M.Sc.,

COMPUTER SCIENCE

SYLLABUS

FROM THE ACADEMIC YEAR 2023 – 2024 ONWARDS

H.H. THE RAJAH' COLLEGE (AUTONOMOUS)

PUDUKKOTTAI – 622 001.

CONTENTS

REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION	
Programme	**M.Sc., Computer Science**
Programme Code	
Duration	**PG - Two Years**
Programme Outcomes (Pos)	**PO1: Problem Solving Skill** Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context. **PO2: Decision Making Skill** Foster analytical and critical thinking abilities for data-based decision-making. **PO3: Ethical Value** Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities. **PO4: Communication Skill** Ability to develop communication, managerial and interpersonal skills. **PO5: Individual and Team Leadership Skill** Capability to lead themselves and the team to achieve organizational goals. **PO6: Employability Skill** Inculcate contemporary business practices to enhance employability skills in the competitive environment. **PO7: Entrepreneurial Skill** Equip with skills and competencies to become an entrepreneur. **PO8: Contribution to Society** Succeed in career endeavors and contribute significantly to society. **PO 9 Multicultural competence** Possess knowledge of the values and beliefs of multiple cultures and a global perspective. **PO 10: Moral and ethical awareness/reasoning** Ability to embrace moral/ethical values in conducting one's life.
Programme Specific Outcomes (PSOs)	**PSO1 – Placement** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions. **PSO 2 - Entrepreneur**

	To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. **PSO3 – Research and Development** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. **PSO4 – Contribution to Business World** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5 – Contribution to the Society** To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

Credit Distribution for PG Programme

Semester – I	**C**	**H**	**Semester – II**	**C**	**H**	**Semester – III**	**C**	**H**	**Semester – IV**	**C**	**H**
1.1. Core-I	5	7	2.1. Core-IV	5	6	3.1. Core-VII	5	6	4.1. Core-XI	5	6
1.2 Core-II	5	7	2.2 Core-V	5	6	3.2 Core-VII	5	6	4.2 Core-XII	5	6
1.3 Core – III	4	6	2.3 Core – VI	4	6	3.3 Core – IX	5	6	4.3 Project with Viva-Voce	7	10
1.4 Elective (Discipline Centric)- I	3	5	2.4 Elective (Discipline Centric) – III	3	4	3.4 Core - X	4	6	4.4 Elective (Industry / Entrepreneurship) 20% Theory 80% Practical) – VI	3	4
1.5 Elective (Generic)-II	3	5	2.5 Elective (Generic)-IV	3	4	3.5 Elective (Discipline Centric) – V	3	3	4.5 Skill Enhancement Course	2	4
			2.6 Skill Enhancement Course SEC I	2	4	3.6 Professional Competency Skill - Online	2	3	4.6 Extension Activity	1	-
						3.7 Internship / Industrial Activity	2	-			
	20	**30**		**22**	**30**		**26**	**30**		**23**	**30**
Total Credit Points – 91											

Component wise Credit Distribution

Credits	Sem I	Sem II	Sem III	Sem IV	Total
Part A	**18**	**18**	**19**	**19**	**74**
Part B **(i) Discipline – Centric / Generic Skill**	**2**	**4**	**5**	**3**	**14**
(ii)Soft Skills	**--**	**--**	**--**	**--**	**2**
(iii)Summer Internship / Industrial Training			**2**		
Part C				**1**	**1**
Total	**20**	**22**	**26**	**23**	**91**

METHODS OF EVALUATION		
Internal Evaluation	Continuous Internal Assessment Test	**25 Marks**
	Assignments / Snap Test / Quiz	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	**75 Marks**
Total		**100 Marks**

METHODS OF ASSESSMENT	
Remembering (K1)	• The lowest level of questions require students to recall information from the course content • Knowledge questions usually require students to identify information in the textbook.
Understanding (K2)	• Understanding of facts and ideas by comprehending organizing, comparing, translating, interpolating and interpreting in their own words. • The questions go beyond simple recall and require students to combined together
Application (K3)	• Students have to solve problems by using / applying a concept learned in the classroom. • Students must use their knowledge to determine a exact response.
Analyze (K4)	• Analyzing the question is one that asks the students to breakdown something into its component parts. • Analyzing requires students to identify reasons causes or motives and reach conclusions or generalizations.
Evaluate (K5)	• Evaluation requires an individual to make judgment on something. • Questions to based to judge the value of an idea, a character, a work of art, or a solution to a problem. • Students are engaged in decision-making and problem–solving. • Evaluation questions do not have single right answers.
Create (K6)	• The questions of this category challenge students to get engaged in creative and original thinking. • Developing original ideas and problem solving skills

PROGRAMME OUTCOMES (PO) - PROGRAMME SPECIFIC OUTCOMES (PSO) MAPPING

PROGRAMME SPECIFIC OUTCOMES (PSO)					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
PSO1	**3**	**3**	**3**	**3**	**3**
PSO2	**3**	**3**	**3**	**3**	**3**
PSO3	**3**	**3**	**3**	**3**	**3**
PSO4	**3**	**3**	**3**	**3**	**3**
PSO5	**3**	**3**	**3**	**3**	**3**

Level of Correlation between PO's and PSO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0 – No Correlation

M.Sc Computer Science

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
Core – I / **23PCS1**	Paper I: Object Oriented Analysis and Design & C++	5	7		25	75	100
Core – II / **23PCS2**	Paper II: Python Programming	5	7		25	75	100
Core – III / **23PCS3P**	Paper III: Python Programming Practical	4		6	40	60	100
E- I / **23PCSE1A**	**Paper IV: Advanced Software Engineering**	3	5		25	75	100
E- I / **23PCSE1B**	Robotic Process Automation For Business						
E– II / **23PCSE2A**	**Paper V: Analysis & Design of Algorithms**	3	5		25	75	100
E– II / **23PCSE2B**	Theory of Computation						
	Total	20	30				
SECOND SEMESTER							
Core – IV / **23PCS4**	Paper VI: Advanced Operating Systems	5	6		25	75	100
Core – V / **23PCS5**	Paper VII: Advanced Java Programming	5	6		25	75	100
Core – VI / **23PCS6P**	Advanced Java Programming Practical	4		6	40	60	100
E – III / **23PCSE3A**	**Multimedia And Its Applications**	3	4		25	75	100
E – III / 23PCSE3B	Artificial Intelligence & Machine Learning						
E –IV / **23PCSE4A**	**Digital Image Processing**	3	4		25	75	100
E –IV / 23PCSE4B	Embedded Systems						
SEC – I / **23PCSSE1**	E-Commerce	2	4		40	60	100
	Total	22	30				

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
THIRD SEMESTER							
Core – VII / **23PCS7**	Advanced Network Security	5	6		25	75	100
Core – VIII / **23PCS8**	Unified Modeling Language	5	6		25	75	100
Core – IX / **23PCS9**	Programming With R	5	6		25	75	100
Core - X / **23PCS10P**	Programming With R Practical	4		6	40	60	100
E- V / **23PCSE5A**	**Software Project Management**	3	3		25	75	100
E– V / **23PCSE5B**	Wireless Networks						
SEC – II / **23PCSSE2**	Professional Competency Skill (**Online Objective**)	2	3		25	75	100
Internship **23PIT**	Industrial Activity	2	-				
	Total	26		30			
FOURTH SEMESTER							
Core – XI / **23PCS11**	Distributed Operating System	5	6		25	75	100
Core – XII / **23PCS12**	Web Services	5	6		25	75	100
Project / **23PCS13PW**	Project with Viva Voce	7	5	5	25	75	100
E – VI / **23PCSE6A**	**Technology Innovation And Sustainable Enterprise**	3	4		25	75	100
E – VI / **23PCSE6B**	Block Chain Technology						
SEC – III / **23PCSSE3**	Cloud Computing	2	4		25	75	100
Extension / **23PEA**	Extension Activity	1					
	Total	23		30			

I – SEMESTER

23PCS1		OBJECT ORIENTED ANALYSIS AND DESIGN & C++	L	T	P	C
Core/~~Elective~~/~~Supportive~~		**Core - I**	7			5
Pre-requisite		Basics of C++ and Object Oriented Concepts				

Course Objectives:

The main objectives of this course are to:

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

Expected Course Outcomes:

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

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

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

Unit:1	**OBJECT MODEL**	**15 hours**

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

Unit:2	**CLASSES AND OBJECTS**	**15 hours**

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

Unit:3	**C++ INTRODUCTION**	**15 hours**

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

Unit:4	INHERITANCE AND OVERLOADING	15 hours
ClassesandObjects–ConstructorsandDestructors–operatorsoverloading–Type Conversion-Inheritance – Pointers and Arrays.		

Unit:5	POLYMORPHISM AND FILES	15 hours
MemoryManagementOperators-Polymorphism–Virtualfunctions–Files–Exception Handling – String Handling -Templates.		
	Total Lecture hours	**75 hours**

Text Books	
1	"Object Oriented Analysis and Design with Applications", Grady Booch, Second Edition, Pearson Education.
2	"Object-Oriented Programming with ANSI & Turbo C++", Ashok N. Kamthane, First Indian Print -2003, Pearson Education.
Reference Books	
1	Balagurusamy, "Object Oriented Programming with C++", TMH, Second Edition, 2003.
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

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

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

I – SEMESTER

23PCS2		PYTHON PROGRAMMING	L	T	P	C
Core/~~Elective~~/~~Supportive~~		Core – II	7			5
Pre-requisite		Basics of any OO Programming Language				

Course Objectives:

The main objectives of this course are to:

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

Expected Course Outcomes:

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

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

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

Unit:1	INTRODUCTION	15 hours

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

Unit:2	CODE 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	MODULES, PACKAGES AND CLASSES	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 withsuper–InselfDefense –GetandSetAttributeValueswithProperties –NameManglingfor Privacy – Method Types – Duck Typing – Special Methods –Composition.

Unit:4	DATA TYPES AND WEB	15 hours

Data Types: Text Strings–BinaryData.**StoringandRetrievingData:** File Input /Output– Structured Text Files – Structured Binary Files - Relational Databases – NoSQL Data Stores.

Web: WebClients –Web Servers–Web Services and Automation

Unit:5	SYSTEMS AND NETWORKS	15 hours

Systems: Files–Directories–ProgramsandProcesses–CalendarsandClocks.

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.

	Total Lecture hours	75 hours

Text Books

1	BillLubanovic, "Introducing Python", O'Reilly, First Edition – Second Release, 2014.
2	MarkLutz, "LearningPython", O'Reilly,FifthEdition, 2013.

ReferenceBooks

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

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

MappingwithProgrammingOutcomes

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

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

I – SEMESTER

23PCS3P	PYTHON PROGRAMMING PRACTICAL	L	T	P	C
Core/~~Elective~~/~~Supportive~~	**Core III**			6	4
Pre-requisite	Basics of any OO Programming Language				

Course Objectives:

The main objectives of this course are to:

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

Expected Course Outcomes:

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

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

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

LISTOF 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	”Python Programming - A Modular Approach", Sheetal Taneja, Naveen Kumar, Pearson Publications.
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]	
1	https://www.programiz.com/python-programming/
2	https://www.tutorialspoint.com/python/index.htm
3	https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

MappingwithProgrammingOutcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	M	S	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

I – SEMESTER

23PCSE1A		ADVANCED SOFTWARE ENGINEERING	L	T	P	C
~~Core~~/Elective/~~Supportive~~		ELECTIVE – I	5			3
Pre-requisite		Basics of Software Engineering & SPM				

Course Objectives:

The main objectives of this course are to:

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

Expected Course Outcomes:

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

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

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

Unit:1	INTRODUCTION	12 hours

Introduction: The Problem Domain – Software Engineering Challenges - Software Engineering Approach – Software Processes: Software Process – Characteristics of a Software Process – Software Development Process Models – Other software processes.

Unit:2	SOFTWARE REQUIREMENTS	12 hours

Software Requirements Analysis and Specification : Requirement engineering – Type of Requirements – Feasibility Studies – Requirements Elicitation – Requirement Analysis – Requirement Documentation – Requirement Validation – Requirement Management – SRS - Formal System Specification – Axiomatic Specification – Algebraic Specification - Case study: Student Resultmanagementsystem. SoftwareQuality Management –SoftwareQuality, Software Quality Management System, ISO 9000, SEI CMM.

Unit:3	PROJECT MANAGEMENT	12 hours

Software Project Management: Responsibilities of a software project manager – Project planning – Metrics for Project size estimation – Project Estimation Techniques – Empirical Estimation Techniques – COCOMO – Halstead‟s software science – Staffing level estimation – Scheduling– Organization and Team Structures – Staffing – Risk management – Software Configuration Management – Miscellaneous Plan.

Unit:4	SOFTWAR EDESIGN	12 hours
Software Design: Outcome of a Design process – Characteristics of a good software design – Cohesion and coupling - Strategy of Design – Function Oriented Design – Object Oriented Design - Detailed Design - IEEE Recommended Practice for Software Design Descriptions.		
Unit:5	**SOFTWARE TESTING**	**12 hours**
Software Testing: A Strategic approach to software testing – Terminologies – Functional testing– Structural testing – Levels of testing – Validation testing - Regression testing – Art of Debugging–Testingtools-Metrics-ReliabilityEstimation.SoftwareMaintenance -Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities.		
	Total Lecture hours	**60 hours**

Text Books	
1	An Integrated Approach to Software Engineering – PankajJalote, Narosa Publishing House, Delhi, 3rd Edition.
2	Fundamentals of Software Engineering –Rajib Mall,PHI Publication,3rdEdition.
ReferenceBooks	
1	Software Engineering – K.K.Aggarwal and Yogesh Singh, New Age International Publishers, 3rd edition.
2	A Practitioners Approach – Software Engineering, - R.S.Pressman, McGraw Hill.
3	Fundamentals of Software Engineering - Carlo Ghezzi, M. Jarayeri, D. Manodrioli, PHI Publication.
Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://www.javatpoint.com/software-engineering-tutorial
2	https://onlinecourses.swayam2.ac.in/cec20_cs07/preview
3	https://onlinecourses.nptel.ac.in/noc19_cs69/preview

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

I – SEMESTER

23PCSE1B		ROBOTIC PROCESS AUTOMATION FOR BUSINESS	L	T	P	C
~~Core~~/Elective/~~Supportive~~		Elective – 2/2	5			3
Pre-requisite		Basics of Robots & its Applications				

Course Objectives:

The main objectives of this course are to:

1. Learn the concepts of RPA, its benefits, types and models.
2. Gain the knowledge in application of RPA in Business Scenarios.
3. Identify measures and skills required for RPA

Expected Course Outcomes:

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

1	Demonstrate the benefits and ethics of RPA	K1,K2
2	Understand the Automation cycle and its techniques	K2
3	Draw inferences and in formation processing of RPA	K3,K4
4	Implement & Apply RPA in Business Scenarios	K5
5	Analyze on Robots & leveraging automation	K5,K6

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

Unit:1	INTRODUCTION	12 hours

IntroductiontoRPA -OverviewofRPA -BenefitsofRPAinabusinessenvironment -Industries & domains fit for RPA - Identification of process for automation - Types of Robots - Ethics of RPA & Best Practices - Automation and RPA Concepts - Different business models for implementingRPA -CentreofExcellence –Typesandtheirapplications -Buildingan RPAteam -ApproachforimplementingRPAinitiatives.

Unit:2	AUTOMATION	12 hours

RoleofaBusinessManagerinAutomationinitiatives-SkillsrequiredbyaBusinessManagerfor successful automation - The importance of a Business Manager in automation - Analyzing different business processes - Process Mapping frameworks - Role of a Business Manager in successful implementation – Part 1 - Understanding the Automation cycle – First 3 automation stages and activities performed by different people.

Unit:3	AUTOMATION IMPLEMENTATION	12 hours

Evaluating the Automation Implementation Detailed description of last 3 stages and activities performed by different people - Role of a Business Manager in successful completion – Part 2 - Activities to be performed post-implementation - Guidelines for tracking the implementation success - Metrics/Parameters to be considered for gauging success - Choosing the right licensing option - Sending emails - Publishing and Running Workflows.

Unit:4	ROBOT	12 hours
Ability to process information through scopes/systems - Understand the skill of information processing and its use in business - Leveraging automation - Creating a Robot - New Processes. Establish causality by variable behavior - Understand the skill of drawing inference or establishing causality by tracking the behavior of a variable as it varies across time/referenced variable - Leveraging automation for this skill - Robot & new process creation.		
Unit:5	**ROBOT SKILL**	**12 hours**
Inference from snapshots of curated terms – Omni-source data curation - Multisource trend tracking - Understand the skill of drawing inference from the behavior of curated terms by taking snapshots across systems in reference to time/variable(s) - Leveraging automation for this skill – Robot creation and new process creation for this skill.		
	Total Lecture hours	**60 hours**

Text Books	
1	Alok Mani Tripathi, ”Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool”, Packt Publishing Limited March 2018.
2	Tom Taulli, “The Robotic Process Automation Handbook”, Apress,February2020.
Reference Books	
1	Steve Kaelble, ”Robotic Process Automation”, John Wiley & Sons, Ltd., 2018
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/uipath/uipath_robotic_process_automation_introduction.htm
2	https://www.javatpoint.com/rpa
3	https://onlinecourses.nptel.ac.in/noc19_me74/preview

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

I – SEMESTER

23PCSE2A		ANALYSIS & DESIGN OF ALGORITHMS	L	T	P	C
~~Core~~/Elective/~~Supportive~~		Elective - II	5			3
Pre-requisite		Basic Data Structures & Algorithms				

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the Elementary Data Structures and algorithms.
2. Presents an introduction to the algorithms, their analysis and design
3. Discuss various methods like Basic Traversal And Search Techniques, divide and conquer method, Dynamic programming, backtracking
4. Understood the various design and analysis of the algorithms.

Expected Course Outcomes:

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

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

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

Unit:1	INTRODUCTION	12 hours

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

Unit:2	TRAVERSAL AND SEARCH TECHNIQUES	12 hours

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

Unit:3	GREEDY METHOD	12 hours

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

Unit:4	DYNAMIC PROGRAMMING	12 hours

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

Unit:5	BACK TRACKING	12 hours
Backtracking:-GeneralMethod–8-QueensProblem–SumOfSubsets–GraphColoring– Hamiltonian Cycles – Branch And Bound: - The Method – Traveling Salesperson.		
	Total Lecture hours	60 hours

Text Books	
1	Ellis Horowitz, “Computer Algorithms”, Galgotia Publications.
2	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms".
ReferenceBooks	
1	Goodrich,“DataStructures&AlgorithmsinJava”,Wiley3rd edition.
2	Skiena,”TheAlgorithmDesignManual”,SecondEdition,Springer,2008
3	AnanyLevith,”IntroductiontotheDesignandAnalysisofalgorithm”,Pearson Education Asia, 2003.
4	Robert Sedgewick, Phillipe Flajolet,”An Introduction to the Analysis of Algorithms”, Addison-Wesley Publishing Company,1996.
RelatedOnlineContents[MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/106/106106131/
2	https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
3	https://www.javatpoint.com/daa-tutorial

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

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

I – SEMESTER

23PCSE2B		THEORY OF COMPUTATION	L	T	P	C
~~Core~~/Elective/~~Supportive~~		Elective - II	5			3
Pre-requisite		Basic Mathematical Foundations				

Course Objectives:

The main objectives of this course are to:

1. To introduce students to the mathematical foundations of computation including automata theory;
2. The theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.
3. To enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.

Expected Course Outcomes:

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

1	Analyse and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.	K1,K2
2	Demonstrate their the understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving.	K2,K3
3	Prove the basic results of the Theory of Computation, state and explain the relevance of the Church-Turing thesis.	K3,K4
4	Demonstrate the concept of backtracking & branch and bound technique.	K5,K6
5	Explore the traversal and searching technique and apply it for trees and graphs.	K6

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

Unit:1	INTRODUCTION	12 hours

Introduction to formal proof – Additional forms of proof – Inductive proofs –Finite. Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite. Automata (NFA) – Finite Automata with Epsilon transitions.

Unit:2	TRAVERSAL AND SEARCH TECHNIQUES	12 hours

Regular Expression – FA and Regular Expressions – Proving languages not to be regular – Closure properties of regular languages – Equivalence and minimization of Automata.

Unit:3	GREEDY METHOD	12 hours

Context-Free Grammar (CFG) – Parse Trees – Ambiguity in grammars and languages – Definition of the Pushdown automata – Languages of a Pushdown Automata – Equivalence of Pushdown automata and CFG– Deterministic Pushdown Automata.

Unit:4	DYNAMIC PROGRAMMING	12 hours
Normal forms for CFG – Pumping Lemma for CFL – Closure Properties of CFL – Turing Machines – Programming Techniques for TM. A language that is not Recursively Enumerable (RE).		
Unit:5	**UNDECIDABLE PROBLEM**	**12 hours**
An undecidable problem RE – Undecidable problems about Turing Machine – Post's Correspondence Problem – The classes P and NP.		
	Total Lecture hours	**60 hours**

Text Books

1	Peter Linz, "An Introduction to Formal Languages and Automata", Third Edition ,Narosa, 2005
2	J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", second Edition, Pearson Education, 2007.

ReferenceBooks

1	H.R. Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education, 2003.
2	Thomas A. Sudkamp," An Introduction to the Theory of Computer Science,Languages and Machines", Third Edition, Pearson Education, 2007.
3	Raymond Greenlaw an H.James Hoover, " Fundamentals of Theory of Computation, Principles and Practice", Morgan Kaufmann Publishers, 1998.
4	Micheal Sipser, "Introduction of the Theory and Computation", Thomson Brokecole, 1997.

RelatedOnlineContents[MOOC, SWAYAM, NPTEL, Websites etc.]

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

MappingwithProgrammingOutcomes

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

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

II – SEMESTER

23PCS4		ADVANCED OPERATING SYSTEMS	L	T	P	C
Core/~~Elective~~/~~Supportive~~		Core - IV	6			5
Pre-requisite		Basics of OS & its functioning				

Course Objectives:

The main objectives of this course are to:

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

Expected Course Outcomes:

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

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

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

Unit:1	BASICS OF OPERATING SYSTEMS	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 SYSTEMS	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	REAL TIME OPERATING SYSTEM	15 hours

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

Unit:4	HAND HELD SYSTEM	15 hours
OperatingSystemsforHandheldSystems:Requirements–TechnologyOverview–Handheld OperatingSystems–PalmOS-SymbianOperatingSystem-Android–Architectureofandroid–		
Securing handheld systems		
Unit:5	**CASE STUDIES**	**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.		
	Total Lecture hours	**75 hours**

Text Books	
1	AbrahamSilberschatz;PeterBaerGalvin;GregGagne,"OperatingSystemConcepts", Seventh Edition, John Wiley & Sons, 2004.
2	Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.
ReferenceBooks	
1	RajibMall,"Real-Time Systems:TheoryandPractice",PearsonEducationIndia,2006.
2	Pramod Chandra P.Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.
3	Daniel.P.Bovet&MarcoCesati,"UnderstandingtheLinuxkernel",3rd edition,O"Reilly,2005
4	NeilSmyth,"iPhoneiOS4DevelopmentEssentials–Xcode",FourthEdition,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

MappingwithProgrammingOutcomes										
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

II – SEMESTER

Course Code	23PCS5	ADVANCED JAVA PROGRAMMING	TOTAL HOURS	CREDITS
			6	5
Core/~~Elective~~/~~Supportive~~		Core - V		

Course Objectives:

- To Understand the OOPs Concept
- To Visualize the OOPs Concepts
- To Program Advanced OPPs Concepts using Java.

Unit:1

Fundamentals of Object Oriented Programming - Overview of Java Language – Introduction to classes – Class Fundamentals – declaring objects – Constructors – Methods – Overloading Methods – Inner classes – Inheritance – Method Overriding – Packages – Interfaces.

Unit:2

Exception Handling – Types of Exception – Try and Catch – Nested Try – Throw and Throws – Multithreading – Thread Priorities – Main Thread – Synchronization.

Unit:3

AWT classes – Window fundamentals –AWT Controls – Labels – Buttons – Menus – Handling Events by Extending AWT Components – Applet class – Applet Architecture – The HTML applet tag- Passing Parameters in Applets.

Unit:4

Networking – Networking basics- Java and the Net – Inet Address – TCP/IP Client sockets – URL – URL Connection – TCP/IP Server Sockets – A catching proxy HTTP Server – Datagrams.

Unit:5

Java database Connectivity – JDBC /ODBC bridge – Java SQL package – JDBC exception Class – Connection to remote database – Data manipulation – Data navigation – Introduction to Java Remote Method Invocation (RMI) – Java servlets – Introduction to Java Beans.

Expected Course Outcomes:

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

CO1: Able to Define OOPs concepts & basics of java programming.

CO2: Able to Identify the use of classes, interface, packages in solving specific problems.

CO3: Able to Analyze the use of Single threading and multithreading programs using synchronization and handle the exceptions to increase the performance of program.

CO4: Able to know the importance of collection framework in developing effective programs.

CO5: Analyse and Design GUI based applications using swings and applets.	
Text Book	
1	Herbert Schildt, "Java2 complete Reference", Tata McGraw Hill, Fourth Edition, 2001.
2	Ivan Bayross, "Java2.0 (Web enabled commercial application development)" – BPB publications Indian Edition 2000 (Chapters 11,13,14 and 16 only).
Reference Book	
1	Java 2, Swing, Servlets, JDBC & JAVA Beans Programs - Black Book, Steven Holzner.
Online Web Reference	
1	• http://www.learnjavaonline.org/

MappingwithProgrammingOutcomes										
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

II – SEMESTER

23PCS6P		ADVANCED JAVA PROGRAMMING PRACTICAL	L	T	P	C
Core/~~Elective~~/~~Supportive~~		Core - VI			6	4
Pre-requisite		Basics in Java Programming				

Course Objectives:

The main objectives of this course are to:

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

Expected Course Outcomes:

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

1	Understand to the implement concepts of Javausing 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. Simple Programs
2. Constructors and Destructors
3. Inheritance
4. Method Overloading
5. Packages and Interface
6. Exception Handling
7. Multi-Threading
8. AWT Class and Applet
9. Network Socket Programs
10. Database Connectivity
11. RMI Concepts
12. Servlet Concept
13. Java Beans

Expert lectures, online seminars – webinars

Total Lecture hours	**75 hours**

Text Books	
1	JamieJaworski, “JavaUnleashed”, SAMS Techmedia Publications, 1999.
2	Campione,Walrath and Huml, “The Java Tutorial”, AddisonWesley,1999.
Reference Books	
1	JimKeogh,”The Complete Reference J2EE”, TataMcGrawHillPublishingCompany Ltd,2010.
2	DavidSawyerMcFarland, “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

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

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

II – SEMESTER

23PCSE3A		MULTIMEDIA AND ITS APPLICATIONS	L	T	P	C
~~Core~~/Elective/~~Supportive~~		Elective – III	4			3
Pre-requisite		Basics of Multimedia				

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	K4
4	Apply and Analyze the role of Multimedia in Internet and real time applications	K4,K5
5	Analyze multimedia applications using HDTV	K5,K6

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

Unit:1	**INTRODUCTION**	**12 hours**

WhatisMultimedia?–IntroductiontomakingMultimedia–MacintoshandWindows Production platforms – Basic Software tools.

Unit:2	**MULTIMEDIATOOLS**	**12 hours**

MakingInstantMultimedia–Multimediaauthoringtools–Multimediabuildingblocks–Text– Sound.

Unit:3	**ANIMATION**	**12 hours**

Images–Animation–Video.

Unit:4	**INTERNET**	**12 hours**

MultimediaandtheInternet–TheInternetandhowitworks–ToolsforWorldWideWeb– Designing for the World Wide Web.

Unit:5	**MULTIMEDIA SYSTEMS**	**12 hours**

High Definition Television and Desktop Computing – Knowledge based Multimedia systems.

	Total Lecture hours	**60 hours**

Text Books	
1	Tay Vaughan, “Multimedia making it work”, Fifth Edition, Tata McGraw Hill.
2	John F.Koegel Bufford, “Multimedia Systems”, Pearson Education.
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/

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

II – SEMESTER

23PCSE3B		ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	L	T	P	C
~~Core~~/Elective/~~Supportive~~		Elective - III	4			3
Pre-requisite		Basics of AI & an Introduction about ML				

Course Objectives:

The main objectives of this course are to:

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

Expected Course Outcomes:

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

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

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

Unit:1	INTRODUCTION	12 hours

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

Unit:2	SEARCH TECHNIQUES	12 hours

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

Unit:3	PREDICATE LOGIC	12 hours

Using Predicate logic: Representing simple facts in logic - Representing Instance and Isa relationships - Computable functions and predicates - Resolution - Natural deduction. Representing knowledgeusingrules:ProceduralVs Declarative knowledge- Logic programming -ForwardVsBackwardreasoning -Matching-Controlknowledge.

Unit:4	MACHINE LEARNING	12 hours

Understanding Machine Learning: What Is Machine Learning?-Defining Big Data – Big Data in Context with Machine Learning – The Importance of the Hybrid Cloud – Leveraging the Power of Machine Learning - The Roles of Statistics and Data Mining with Machine Learning - Putting Machine Learning in Context - Approaches to Machine Learning.		
Unit:5	**APPLICATIONS OF MACHINE LEARNING**	**12 hours**
Looking Inside Machine Learning: The Impact of Machine Learning on Applications - Data Preparation-The Machine Learning Cycle.		
	Total Lecture hours	**60 hours**

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

Mapping with Programming Outcomes

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

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

II - SEMESTER

23PCSE4A		DIGITAL IMAGE PROCESSING	L	T	P	C
~~Core~~/Elective/~~Supportive~~		Elective - IV	4			3
Pre-requisite		Basics of Image Processing				

Course Objectives:

The main objectives of this course are to:

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

Expected Course Outcomes:

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

1	Understand the fundamentals of Digital Image Processing	K1,K2
2	Understandthemathematicalfoundationsfordigitalimagerepresentation, 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	Applytheconceptsoffilteringandsegmentationfordigitalimageretrieval	K4,K5
5	Explore the concepts of Multi-resolution process and recognize the objects in an efficient manner	K5,K6

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

Unit:1	INTRODUCTION	12hours

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	IMAGEENHANCEMENT	12hours

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

Unit:3	IMAGERESTORATION	12hours

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	IMAGECOMPRESSION	12hours

ImageCompression:Fundamentals–Imagecompressionmodels–ElementsofInformation Theory – Error Free compression – Lossy compression – Image compression standards.		
Unit:5	**IMAGESEGMENTATION**	**12hours**
Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.		
	TotalLecturehours	**60hours**

Text Books	
1	RafaelC.Gonzalez,RichardE.Woods,"DigitalImageProcessing",SecondEdition,PHI/Pearson Education.
2	B.Chanda,D.DuttaMajumder,"DigitalImageProcessingandAnalysis",PHI, 2003.
Reference Books	
1	NickEfford,"DigitalImageProcessingapracticalintroducingusingJava",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

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

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

II – SEMESTER

23PCSE4B		EMBEDDED SYSTEMS	L	T	P	C
~~Core~~/Elective/~~Supportive~~		Elective - IV	3			4
Pre-requisite		Basics of Micro Controller				

Course Objectives:

The main objectives of this course are to:

1. Presenttheintroductionto8051MicrocontrollerInstructionSet,conceptsonRTOS&Software tools.
2. Gain the knowledge about the embedded software development.
3. Learn about Micro controller and software tools in the embedded systems.

Expected Course Outcomes:

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

1	Understand the concept of 8051 microcontroller	K1,K2
2	Understand the Instruction Set and Programming	K2,K3
3	Analyze the concepts of RTOS	K3,K4
4	Analyze and design various real time embedded systems using RTOS	K5
5	Debug them all functioning system using various debugging techniques	K5,K6

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

Unit:1	**8051 MICROCONTROLLER**	**12Hours**

8051Microcontroller:Introduction-8051Architecture-Input/OutputPins,PortsandCircuits- External Memory - Counters / Timers - Serial Data Input / Output –Interrupts

Unit:2	**PROGRAMMINGBASICS**	**12Hours**

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	**CONCEPTSONRTOS**	**12Hours**

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	**DESIGNUSING RTOS**	**12Hours**

Basic Design using a RTOS: Principles - Encapsulating semaphores and Queues-Hard real time scheduling considerations-Saving memory space and power- introductions to RTL &QNX.

Unit:5	**SOFTWARETOOLS**	**12Hours**

SOFTWARETOOLS:EmbeddedsoftwareDevelopmentTools:HostsandTargetMachines-

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.		
	TotalLecturehours	**60Hours**

Text Books	
1	David E. Simon, "An Embedded Software primer", Pearson Education Asia, 2003.
2	KennethJAyala,"The8051MicrocontrollerandArchitectureprogrammingand application", Second Edition, Penram International.
Reference Books	
1	Raj Kamal, "Embedded Systems – Architecture, programming and design", Tata McGraw–Hill, 2003.
Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]	
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

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

II – SEMESTER

23PCSSE1		E-COMMERCE	L	T	P	C
~~Core/Elective/Supportive~~		SKILL ENHANCEMENT COURSE – I	4			2
Pre-requisite		Basics of Internet and world wide web				

Course Objectives:

The main objectives of this course are to:

1. Understand the basics of Internet & World Wide Web
2. Acquire the knowledge in Electronic Commerce, Electronic Payment Systems
3. Understand the concepts of security systems, online advertising and marketing

Expected Course Outcomes:

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

1	Would have learnt the Concepts of E-Commerce.	K1,K2
2	Understand different Knowledge base systems.	K2,K3
3	Understand the application of tools and services to the development of small scale E -Commerce applications	K3,K4
4	Would have learnt the Applications of E- Commerce.	K4,K5
5	Understand designing of knowledge base Systems to improve the efficiency of organizations based on their need.	K5,K6

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

Unit:1		**6 hours**

Introduction: Electronic Commerce Frame Work: The Anatomy of E-Commerce Applications- Electronic Commerce Consumer Applications – Electronic Commerce Organisation Applications.

Unit:2		**6 hours**

The Network Infrastructure for E-Commerce: Components of Highway – Network Access Equipment – Global Information Distribution Networks

Unit:3		**6 hours**

The Internet as Network Infrastructure: The Internet Terminology/Chronological History Of The Internet- The Business Of Internet Commercialization: Telco/Cable/Online Companies –National Independents ISPs – Regional Level ISPs – Local Level ISPs

Unit:4		**6 hours**

Network Security And Firewalls: Client Server Network Security – Firewalls And Network Security – Data And Message Security – Challenge Response System – Encrypted Documents And Electronic Mail.		
Unit:5		**6 hours**
Electronic Commerce And World Wide Web: Architectural Framework For E-Commerce-Technology Behind The Web – Security And The Web		
	Total Lecture hours	**30 hours**

Text Books	
1	Ravi kalakola & Andrew Whinston, "Frontiers of Electronic Commerce", Addison Wesley, 2000.
Reference Books	
1	Electronic Commerce – Rary P. Schneider and James T. Parry.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.geeksforgeeks.org/e-commerce/
2	https://www.tutorialspoint.com/e-business-and-e-commerce
3	https://nptel.ac.in/courses/106/105/106105077/

Mapping with Programming Outcomes

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

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

III – SEMESTER

23PCS7		ADVANCED NETWORK SECURITY	L	T	P	C
Core/~~Elective~~/~~Supportive~~		Core - VII	6			5
Pre-requisite		Basics of Networks, ISO/OSI and Security				

Course Objectives:

The main objectives of this course are to:

1. To Recall the Understanding of ISO/OSI Model
2. To Understand the need for Security
3. To learn the techniques of Cryptography

Expected Course Outcomes:

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

1	Understand and apply the cryptographic algorithms to safeguard from intruders	K1,K2
2	Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack	K2,K3
3	Implement the various key distribution, management and message authentication schemes to send the messages with security	K3
4	Identify information system requirements for Transport level, wireless network, E-Mail and IP	K4,K5
5	Designa network security system by implementing all the concepts of encryption and decryption algorithms	K5,K6

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

Unit:1	THE OVERVIEW	15 hours

Overview: Computer Security Concepts - The OSI Security architecture – Security Attacks- Security Services – Security Mechanisms - A model for network security - **Classical Encryption Techniques**: Symmetric Cipher model - Substitution Techniques – Transposition Techniques - **Block Cipher and DES:** Traditional Block Cipher Structure - Principles - The Data Encryption Standard (DES) – The Strength of DES.

Unit:2	ADVANCED ENCRYPTION STANDARDS	15 hours

Finite Field Arithmetic - AES Structure - **Block Ciphers Operation**: Multiple Encryption and triple DES – Electronic Code Book – Ciphers Block Chaining Mode- Cipher Feedback Mode – Output Feedback Mode – Counter Mode. **Random Bit Generation and Stream Cipher :** Principles of Pseudo Random Number Generation using Block Cipher – Pseudo Random Number Generator using Stream Ciphers Principles of Pseudorandom number generation – Pseudorandom number generation – stream ciphers - RC4.

Unit:3	PUBLIC KEY CRYPTOGRAPHY & RSA	15 hours
Principles of Public- Key Cryptosystems – RSA algorithm**. Other Public-Key Cryptosystems**: Diffie - Hellman Key Exchange – Elliptic curve Arithmetic – Elliptic curve Cryptography. Message Authentication Code: Message Authentication Requirements – Message Authentication Functions- Requirements for Message Authentication codes- Security of MACs.		
Unit:4	**ELECTRONIC MAIL SECURITY**	**15 hours**
Internet mail architecture – Email Threats and comprehensive Email security - Pretty Good Privacy – S/MIME.**IP Security**: IP Security Overview – IP Security Policy – Encapsulating Security Payload – Combining Security Associations - Internet Key Exchange – Cryptographic Suites.		
Unit:5	**INTRUDERS**	**15 hours**
Intruders: Intruders – Intrusion detection – Password Management. Malicious Software: Viruses – Virus Counter Measures. Firewall: The need for Firewalls- Firewall Design Principles- Trusted Systems.		
	Total Lecture hours	**75 hours**

Text Books	
1	"Cryptography and Network Security", William Stallings, Fifth Edition, Pearson Education, 2006.
Reference Books	
1	"Introduction to Cryptography", Johannes A. Buchaman, Springer – Verlag.
2	"Cryptography and Network Security", Atul Kahate, TMH.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.studytonight.com/computer-networks/
2	https://www.w3schools.com
3	https://www.ish-muc.com/trainings/advanced-network-security

Mapping with Programming Outcomes

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

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

III – SEMESTER

23PCS8		UNIFIED MODELING LANGUAGE	L	T	P	C
Core/~~Elective~~/~~Supportive~~		Core - VIII	6			5
Pre-requisite		Basics of modeling the Object Oriented Concepts and rendering graphical design				

Course Objectives:

The main objectives of this course are to:

1. To learn the concepts of object oriented concepts
2. To learn the symbols of OO Concepts
3. To learn the various methodologies of Object orientation
4. To learn to draw the diagrams of OO.

Expected Course Outcomes:

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

1	Understand to define a standard way to visualize the way a system has been designed.	K1,K2
2	Use UML diagrams to portray the behavior and structure of a system.	K2,K3
3	Helps software engineers, businessmen, and system architects with modeling, design, and analysis.	K3
4	Use to specify, visualize, construct, and document the artifacts (major elements) of the software system.	K4,K5
5	Helps in designing and characterizing, especially those software systems that incorporate the concept of Object orientation.	K5,K6

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

Unit:1	THE INTRODUCTION	15 hours

Introduction: The Importance of Modeling - Principles of Modeling - Object-Oriented Modeling - Overview of UML - Conceptual Model of UML - Architecture - Software Development Life Cycle - Key Abstractions - Mechanisms - Components.

Unit:2	BASIC STRUCTURAL MODELING	15 hours

Basic Structural Modeling: Classes - Relationships - Common Mechanisms - Diagrams - Class Diagrams.

Unit:3	ADVANCED STRUCTURAL MODELING	15 hours

Advanced Structural Modeling: Advanced Classes - Advanced Relationships - Interfaces, Types and Roles - Packages - Instances - Object Diagrams

Unit:4	**BASIC BEHAVIORAL MODELING**	**15 hours**
Basic Behavioral Modeling: Interactions - Use Cases - Use Case Diagrams		
Unit:5	**IMPORTANT DIAGRAMS**	**15 hours**
Interaction Diagrams - Activity Diagrams - Statechart Diagrams - Component Diagrams.		
	Total Lecture hours	**75 hours**

Text Books	
1	The Unified Modeling Language User Guide – Grady Booch, James Rumbaugh and Ivar Jacobson – Addison-Wesley.
Reference Books	
1	Object Oriented Systems Development – Ali Bahrami – Tata McGraw Hill
2	UML Distilled – Martin Fowler – Prentice Hall of India / Pearson Education
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.img.org/
2	https://www.w3schools.com/UML
3	https://egyankosh.ac.in/bitstream/123456789/86218/1/Unit-3.pdf

Mapping with Programming Outcomes

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

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

III – SEMESTER

23PCS9		PROGRAMMING WITH R	L	T	P	C
Core/~~Elective~~/~~Supportive~~		Core - IX	6			5
Pre-requisite		Basics of programming and Object Oriented Concepts				

Course Objectives:

The main objectives of this course are to:

4. Present the basics of R programming.
5. Enables the students to learn the vectorized code, scoping, and S3 methods.
6. Enable the students to understand packages making work with dates or times in R

Expected Course Outcomes:

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

1	Understand the concept of basic programming development and techniques	K1,K2
2	Gain knowledge about the various steps performed during programming	K2,K3
3	Resolve solution based problems using the logical solving methods	K3
4	Create and establish normal programs using the language	K4,K5
5	Apply the basic concepts to write R program	K5,K6

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

Unit:1	THE VERY BASICS	15 hours

Introduction: The R User Interface - Objects - Functions - Sample with Replacement - Writing Functions - Arguments - Scripts - Packages - Getting Help with Help Pages.

Unit:2	PLAYING CARDS	15 hours

R Objects: Atomic Vectors - Attributes - Matrices - Arrays - Class - Coercion - Lists Data Frames - Loading Data - Saving Data - R Notation: Selecting Values - Deal a Card - Shuffle the Deck - Dollar Signs and Double Brackets.

Unit:3	MODIFYING VALUES	15 hours

Modifying Values: Changing Values in Place - Logical Sub-setting - Missing Information - Environments: Working with Environments - Scoping Rules - Assignment - Evaluation - Closures.

Unit:4	THE SLOT MACHINE	15 hours
Programs: Strategy - if Statements - else Statements - Lookup Tables - Code Comments - The S3 System - Attributes - Generic Functions - Methods - Classes - S3 and Debugging - S4 and R5.		

Unit:5	LOOPS	15 hours
Loops: Expected Values - Expand.grid - for Loops - while Loops - repeat Loops - Installing R and RStudio.		
	Total Lecture hours	**75 hours**

Text Books

1	"Hands-On Programming with R", Garrett Grolemund, O'Reilly – 2014.

Reference Books

1	"R Graphics Cookbook: Practical Recipes for Visualizing Data", Winston Chang, Shroff/O'Reilly – 2012.

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

1	https://www.geeksforgeeks.org/r-programming-language-introduction/
2	https://www.w3schools.com/r/r_intro.asp
3	https://www.programiz.com/r/examples

Mapping with Programming Outcomes

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

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

III – SEMESTER

23PCS10P	PROGRAMMING WITH R PRACTICAL	L	T	P	C
Core/~~Elective~~/~~Supportive~~	**Core X**			6	4
Pre-requisite	Basics of any Programming Language				

Course Objectives:

The main objectives of this course are to:

5. This course presents an overview of elementary data items, lists, dictionaries, sets
6. Understand and write simple R programs
7. Understand the OOPS concepts of R
8. Develop simple applications using R

Expected Course Outcomes:

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

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

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

LIST OF PROGRAMS	**75 hours**

Implement the following in R:

11. R Program to implement Vector Elements Arithmetic: Find Sum, Mean and Product of Vector
12. R Program to find the factorial of a number
13. R Program to check whether a given number is Prime or Not
14. R Program to find whether a given number is Armstrong or not.
15. R Program to implement binary search in array
16. R Program to implement Fibonacci Sequence Using Recursive Function in R Program
17. R Program to create inner, outer, left, right join(merge) from given two data frames
18. R Program to database manipulation.
19. R Program to check whether a file exists using R program
20. R Program to File Handling

Total Practical hours	**75 hours**

Text Books

1. "Hands-On Programming with R", Garrett Grolemund, O'Reilly – 2014.
2. "R Graphics Cookbook: Practical Recipes for Visualizing Data", Winston Chang, Shroff/O'Reilly – 2012.

Reference Books	
1	"The Art of R Programming", Norman Matloff, No Starch Press, 2011
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://www.programiz.com/r/examples
2	https://learnetutorials.com/r-programming/programs
3	https://www.geeksforgeeks.org/working-with-databases-in-r-programming/

MappingwithProgrammingOutcomes										
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

III - SEMESTER

23PCSE5A		SOFTWARE PROJECT MANAGEMENT	L	T	P	C
~~Core~~/Elective/~~Supportive~~		Elective - V	3			3
Pre-requisite		Basics concepts of software engineering				

Course Objectives:

The main objectives of this course are to:

1. To Understand the Concepts of Project Management
2. To Understand the Planning aspects of a Software Project
3. To Understand Software Cost Estimation

Expected Course Outcomes:

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

1	Understand and apply the cryptographic algorithms to safeguard from intruders	K1,K2
2	Learnt about Software Cost Estimation	K2,K3
3	Implement the various aspect of Software Activity Planning.	K3
4	Identify the framework of project management	K4,K5
5	Design and implement software configuration management	K5,K6

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

Unit:1	INTRODUCTION	12 hours

Introduction to software management: Introduction- why is SPM important? –Project- Software project Vs other type of project – Contract and technical project management – Activities- plan, methods And methodologies – categorizing software projects – stakeholders – Setting objectives – Business case – project success and failures –Managements.

Unit:2	EVALUATION & MANAGEMENT	12 hours

Project Evaluation and Programme Management: Introduction-Business case- Project portfolio management- Evaluation of individual Projects-Cost benefit Evaluation Techniques - Risk Evaluation - Programme Management – managing the allocation of resources – Strategic programme management – Creating a programme and aids –Benefits management.

Unit:3	PROJECT PLANNING	12 hours

Overview of Project Planning: Introduction- Stepwise Project Planning- steps. Selection of An Appropriate Project Approach: Introduction-Build or buy- Choosing methodologies and technologies-- software Processes and models-choice of Process models- Structure Vs speed of delivery – Waterfall model - spiral model – software prototyping - Rapid application development – Agile methods- Extreme programming.

Unit:4	PROCESS MODELS - REVISIT	12 hours
Software Effort Estimation: Introduction-Where are estimates done? – Problems with over and under estimates – Basis for estimating and its Techniques – Bottom up estimating-Top down approach and parametric models- Expert judgment-Estimating by analogy Function point analysis-FP markII-COSMIC full FP-COCOMO II-cost estimation and staffing patterns.		
Unit:5	**EFFORT ESTIMATION**	**12 hours**
Activity Planning: Introduction-objectives-when to plan?-project schedules-Projects activities-network Planning models-sequencing and scheduling activities-Formulating a network model-Adding the time dimension-Forward and backward Pass- critical Path-activity Float- Shortening the project duration-critical activities- Activity on arrow network.		
	Total Lecture hours	**60 hours**

Text Books

1	"Software Project Management" – Bob Hughes, Mike Cotterell and Rajib Mall, 5th Ed.

Reference Books

1	"Software Project Management", Walker Royce, Pearson Education.

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

1	http://brodzinski.com/2010/06/learning-project-management-basics.html
2	
3	

Mapping with Programming Outcomes

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

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

III – SEMESTER

23PCSE5B		WIRELESS NETWORKS	L	T	P	C
~~Core~~/Elective/~~Supportive~~		Elective - V	3			3
Pre-requisite		Basics concepts of computer networks				

Course Objectives:

The main objectives of this course are to:

1. To Study about Wireless Networks, Protocol Stack and Standards.
2. To Study about Fundamentals of 3G Services, Its Protocols and Applications.
3. To Study about Evolution of 4G Networks, its Architecture and Applications.

Expected Course Outcomes:

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

1	Conversant With The Latest 3G/4G And WiMAX Networks And Its Architecture.	K1,K2
2	Design and Implement Wireless Network Environment For Any Application Using Latest Wireless Protocols And Standards.	K2,K3
3	Implement Different Type Of Applications For Smart Phones And Mobile Devices With Latest Network Strategies.	K3
4	Analyse the various layers for communication	K4,K5
5	Understand about different types of netwoks.	K5,K6

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

Unit:1	WIRELESS LAN	12 hours

Introduction-WLAN Technologies: Infrared, UHF Narrowband, Spread Spectrum -IEEE802.11: System Architecture, Protocol Architecture, Physical Layer, MAC Layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband Layer, Link Manager Protocol, Security – IEEE802.16-WIMAX: Physical Layer, MAC, Spectrum Allocation For WIMAX

Unit:2	MOBILE NETWORK LAYER	12 hours

Introduction – Mobile IP: IP Packet Delivery, Agent Discovery, Tunneling And Encapsulation, IPV6-Network Layer In The Internet- Mobile IP Session Initiation Protocol – Mobile Ad-Hoc Network: Routing, Destination Sequence Distance Vector, Dynamic Source Routing.

Unit:3	MOBILE TRANSPORT LAYER	12 hours

TCP Enhancements For Wireless Protocols – Traditional TCP: Congestion Control, Fast Retransmit/Fast Recovery, Implications Of Mobility – Classical TCP Improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time Out Freezing, Selective Retransmission, Transaction Oriented TCP – TCP Over 3G Wireless Networks.

Unit:4	WIRELESS WIDE AREA NETWORK	12 hours
Overview Of UTMS Terrestrial Radio Access Network-UMTS Core Network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High Speed Downlink Packet Access (HSDPA)- LTE Network Architecture And Protocol.		
Unit:5	**4G NETWORKS**	**12 hours**
Introduction – 4G Vision – 4G Features And Challenges – Applications Of 4G – 4G Technologies: Multicarrier Modulation, Smart Antenna Techniques, OFDM-MIMO Systems, Adaptive Modulation And Coding With Time Slot Scheduler, Cognitive Radio.		
	Total Lecture hours	**60 hours**

Text Books

1	”Mobile Communications”, Jochen Schiller, Second Edition, Pearson Education 2012.
2	“Wireless Communications And Networking”, Vijay Garg, First Edition, Elsevier 2014.

Reference Books

1	“3G Evolution HSPA And LTE For Mobile Broadband”, Erik Dahlman, Stefan Parkvall, Johan Skold And Per Beming, Second Edition, Academic Press, 2008.
2	“Wireless Networking”, Anurag Kumar, D.Manjunath, Joy Kuri, First Edition, Elsevier 2011.

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

1	http://brodzinski.com/2010/06/learning-project-management-basics.html
2	https://www.tutorialspoint.com/Wireless-Networks
3	https://www.shiksha.com/online-courses/articles/wireless-networking/

Mapping with Programming Outcomes

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

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

III – SEMESTER

23PIT		INDUSTRIAL INTERNSHIP ACTIVITY	L	T	P	C
			-			2
Pre-requisite		A basic idea about a core company				

Course Objectives:

The main objectives of this course are to:

1. Get awareness about a core company.
2. To communicate with employees of the company to have a hands-on knowledge.
3. Effectively manage work ethic inside a company.

Expected Course Outcomes:

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

1	Demonstrate an awareness of their selected company.	K1,K2
2	Understanding of the function of a core company.	K2,K3
3	Provide logical solution by understanding the underlying problem.	K3
4	Utilize the gained knowledge when project work is undertaken.	K4,K5
5	Able to build a small application from the above study.	K5,K6

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

Each candidate shall be required to take up a company internship and submit it at the end of the third semester. The Head of the Department shall assign the Guide who, in turn, will assess the submitted document by the student. A copy of the Internship Report will be submitted to the Department on or before the date fixed by the CoE. The candidate concerned will have to present his findings through a Viva Voce conducted internally.

Max Marks : 100

IV – SEMESTER

23PCS11	DISTRIBUTED OPERATING SYSTEM	L	T	P	C
Core/~~Elective~~/~~Supportive~~	Core - XI	6			5
Pre-requisite	Basics concepts of operating system				

Course Objectives:

The main objectives of this course are to:

1. To Learn the Basics of Distributed computing
2. To Learn the Concepts of Distributed Operating systems
3. To Learn the Distributed File Systems

Expected Course Outcomes:

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

1	Revisit the concepts of Operating Systems.	K1,K2
2	Understand the basic concepts of Distributed Operating System.	K2,K3
3	Identify the basic concepts of Clock Synchronization.	K3
4	Design and implement Resource Management.	K4,K5
5	Understand the aspects of Distributed File System.	K5,K6

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

Unit:1	FUNDAMENTALS	15 hours

Evolution – System Models- Distributed Operating System – Issues – Distributed Computing environment. Message passing: Introduction – Features – Issues – Synchronization – Buffering – Message – Encoding – Decoding – process addressing – Failure Handling

Unit:2	REMOTE PROCEDURE CALLS	15 hours

Introduction – Model – Transparency – Implementation - Stub Generation - Messages - Marshaling Arguments and results- server Management - Parameter passing Semantics - Call Semantics - Communication Protocols- Complicated RPC's – Client -Server Binding - Exception handling – Security - Distributed Shared Memory – Introduction- Architecture – Issues - Granularity Structure - Consistency Models – Replacement Strategy – Thrashing

Unit:3	SYNCHRONIZATION	15 hours

Introduction – Clock Synchronization – Event ordering – Mutual Exclusion – Deadlock – Election Algorithms

Unit:4	**RESOURCE MANAGEMENT**	**15 hours**
Introduction – Features – Task Assignment approach – Load Balancing Approach – Load –Sharing Approach process Management – Introduction – process Migration – Threads		
Unit:5	**DISTRIBUTED FILE SYSTEM**	**15 hours**
Introduction – Features – File Models – Accessing Models – Sharing Semantics – Caching Schemes – File Replication – Fault Tolerance – Atomic Transactions – Design Principles Naming – Introduction – Features – terminologies – Concepts		
	Total Lecture hours	**75 hours**

Text Books	
1	"Distributed Operating Systems, Concepts and Design", Pradeep K. Sinha, Prentice Hall of India, New Delhi,2001.
Reference Books	
1	"Distributed Operating Systems", Andrew S.Tanenbaum, Pearson Education,Delhi,2002.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://ecomputernotes.com/fundamental/disk-operating-system/distributed-operating-system
2	
3	

Mapping with Programming Outcomes

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

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

IV – SEMESTER

23PCS12		WEB SERVICES	L	T	P	C
Core/~~Elective~~/~~Supportive~~		Core - XII	6			5
Pre-requisite		Knowledge and function of Internet and World Wide Web				

Course Objectives:

The main objectives of this course are to:

1. To understand the Basics of Web Services
2. To Learn SOAP with XML
3. To Learn WSDL
4. To Learn UDDI

Expected Course Outcomes:

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

1	Learn about the basic building blocks of web services.	K1,K2
2	Understand XML basics and its relevant technologies.	K2,K3
3	Implement Schema, Namespace and Document of XML.	K3
4	Develop in-depth knowledge about SOAP, WSDL AND WSCL.	K4,K5
5	Design the basic principles of Business Process Management.	K5,K6

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

Unit:1	INTRODUCTION	15 hours

What are Web Services? SOAP WSDL UDDI – Why was a service are important? – The evolution of web applications Not Just another distributed Computing platform – Web Services and enterprises. XML Fundamentals: The Lingua Franca of Web Services – XML Documents – XML namespaces Explicit and Default namespaces, inheriting namespaces, and not inheriting namespaces, Attributes and namespaces

Unit:2	SCHEMA, NAMESPACE & DOCUMENT	15 hours

XML Schema XML Schema and namespaces, A First Schema, Implementing XML Schema types, The any Element, Inheritance, Substitution groups, Global and local type declarations, Managing Schemas, Schemas and instance documents, XML Schema best practices. SOAP: SOAP Messages – SOAP Encoding – RPC

Unit:3	WEB SERVICES DEFINITION LANGUAGE	15 hours

WSDL: WSDL – Using SOAP WSDL - UDDT at glance – The UDDI Business registry – UDDI under the covers – Accessing UDDI – How UDDI is playing out

Unit:4	**WEB SERVICES CONVERSATION LANGUAGE**	**15 hours**
Conversations: Overview – Web Services Conversation Language – WSCL Interface components – The Bar Scenario Conversations – Relationship between WSCL and WSDL		
Unit:5	**BPEL**	**15 hours**
Workflow – Business Process Management – Workflows and Workflow Management Systems- Business Process Execution Language for Web Services		
	Total Lecture hours	**75 hours**

Text Books	
1	"Developing Enterprise web services". Sandeep Chatterjee, James Webber, Pearson Education, 2004.
Reference Books	
1	"XML, Web Services and the Date Revolution", Frank, P.Coyle, Pearson Education, 2002.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/webservices/index.htm
2	
3	

Mapping with Programming Outcomes

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

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

IV – SEMESTER

23PCS13PW		PROJECT WITH VIVA VOCE	L	T	P	C
			5		5	7
Pre-requisite		Theoretical knowledge of software engineering				

Course Objectives:

The main objectives of this course are to:

4. Effectively manage tasks and solve problems.
5. To communicate with vendors and the community at large in written an oral forms.
6. Effectively organize time to deliver on the dissertation's aims within the limited time available.

Expected Course Outcomes:

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

1	Demonstrate a sound technical knowledge of their selected project topic.	K1,K2
2	Undertake problem identification, formulation and solution.	K2,K3
3	Design engineering solutions to complex problems utilizing a systems approach.	K3
4	Demonstrate the knowledge, skills and attitudes of a professional engineer.	K4,K5
5	Able to build a small application from the above study.	K5,K6

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

Each candidate shall be required to take up a Project Work and submit it at the end of the final year. The Head of the Department shall assign the Guide who, in turn, will suggest the Project Work to the student in the beginning of the final year. A copy of the Project Report will be submitted to the Department on or before the date fixed by the CoE. The candidate concerned will have to defend his/her Project through a Viva-voce.

Max Marks : 100

Internal : 25

External : 75

Related Online Contents [Websites]

1	https://sourceforge.net
2	https://github.com/
3	https://www.codeguru.com/

IV – SEMESTER

23PCSE6A		TECHNOLOGY INNOVATION AND SUSTAINABLE ENTERPRISE	L	T	P	C
~~Core~~/Elective/~~Supportive~~		Elective - VI	4			3
Pre-requisite		Basic Idea about Knowledge Management and its related activities				

Course Objectives:

The main objectives of this course are to:

1. Provide information, frameworks for identifying and pursuing sustainable business opportunities.
2. Inform students of the changing dynamics of nature–human interdependencies globally.
3. Examine examples of innovators implementing successful green strategies.

Expected Course Outcomes:

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

1	Identify entrepreneurial traits.	K1,K2
2	Develop comprehensive business plans.	K2,K3
3	Prepare plans to manage the enterprise effectively.	K3
4	Acquire knowledge about Web Marketing.	K4,K5
5	Understand ERP techniques.	K5,K6

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

Unit:1	INNOVATION	12 hours

Need - Objectives of innovation - Technology innovation - its importance - Knowledge Management- need - Business strategies related to knowledge management - Knowledge Management Approaches-Transformation of an enterprise through Knowledge Management - Creating Knowledge Management System in Organization Establishing Knowledge Management through IT Organizational culture for Knowledge Management - Future of Knowledge Management.

Unit:2	TECHNOLOGY TRANSFER AND JOINT VENTURES	12 hours

Policy, Procedure & Practices - India's Technology base and Capabilities - Preference of Indian Technology - major Constraints and problems - Operational constraints - Problems in Indian Business Environment Problems in Finalization of Agreement - Major Problems in Technology transfer Collaboration Agreements, R& D, Import Substitution, Scaling, Diagrams - Patterns and Intellectual Property rights.

Unit:3	WEB MARKETING	12 hours
Meaning - Benefits of Web Marketing - Myths and Facts in Web Marketing Web Psychology: Understanding the Internet mind - The Internet and the Law: Copyright, Censorship, Privacy, Jurisdiction - Do's and Don'ts on Web.		
Unit:4	**WEB MARKETING STRATEGIES**	**12 hours**
Choosing the strategy - Online store fronts - Target Marketing Attracting Customers- Web Advertising - E-Mail Marketing-Instant market research - Securities Issues.		
Unit:5	**ENTERPRISE RESOURCE PLANNING**	**12 hours**
The E-Business backbone - Meaning - ERP decision Enterprise Architecture Planning - ERP Implementation - The Future of ERP Applications - Procurement - Business Blueprint Planning.		
	Total Lecture hours	**60 hours**

Text Books

1	"Knowledge Management for Competitive advantage", Harish Chandra Chaudharaty, Excel Books Publications, New Delhi.
2	"Technology Transfer and Joint Ventures Abroad", R.R.Azad, Deep & Deep Publications, New Delhi.

Reference Books

1	"Web Advertising and marketing", Thomas J Kuegler,Jr. #rd Edition -Prentice-Hall of India, New Delhi.
2	"e-Business Roadmap for Success", Dr. Ravi Kalakota - Perason Education.
3	"Frontiers of Electronic Commerce", Ravi Kalakota, Andrew B. Whinston, Addition -Wesley, 2000
4	"The Lean Startup", Eric Ries, Publisher : Eric Ries, 2017.

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

1	http://www.startupindia.gov.in/
2	http://www.ediindia.org/institute.html
3	http://www.ediindia.org/centres.html
	http://niesbud.nic.in/Publication.html

Mapping with Programming Outcomes

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

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

VI – SEMESTER

23PCSE6B		BLOCKCHAIN TECHNOLOGY	L	T	P	C
~~Core~~/Elective/~~Supportive~~		Elective - VI	4			3
Pre-requisite		Knowledge and function of Cryptography				

Course Objectives:

The main objectives of this course are to:

1. To understand the history, types and applications of Blockchain.
2. To acquire knowledge about cryptography and consensus algorithms.
3. Deploy projects using Web3j and design blockchain based applications.

Expected Course Outcomes:

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

1	Contentedly discuss and describe the history, types and applications of Blockchain	K1,K2
2	Gains familiarity with cryptography and Consensus algorithms.	K2,K3
3	Create and deploy projects using Web3j.	K3
4	Implement an ICO on Ethereum	K4,K5
5	Design blockchain based application with Swarm and IPFS	K5,K6

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

Unit:1	INTRODUCTION TO BLOCKCHAIN	12 hours

Distributed DBMS – Limitations of Distributed DBMS, Introduction to Block chain – History, Definition, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Features of Blockchain, and Types of Blockchain.

Unit:2	BLOCKCHAIN ARCHITECTURE	12 hours

Operation of Bitcoin Blockchain, Blockchain Architecture – Block, Hash, Distributer P2P, Structure of Blockchain - Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET).

Unit:3	BLOCKCHAIN-BASED FUTURES SYSTEM	12 hours

Project presentation- Futures smart contract: Blockchain oracles- Web3j: Setting up the Web3J- Installing web3j- Wallet creation, Java client: The wrapper generator- Initializing web3j- Setting up Ethereum accounts- Deploying the contract.

Unit:4	BLOCKCHAINS IN BUSINESS	12 hours
Public versus private and permissioned versus permission less blockchains - Privacy and anonymity in Ethereum - Why are privacy and anonymity important? - The Ethereum Enterprise Alliance - Blockchain as-a-Service.		
Unit:5	**DISTRIBUTED STORAGE IPFS AND SWARM**	**12 hours**
Ethereum Virtual Machine - Swarm and IPFS: Installing IPFS, Hosting our frontend: Serving your frontend using IFPS, Serving your frontend using Swarm, IPFS file uploader project: Project setup the web page.		
	Total Lecture hours	**60 hours**

Text Books

1	"Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", Imran Bashir, 2nd Edition, Packt Publishing Ltd, March 2018.
2	"Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Bellaj Badr et. al., Packt Publishing Limited, 2018.

Reference Books

1	"Mastering Bitcoin: Unlocking Digital Cryptocurrencies", Andreas M. Antonopoulos, O'Reilly Media Inc, 2015.
2	"Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Arvind Narayanan et. al., Princeton University Press, 2016.

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

1	https://www.simplilearn.com/tutorials/blockchain-tutorial/blockchaintechnology
2	https://www.ibm.com/in-en/topics/what-is-blockchain
3	https://www.investopedia.com/terms/b/blockchain.asp

Mapping with Programming Outcomes

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

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

IV – SEMESTER

23PCSSE3		CLOUD COMPUTING	L	T	P	C
~~Core~~/~~Elective~~/Supportive		Skill Enhancement Course - II	4			2
Pre-requisite		Knowledge and function of computing technology				

Course Objectives:

The main objectives of this course are to:

1. To impart knowledge on Introduction to Cloud Computing,
2. To understand the Evolution of SaaS,
3. To learn the Anatomy of Cloud Infrastructure,

Expected Course Outcomes:

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

1	Able to explain and examine various computing paradigms.	K1,K2
2	Able to define cloud computing and explain fundamental concepts of cloud.	K2,K3
3	Able to describe cloud architecture, deployment and management.	K3
4	Able to explain the basics of cloud computing stack and cloud service models.	K4,K5
5	Able to Identify various cloud service providers, their services and tools.	K5,K6

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

Unit:1	INTRODUCTION	12 hours

Introduction to Cloud Computing: Roots of Cloud Computing - Layers and Types of Cloud - Features of a cloud-Infrastructure Management-Infrastructure as a Service Providers-Platform as a Service Providers-Challenges and Risks. Broad Approaches to Migrating into the Cloud - Seven Step Model of Migration into a Cloud.

Unit:2	SaaS	12 hours

The Evolution of SaaS-The Challenges of SaaS Paradigm- Approaching the SaaS Integration Enigma- New Integration Scenarios- The Integration Methodologies- SaaS Integration Products, Platforms and Services-B2Bi Services -. Background of Enterprise cloud computing paradigm- Issues for Enterprise Applications on the Cloud- Transition Challenges.

Unit:3	CLOUD INFRASTRUCTURE	12 hours

The Anatomy of Cloud Infrastructure- Distributed Management of Virtual Infrastructures- Scheduling Techniques for Advance Reservation of Capacity- RVWS Design - Cluster as a Service: The Logical Design - Cloud Storage : from LANs TO WANs- Technologies for Data Security in Cloud Computing.

Unit:4	WORKFLOW MANAGEMENT	12 hours
Workflow Management Systems and Clouds - Architecture of Workflow Management Systems - Utilizing Clouds for Workflow Execution- A Classification of Scientific Applications and Services in the Cloud- SAGA based Scientific Applications that Utilize Clouds. MapReduce Programming Model- Major MapReduce Implementations for the Cloud- MapReduce Impacts and Research Directions.		
Unit:5	**GRID & CLOUD**	**12 hours**
Grid and Cloud- HPC in the Cloud: Performance related Issues -Data Security in the Cloud- The Current State of Data Security in the Cloud- Homo Sapiens and Digital Information- Risk- Identity- The Cloud, Digital Identity and Data Security - Content Level Security:Pros and Cons- Legal Issues in Cloud Computing - Data Privacy and Security Issues.		
	Total Lecture hours	**60 hours**

Text Books

1	"Cloud Computing - Principles and Paradigms", Rajkumar Buyya, James Broberg, and Andrzej Goscinski, 2011.

Reference Books

1	"Cloud Application Architectures", George Reese, ISBN: 84047142, Shroff / O'Reilly,2009.

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

1	https://www.guru99.com/cloud-computing-for-beginners.html
2	
3	

Mapping with Programming Outcomes

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

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

IV – SEMESTER

23PEA		EXTENSION ACTIVITY	L	T	P	C
			-			1
Pre-requisite		Social Work				

Course Objectives:

The main objectives of this course are to:

1. Get awareness about the society we live in.
2. To communicate with people who are native to the locality.
3. Effectively contribute to the society.

Each candidate shall be required to enroll himself / herself with a club within the college (Ex: NSS, RR Club or YRC, etc) and actively participate in community activities which ultimately be helpful to the community the student live in. Credit is provided after the due completion of the participation activities with the club.