applications using C#
- To Design and develop the data base applications using ADO.NET control.

Expected Course Outcomes:

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

1	Understand to create web pages using ASP.NET	K1,K2
2	Capable of developing interactive web applications using ASP.NET	K2,K3
3	Able to write dynamic web applications using C#	K3,K4
4	Must be able develop data base applications using ADO.NET control	K5,K6

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

LIST OF PROGRAMS	75 hours

ASP.NET PROGRAMS

1. CollegeWebsite
2. Online ExaminationSystem
3. Online Mobile phoneshop
4. Online registrationform

C# PROGRAMS

5. Student Information using inheritance.
6. Sales bill preparation using interface.
7. Insert record using data grid view.
8. Create user login form.

ADO.NET Programming

9. Develop a Windows application with ADO.NET to perform Insert, Delete, Update and Select operations.

10. Build an ADO.NET program which displays the Employee information in the relevant fields from the database which already exists	
Total Lecture hours	**75 hours**
Text Books	
1	Matthew MacDonald (2008), Beginning ASP.NET 3.5 in C#, 2/e; A press Berkeley.
2	Jesse Liberty (2003), Programming Visual Basic .NET, 2/e; O'Reilly, Shroff Publishers and Distributors Pvt. Ltd.
Reference Books	
1	Bill Evjen, Jason Beres (2009), Visual Basic .Net Bible, Hungry Minds Inc.
2	Herbert Schildt (2010), Complete Reference C#, Tata McGraw-Hill.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/asp.net/index.htm
2	https://www.javatpoint.com/net-framework
3	https://www.btechguru.com/training--dot-net--c-sharp-dot-net--framework--microsoft-net-framework-part-1-video-lecture--11280--27--139.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		DIGITAL IMAGE PROCESSING	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		It requires some of the basic programming skills, know about signals and system with calculus and probability.	Syllabus Version		2020-21 Onwards	

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		BIG DATA ANALYTICS	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Students should able to handle large datasets with required market of the business.	Syllabus Version		2020-21 Onwards	

Course Objectives:

The main objectives of this course are to:

1. Present the Importance of Big Data and the features of R and Hadoop.
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	Understand about HDFS	K2,K3
3	Installation of R and Hadoop	K3,K4
4	Apply MapReduce concepts to process big data	K4,K5
5	Design big data applications using Hadoop components and R programming	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	R INSTALLATION	12 hours

Installing R - Installing RStudio - Understanding the features of R language - Using R packages - Performing data operations - Increasing community support - Performing data modeling in R.

Unit:3	HADOOP INSTALLATION	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 (multinode cluster) - Installing ClouderaHadoop on Ubuntu

Unit:4	BASICS OF HADOOP	10 hours

Understanding Hadoop features - Understanding HDFS - Understanding the characteristics of HDFS - Understanding MapReduce -Learning the HDFS and MapReduce architecture.

Unit:5	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: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.	
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://www.javatpoint.com/what-is-big-data	
3	https://onlinecourses.nptel.ac.in/noc20_cs92/preview	
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		CLOUD COMPUTING	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Basic Knowledge to store data with handling of operating systems.	Syllabus Version		2020-21 Onwards	

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		PHP PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Core Lab	4			4
Pre-requisite		Students should know the concept of technologies like Html, My Sql, CSS and Java Script	Syllabus Version		2020-21 Onwards	

Course Objectives:

The main objectives of this course are to:

1. Present the Introduction to PHP, PHP functions, database handling and in addition AJAX is taught.
2. Enable the students to learn the fundamentals of Open Source software and get experience in PHP and AJAX.
3. Acquire skills to write PHP programs.

Expected Course Outcomes:

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

1	Understand the concepts of open source softwares	K1,K2
2	Understand the functions and browser handling power of PHP	K2,K3
3	Apply object oriented concepts and file handling concepts of PHP	K3,K4
4	Evaluate database and set sessions, cookies and FTP	K4,K5
5	Develop web pages using PHP	K5,K6

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

Unit:1	INTRODUCTION	12 hours

Open Source Softwares: Overview of Free/ Open Source Software: The Open Source Definition - Examples of OSD Compliant Licenses - Examples of Open Source Software Product – The Open Source Software Development Process – A History of Open Source software: The Berkeley Software Distribution – The Free Software Foundation – Linux – Apache – Mozilla – Open Source Software.

PHP: Introduction – Essential PHP – Operators and Flow control: Working with math, assignment, increment and decrement, string, bitwise, execution, comparison and logical operators, Working with loops – Strings and Arrays.

Unit:2	FUNCTIONS AND WEB PAGES	12 hours

PHP Functions and Browser handling power: Creating Functions, passing functions, passing arrays, pass by reference, default arguments, returning data, arrays, lists, references, accessing global data, working with static variables, PHP conditional functions, variable functions, nesting functions – Reading data in web pages: Handling text fields, areas, check boxes, radio buttons, list boxes, password controls, hidden controls, image maps, file uploads, buttons – PHP Browser handling power

Unit:3	OOP'S AND FILES	12 hours

Working with Object oriented programming and File handling: Object oriented programming: creating classes, objects, setting access to properties and methods, using constructors and

destructors, inheritance, overriding and overloading methods, auto loading classes – File Handling: open, read, close, parsing files, copy, delete, write and append files.		
Unit:4	**DATABASES, SESSIONS AND COOKIES**	**12 hours**
Working with databases and setting sessions, cookies and FTP: Databases: creating, accessing, updating, inserting, deleting and sorting databases – Setting sessions, cookies and FTP: setting, reading, and deleting cookies, working, downloading, uploading, deleting, creating and removing directories with FTP.		
Unit:5	**AJAXANDSERVERIMAGES**	**10 hours**
AJAX and Drawing Images on the server: Ajax: Handling AJAX requests, downloading images using AJAX, downloading javascript with AJAX– Drawing images on the server: creating and displaying images, drawing lines, rectangles, ellipse, arcs, polygons, figures, individual pixels, text, virtual text, working with image files, tiling images, copying images.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	Joseph Feller, Brain Fitzgerald, Eric S. Raymond, "Understanding Open Source Software Development", Addison-Wesley Professional, 1st Edition, 2001.
2	"The Complete Reference PHP Covers PHP 5.2, "Steven Holzner, Tata McGraw-Hill Edition 2008.
Reference Books	
1	PHP6 and MySQL6 Bible – Steve Svehring.
2	PHP Programming Solutions – VickramViswani.
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		PRACTICAL V :DIGITAL IMAGE PROCESSING Using MATLAB	L	T	P	C
Core/Elective/Supportive		Core Lab			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 enhancementTechnique.
2. HistogramEqualization
3. ImageRestoration.
4. Implement ImageFiltering.
5. Edge detection using Operators (Roberts, Prewitts and Sobelsoperators)
6. Implement imagecompression.
7. ImageSubtraction
8. Boundary Extraction usingmorphology.
9. ImageSegmentation

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		PRACTICAL VI :PHP PROGRAMMING LAB	L	T	P	C
Core/Elective/Supportive		Core Lab			4	4
Pre-requisite		Basic requirements of technologies for web development as well: Basic HTML. MySQL. Basic CSS with LAMP and WAMP	Syllabus Version		2020-21 Onwards	

Course Objectives:

The main objectives of this course are to:

- Understand the features like basic functions and features in PHP.
- Must be able to know the implementation of Files handling, OOPs concepts, cookies in PHP
- Able to write PHP programs for File manipulation
- Able to write a Data base application in PHP

Expected Course Outcomes:

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

1	Understand to write programs in PHP for OOPS concepts	K1,K2
2	Capable of developing interactive web applications using PHP	K2,K3
3	Able to write PHP programs for File handling	K3,K4
4	Must be able develop data base applications using PHP	K5,K6

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

LIST OF PROGRAMS	60 hours

1. Write a PHP Program for String handling.
2. Write a PHP Program for associative array.
3. Write a PHP Program to use various Functions of PHP.
4. Write a PHP Program to read form data.
5. Write a PHP Program to implement Overloading and overriding.
6. Write a PHP Program to implement Inheritance.
7. Write a PHP Program for File handling.
8. Develop PHP Program to Create a Database and to Insert , Delete and List the records.
9. Write a PHP Program to implement cookies.
10. Write a PHP Program for Drawing images on a webpage.

Total Lecture hours	60 hours

Text Books	
1	Joseph Feller, Brain Fitzgerald, Eric S. Raymond, "Understanding Open Source Software Development", Addison-Wesley Professional, 1st Edition, 2001.
2	"The Complete Reference PHP Covers PHP 5.2, "Steven Holzner, Tata McGraw-Hill Edition 2008.
Reference Books	
3	PHP6 and MySQL6 Bible – Steve Svehring.
4	PHP Programming Solutions – VickramViswani.
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
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		PRACTICAL VII :WEB APPLICATION DEVELOPMENT AND HOSTING (Effective for the candidates admitted from the academic Year 2020-2021)	L	T	P	C
Core/Elective/Supportive		Core Lab			2	2
Pre-requisite		Students should able to know basic html,CSS and php concepts.	Syllabus Version		2020-21 Onwards	

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 Framesets, 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 Framesets 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

Course code		MULTIMEDIA AND ITS APPLICATIONS	L	T	P	C
Core/Elective/Supportive		Elective	4			4
Pre-requisite		Able to understand the basic hardware of keyboard, mouse, monitor, input, output, primary memory and secondary memory etc.	Syllabus Version		2020-21 Onwards	

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		MOBILE COMPUTING	L	T	P	C
Core/Elective/Supportive		Elective	4			4
Pre-requisite		Students should able to know the technology of Mobile communication with the generation of 2G,3G,4G etc.	Syllabus Version		2020-21 Onwards	

Course Objectives:

The main objectives of this course are to:

1. Present the overview of Mobile computing, Applications and Architectures.
2. Describe the futuristic computing challenges.
3. Enable the students to learn the concept of mobile computing.

Expected Course Outcomes:

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

1	Understand the need and requirements of mobile communication	K1,K2
2	Focus on mobile computing applications and techniques	K3,K4
3	Demonstrate satellite communication in mobile computing	K4,K5
4	Analyze about wireless local loop architecture	K5
5	Analyze various mobile communication technologies	K5,K6

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

Unit:1	INTRODUCTION	12 hours

Introduction: Advantages of Digital Information - Introduction to Telephone Systems –Mobile communication: Need for Mobile Communication – Requirements of Mobile Communication – History of Mobile Communication.

Unit:2	MOBILE COMMUNICATION	12 hours

Introduction to Cellular Mobile Communication – Mobile Communication Standards –Mobility Management – Frequency Management – Cordless Mobile Communication Systems.

Unit:3	MOBILE COMPUTING	12 hours

Mobile Computing: History of data networks – Classification of Mobile data networks - CDPD System – Satellites in Mobile Communication: Satellite classification – Global Satellite Communication – Changeover from one satellite to other – Global Mobile Communication – Interferences in Cellular Mobile Communication.

Unit:4	MOBILE INTERNET	12 hours

Important Parameters of Mobile Communication System – Mobile Internet: Working of Mobile IP – Wireless Network Security – Wireless Local Loop Architecture: Components in WLL – Problems in WLL – Modern Wireless Local Loop – Local Multipoint Distribution Service – Wireless Application Protocol.

Unit:5	MOBILE TECHNOLOGIES	10 hours

WCDMA Technology and Fibre Optic Microcellular Mobile Communication – Ad hoc Network and Bluetooth technology – Intelligent Mobile Communication system – Fourth Generation Mobile Communication systems.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**
Text Books		
1	T.G. Palanivelu, R. Nakkeeran, "Wireless and Mobile Communication", PHI Limited, 2009.	
2	Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2007.	
Reference Books		
1	Asoke K Talukder,HasanAhmed,RoopaYavagal, "Mobile Computing",TMH, 2010.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.tutorialspoint.com/mobile_computing/index.htm	
2	https://www.javatpoint.com/mobile-computing	
3	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/	
Course Designed By:		

Mapping with Programming Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	L	M	L	L	M	S	M	M	M	M
CO2	S	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		SOFTWARE TESTING	L	T	P	C
Core/Elective/Supportive		Elective	4			4
Pre-requisite		Able to know the concept of SDLC concepts with Manual and Automated Testing Tools.	Syllabus Version		2020-21 Onwards	

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		WEB SERVICES	L	T	P	C
Core/Elective/Supportive		Elective	4			4
Pre-requisite		Able to know the request/response services of Client and Server.	Syllabus Version		2020-21 Onwards	

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		SOFT COMPUTING	L	T	P	C
Core/Elective/Supportive		Elective	4			4
Pre-requisite		Able to build algorithms, know the programming skills with critical thinking.	Syllabus Version		2020-21 Onwards	

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		EMBEDDED SYSTEMS	L	T	P	C
Core/Elective/Supportive		Elective	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		2020-21 Onwards	

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		INTERNET OF THINGS	L	T	P	C
Core/Elective/Supportive		Elective	4			4
Pre-requisite		Aware to know the Machine learning concepts and able to collect, analyze and handling huge amount of data.	Syllabus Version		2020-21 Onwards	

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	DesignIoT 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		CRITICAL THINKING, DESIGN THINKING AND PROBLEM SOLVING	L	T	P	C
Core/Elective/Supportive		Elective	4			4
Pre-requisite		Students should able to learn problem solving pattern, reasoning and designing tools for the need of the requirement.	Syllabus Version		2020-21 Onwards	

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	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