



## CURRICULUM AND SYLLABUS

### REGULATION 2018

**Programme: Master of Computer Applications**

**Vision of the Department:**

To meet the technology and evolve innovative applications according to software industry and to promote technological advancement through knowledge dissemination

**Mission of the Department:**

**M1:** To achieve excellence in the field of computer applications

**M2:** To create a quality professionals to meet the emerging industrial needs

**M3:** To inculcate ethical and professional standards among our students by providing quality education

**Programme Educational Objectives (PEOs):**

**PEO1:** Ability to face the changing trends and career opportunities in computer applications

**PEO2:** Exhibit their expertise in problem Solving skills through design and development of computer applications

**PEO3:** Develop Communication Skills necessary to function productively to achieve successful professional career with integrity and societal commitments

**Mapping of Programme Educational Objectives with Mission of the Department:**

PEOs / Department Mission Statements	M1	M2	M3
PEO1	2	3	3
PEO2	2	3	2
PEO3	2	2	3

**1: Slight (Low)**

**2: Moderate (Medium)**

**3: Substantial (High)**





**Programme Outcomes (POs):**

**PO1:** Understand and apply mathematical foundation, computing and domain knowledge for the conceptualization of computing models from defined problems.

**PO2:** Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects

**PO3:** Ability to select modern computing tools, skills and techniques necessary for innovative software solutions

**PO4:** Ability to apply and commit professional ethics and cyber regulations in a global economic environment.

**PO5:** Understand Management Principles and apply these to develop software as a team member and manage projects efficiently for multidisciplinary environments

**PO6:** Communicate effectively and present technical information in oral and written reports

**Programme Specific Outcomes (PSOs):**

**PSO1:** Design, develop applications to meet the needs of the industry by using latest computing tools and technologies

**PSO2:** Able to pursue carrier in industry, academia, research and other technology enables services

**Mapping of Programme Educational Objectives with Programme Outcomes and Programme Specific Outcomes:**

PEOs / POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
<b>PEO1</b>	1	3	2	1	2	2	2	3
<b>PEO2</b>	3	3	3	2	2	2	2	2
<b>PEO3</b>	2	2	2	3	2	3	2	2

**1: Slight (Low)**

**2: Moderate (Medium)**

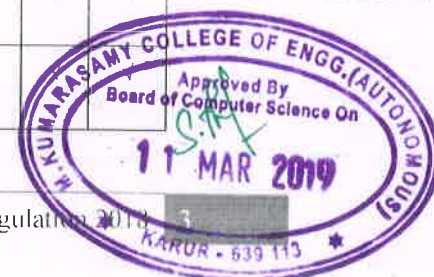
**3: Substantial (High)**





### Programme Articulation

Semester	Course Code	Course Name	POs						PSOs	
			PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	18PCAC101T	Computer Organization	√	√	√		√	√	√	√
1	18PCAC102T	Design and Analysis of Algorithms	√	√	√		√	√	√	√
1	18PCAC103T	Programming in C	√	√	√	√	√	√	√	√
1	18PCAC104T	Operating Systems	√	√	√	√		√	√	√
1	18PCAC105T	Computer Graphics	√	√	√		√	√	√	√
1	18LEM101T	Constitution of India			√		√	√		√
1	18PCAP101L	Algorithms Laboratory	√	√	√		√	√	√	√
1	18PCAP102L	Programming in C Laboratory	√	√	√	√	√		√	√
2	18PCAC106T	Embedded Systems	√	√	√			√	√	√
2	18PCAC107T	Data Structures	√	√	√	√	√	√	√	√
2	18PCAC108T	Object Oriented Programming	√	√	√		√	√	√	√
2	18PCAC109T	Software Engineering	√	√	√		√	√	√	√
2	18PCAC110T	Multimedia Systems	√	√	√	√	√	√	√	√
2	18LEM102T	Value Education				√	√	√	√	√
2	18PCAP103L	Data Structures Laboratory	√	√	√			√	√	√
2	18PCAP104L	Object Oriented Programming Laboratory	√	√	√			√	√	√
3	18PMAF201T	Mathematical Foundations of Computer Applications	√		√				√	√
3	18PCAC201T	Computer Networks	√	√	√	√	√	√	√	√
3	18PCAC202T	Java Programming	√	√	√		√	√	√	√
3	18PCAC203T	Object Oriented Analysis and Design	√	√	√		√	√	√	√
3	18PCAC204T	Data base management systems	√	√	√		√	√	√	√
3	18PCAP201L	Java Programming Laboratory	√	√	√		√	√	√	√





Semester	Course Code	Course Name	POs						PSOs		
			PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	
3	18PCAP202L	DBMS Laboratory		√	√					√	
3	18MBM201L	Competencies in Social Skills	√						√		
4	18PCAC205T	Mobile Application Development	√	√	√					√	√
4	18PCAC206T	Cryptography and Network Security	√	√	√	√	√	√	√	√	√
4	18PCAC207T	Data Mining	√		√				√		
4	18PCAC208T	Software Project Management	√	√	√	√	√	√	√	√	√
4	18PCAC209T	Web Programming	√	√	√	√	√	√	√	√	√
4	18PCAP203L	Mobile Application Development Laboratory	√	√	√	√				√	√
4	18PCAP204L	Web Programming Laboratory	√	√	√		√	√	√	√	√
4	18PCAP205L	Mini Project	√	√	√	√	√	√	√	√	√
4	18MBM202L	Critical and Creative Thinking Skills	√						√		





Semester	Course Code	Course Name	POs						PSOs	
			PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
5	18PCAC301T	Internet of Things	√	√	√	√	√	√	√	√
5	18PCAC302T	Data Analytics	√	√	√	√	√	√	√	√
5	18PCAC303T	Software Testing and Quality Assurance	√	√	√	√	√	√	√	√
5	18PCAP301L	IoT Laboratory	√	√	√		√	√	√	√
5	18PCAP302L	Data Analytics Laboratory	√	√	√			√	√	√
5	18PCAP303L	Software Testing Laboratory	√	√	√		√		√	
6	18PCAP304L	Project Work and Viva Voce	√	√	√	√	√	√	√	√
**	18PCAE001T	Ad hoc and Sensor Networks	√	√	√	√	√		√	
**	18PCAE002T	Game Programming	√	√	√		√	√	√	
**	18PCAE003T	Service Oriented Architecture	√	√	√			√	√	
**	18PCAE004T	Intelligent Information Retrieval	√	√	√			√	√	
**	18PCAE005T	Operations Research	√							
**	18PCAE006T	Bio Informatics	√	√	√				√	
**	18PCAE007T	Social Network Analysis	√	√	√	√	√	√	√	
**	18PCAE008T	Principles of Compiler Design	√	√	√		√	√	√	
**	18PCAE009T	Machine Learning Techniques	√	√	√				√	
**	18PCAE010T	Agile Methodologies for Software Development	√	√	√	√	√		√	√
**	18PCAE011T	Cloud Computing	√	√	√		√			
**	18PCAE012T	Human and Computer Interaction	√	√	√	√				





Semester	Course Code	Course Name	POs						PSOs	
			PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
**	18PCAE013T	Block Chain Technology	√	√	√					
**	18PCAE014T	Cyber Forensics	√	√	√	√			√	
**	18PCAE015T	Business Intelligence	√	√	√	√	√	√	√	√
**	18PCAE016T	Distributed Systems	√							
**	18PCAE017T	Advanced Database	√	√	√				√	
**	18PCAE018T	Optimization Techniques	√	√	√	√			√	



**Structure of Curriculum**

Sl.No.	Category	Credits
1	Foundation Courses	4
2	Professional core courses (C)	73
3	Professional Elective courses relevant to chosen specialization/branch (E)	6
4	Project work, Minor project **, seminar and internship in industry or elsewhere (P)	36
5	Placement Course	2
6	Mandatory Courses (M)	2
<b>Total Credits</b>		<b>121</b>

**1. Professional core courses (C)**

Course Code	Course Name	Hours / Week			C
		L	T	P	
18PCAC101T	Computer Organization	3	0	0	3
18PCAC102T	Design and Analysis of Algorithms	3	0	0	3
18PCAC103T	Programming in C	4	0	0	4
18PCAC104T	Operating Systems	3	0	0	3
18PCAC105T	Computer Graphics	3	0	0	3
18PCAC106T	Embedded Systems	3	0	0	3
18PCAC107T	Data Structures	3	0	0	3
18PCAC108T	Object Oriented Programming	4	0	0	4
18PCAC109T	Software Engineering	3	0	0	3
18PCAC110T	Multimedia Systems	3	0	0	3
18PCAC201T	Computer Networks	3	0	0	3
18PCAC202T	Java Programming	4	0	0	4
18PCAC203T	Object Oriented Analysis and Design	3	0	0	3
18PCAC204T	Data base management systems	3	0	0	3
18PCAC205T	Mobile Application Development	4	0	0	4





18PCAC206T	Cryptography and Network Security	3	0	0	3
18PCAC207T	Data Mining	3	0	0	3
18PCAC208T	Software Project Management	3	0	0	3
18PCAC209T	Web Programming	4	0	0	4
18PCAC301T	Internet of Things	4	0	0	4
18PCAC302T	Data Analytics	3	0	0	3
18PCAC303T	Software Testing and Quality Assurance	3	1	0	4
Total Credits					73

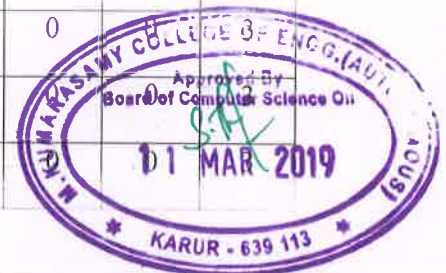
L-Lecture T-Tutorial P-Practical

## 2. Foundation Courses

Course Code	Course Name	Hours / Week			C
		L	T	P	
18PMAF201T	Mathematical foundations of Computer Applications	3	1	0	4
Total Credits					4

## 3. Program Elective courses relevant to chosen specialization/branch (E)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18PCAE001T	Ad hoc and Sensor Networks	3	0	0	3
18PCAE002T	Game Programming	3	0	0	3
18PCAE003T	Service Oriented Architecture	3	0	0	3
18PCAE004T	Intelligent Information Retrieval	3	0	0	3
18PCAE005T	Operations Research	3	0	0	3
18PCAE006T	Bio Informatics	3	0	0	3
18PCAE007T	Social Network Analysis	3	0	0	3
18PCAE008T	Principles of Compiler Design	3	0	0	3
18PCAE009T	Machine Learning Techniques	3	0	0	3





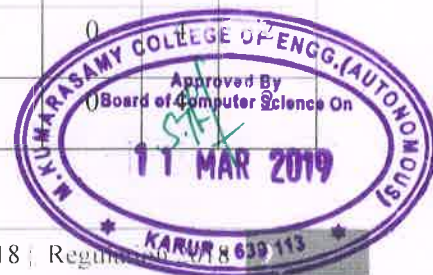


18PCAE010T	Agile Methodologies for Software Development	3	0	0	3
18PCAE011T	Cloud Computing	3	0	0	3
18PCAE012T	Human and Computer Interaction	3	0	0	3
18PCAE013T	Block Chain Technology	3	0	0	3
18PCAE014T	Cyber Forensics	3	0	0	3
18PCAE015T	Business Intelligence	3	0	0	3
18PCAE016T	Distributed Systems	3	0	0	3
18PCAE017T	Advanced Database	3	0	0	3
18PCAE018T	Optimization Techniques	3	0	0	3
Total Credits					54

L-Lecture T-Tutorial P-Practical

**4. Project work, minor project, seminar and internship in industry or elsewhere (P)**

Course Code	Course Name	Hours / Week			C
		L	T	P	
18PCAP101L	Algorithms Laboratory	0	0	4	2
18PCAP102L	Programming in C Laboratory	0	0	4	2
18PCAP103L	Data Structures Laboratory	0	0	4	2
18PCAP104L	Object Oriented Programming	0	0	4	2
18PCAP201L	Java Programming Laboratory	0	0	4	2
18PCAP202L	DBMS Laboratory	0	0	4	2
18PCAP203L	Mobile Application Development Laboratory	0	0	4	2
18PCAP204L	Web Programming Laboratory	0	0	4	2
18PCAP205L	Mini Project	0	0	4	2
18PCAP301L	IoT Laboratory	0	0	4	2
18PCAP302L	Data Analytics Laboratory	0	0	4	2





18PCAP303L	Software Testing Laboratory	0	0	4	2
18PCAP304L	Project Work and Viva Voce	0	0	24	12
Total Credits					36

L-Lecture T-Tutorial P-Practical

### 5. Mandatory Courses (M)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18MBM201L	Competencies in Social Skills	0	0	2	1
18MBM202L	Critical and Creative Thinking Skills	0	0	2	1
18LEM101T	Constitution of India	1	0	0	Nil
18LEM102	Value Education	1	0	0	Nil
Total Credits					2

L-Lecture T-Tutorial P-Practical





### I to VI Semester Curriculum

Semester I						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC101T	Computer Organization	3	0	0	3
C	18PCAC102T	Design and Analysis of Algorithms	3	0	0	3
C	18PCAC103T	Programming in C	4	0	0	4
C	18PCAC104T	Operating Systems	3	0	0	3
C	18PCAC105T	Computer Graphics	3	0	0	3
M	18LEM101T	Constitution of India	1	0	0	Nil
Practical						
P	18PCAP101L	Algorithms Laboratory	0	0	4	2
P	18PCAP102L	Programming in C Laboratory	0	0	4	2
Total Credits						20

L-Lecture    T-Tutorial    P-Practical





Semester II						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC106T	Embedded Systems	3	0	0	3
C	18PCAC107T	Data Structures	3	0	0	3
C	18PCAC108T	Object Oriented Programming	4	0	0	4
C	18PCAC109T	Software Engineering	3	0	0	3
C	18PCAC110T	Multimedia Systems	3	0	0	3
M	18LEM102T	Value Education	1	0	0	Nil
<b>Practical</b>						
P	18PCAP103L	Data Structures Laboratory	0	0	4	2
P	18PCAP104L	Object Oriented Programming Laboratory	0	0	4	2
Total Credits						20

L-Lecture    T-Tutorial    P-Practical



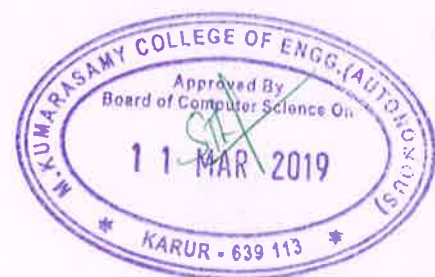


Semester III						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
F	18PMAF201T	Mathematical Foundations of Computer Applications	3	1	0	4
C	18PCAC201T	Computer Networks	3	0	0	3
C	18PCAC202T	Java Programming	4	0	0	4
C	18PCAC203T	Object Oriented Analysis and Design	3	0	0	3
C	18PCAC204T	Data base management systems	3	0	0	3
<b>Practical</b>						
P	18PCAP201L	Java Programming Laboratory	0	0	4	2
P	18PCAP202L	DBMS Laboratory	0	0	4	2
M	18MBM201L	Competencies in Social Skills	0	0	2	1
Total Credits						22

L-Lecture    T-Tutorial    P-Practical



Semester IV						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC205T	Mobile Application Development	4	0	0	4
C	18PCAC206T	Cryptography and Network Security	3	0	0	3
C	18PCAC207T	Data Mining	3	0	0	3
C	18PCAC208T	Software Project Management	3	0	0	3
C	18PCAC209T	Web Programming	4	0	0	4
<b>Practical</b>						
P	18PCAP203L	Mobile Application Development Laboratory	0	0	4	2
P	18PCAP204L	Web Programming Laboratory	0	0	4	2
P	18PCAP205L	Mini Project	0	0	4	2
M	18MBM202L	Critical and Creative Thinking Skills	0	0	2	1
Total Credits						24





Semester V						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC301T	Internet of Things	4	0	0	4
C	18PCAC302T	Data Analytics	3	0	0	3
C	18PCAC303T	Software Testing and Quality Assurance	3	1	0	4
E	18PCAE***T	Elective - I	3	0	0	3
E	18PCAE***T	Elective - II	3	0	0	3
Practical						
P	18PCAP301L	IoT Laboratory	0	0	4	2
P	18PCAP302L	Data Analytics Laboratory	0	0	4	2
P	18PCAP303L	Software Testing Laboratory	0	0	4	2
Total Credits						23





Semester VI						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	18PCAP304L	Project Work and Viva Voce	0	0	24	12
Total Credits						12

**Total Credits: 121**







Regulations 2018		Semester I	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC101T	COMPUTER ORGANIZATION	3	0	0	3

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	To become familiar with number systems and Boolean Algebra
2	To study the different types of combinational and sequential circuits
3	To comprehend the basis operations that happen in a CPU
4	To learn the data path and control path implementation
5	To become familiar with the memory hierarchy design and I/O design

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Perform conversions and arithmetic operations in various number systems
CO2	Design various combinational and sequential circuits
CO3	Differentiate between the various mapping policies used in cache memories
CO4	Discuss the implementation of virtual memory
CO5	Discuss the various types of I/O transfers

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	1	1	2	-	2	2	1	2
CO2	2	3	2	-	2	2	2	1
CO3	2	2	1	-	2	2	2	2
CO4	2	2	1	-	1	1	1	2
CO5	2	2	2	--	2	2	2	1
CO (Avg)	2	2	1.6	-	1.8	2	2	1.6

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>DIGITAL FUNDAMENTALS</b>	<b>9</b>
Number Systems and Conversions – Boolean Algebra and Simplifications – Minimization of Boolean Functions – Karnaugh Map, QuineMcClusky Method. Logic Gates – NAND NOR implementation		
<b>UNIT II</b>	<b>COMBINATIONAL AND SEQUENTIAL CIRCUITS</b>	<b>9</b>
Design of Circuits –Adder /Subtractor – Encoder – Decoder – MUX /DEMUX – Comparators, Flip flops – Triggering – Master – Slave Flip Flop – State Diagram and Minimization – Counters – Registers		
<b>UNIT III</b>	<b>BASIC STRUCTURE OF COMPUTER</b>	<b>9</b>
Functional Units - Basic Operational Concepts – Bus structures – Performance and Metrics – instruction and instruction sequencing – Hardware Software Interface – Addressing modes – Instruction Sets – RISC and CISC – ALU Design – Fixed point and Floating point operations		
<b>UNIT IV</b>	<b>PROCESSOR DESIGN</b>	<b>9</b>
Processor basics --CPU Organization – Data Path Design – Control Design – Basic concepts – Hardwired control – Micro Programmed control – Pipe control – Hazards super scale operations		
<b>UNIT V</b>	<b>MEMORY AND I/O SYSTEMS</b>	<b>9</b>
Memory technology – Memory Systems- Virtual Memory – Caches – Design Methods – Associative memories – Input /output system – Programmed I/O – DMA and interrupts – I/O devices and Interfaces		
<b>Reference (s)</b>		
1	Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw Hill, 2012.	
2	William Stallings,“Computer Organization & Architecture – Designing for Performance” 6th Edition Pearson Education, 2003.	
3	M Morris Mano, “Digital Logic and Computer Design”, 1st Edition. Pearson Education. 2016	



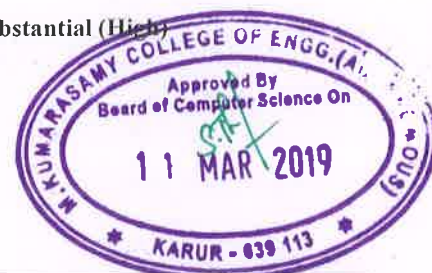


Regulations 2018		Semester I				Total Hours		45
Category	Course Code	Course Name	Hours / Week			C		
			L	T	P			
C	18PCAC102T	DESIGN AND ANALYSIS OF ALGORITHMS	3	0	0	3		
<b>Prerequisite Course (s)</b>								
Nil								
<b>Course Objective (s):</b>								
The purpose of learning this course is to:								
1	To learn various algorithms and techniques for problem solving							
2	Explain the algorithmic approach and analyze its efficiency							
3	Able to analyze a given problem by using the appropriate algorithm							
<b>Course Outcome (s) (Cos):</b>								
At the end of this course, learners will be able to:								
CO1	To design algorithms for problem solving by using the suitable algorithmic technique							
CO2	To analyze a given algorithm for its efficiency based on time and space it occupies							
CO3	To differentiate among various algorithmic approaches							
<b>CO-PO Mapping</b>								
	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	3	2	-	2	2	1	2
CO2	2	3	2	-	1	1	2	2
CO3	2	2	1.5	-	2	2	1	2
CO (Avg)	2.3	2.6	1.8	-	1.6	1.6	1.3	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Fundamentals of algorithmic problem solving – Important problem types – Fundamentals of the analysis of algorithm efficiency – analysis frame work – Asymptotic notations – Mathematical analysis for recursive and non-recursive algorithms		
<b>UNIT II</b>	<b>DIVIDE AND CONQUER METHOD AND GREEDY METHOD</b>	<b>9</b>
Divide and conquer methodology – Merge sort – Quick sort – Binary search – Binary tree traversal – Multiplication of large integers – Strassen’s matrix multiplication – Greedy method – Prim’s algorithm – Kruskal’s algorithm – Dijkstra’s algorithm		
<b>UNIT III</b>	<b>DYNAMIC PROGRAMMING</b>	<b>9</b>
Computing a binomial coefficient – Warshall’s and Floyd’ algorithm – Optimal binary search tree – Knapsack problem – Memory functions.		
<b>UNIT IV</b>	<b>BACKTRACKING AND BRANCH AND BOUND</b>	<b>9</b>
Backtracking – N-Queens problem – Hamiltonian circuit problem – Subset sum problem – Branch and bound – Assignment problem – Knapsack problem – Traveling salesman problem		
<b>UNIT V</b>	<b>NP-HARD AND NP-COMPLETE PROBLEMS</b>	<b>9</b>
P & NP problems – NP-complete problems – Approximation algorithms for NP-hard problems – Traveling salesman problem – Knapsack problem.		
<b>Reference (s)</b>		
1	AnanyLevitin “Introduction to the Design and Analysis of Algorithms” Pearson Education 2003	
2	Deitel and Deitel, “C How to Program”, Pearson Education. 2013,7th Edition	





Regulations 2018		Semester I	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC103T	PROGRAMMING IN C	4	0	0	4

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

- 1 To make the students fundamentally strong in the programming languages
- 2 Enables the students to solve problems using programmable logic
- 3 To design, implements, test, and apply the basic C programming concepts

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

- CO1 Able to design a computational solution for a given problem
- CO2 Able to transform a problem solution into programs involving programming constructs.
- CO3 To write programs using structures, strings, arrays, pointer and files for solving complex computational problem

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	3	3	1	2	2	2	2
CO2	2	2	2	2	2	1	3	3
CO3	2	2	1.5	2	2	3	2	2
CO (Avg)	2.3	2.3	2.1	1.6	2	2	2.3	2.3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>INTRODUCTION TO C PROGRAMMING</b>	<b>12</b>
Features – Basic Structure – Constants – Variables – Operators – Expressions		
<b>UNIT II</b>	<b>DATA TYPES; INPUT / OUTPUT OPERATORS</b>	<b>12</b>
Data types – Conversion of data types – Formatted input and output - The type cast Operator, The type char, Keywords, Character Input and Output, Formatted input and output, The gets() and puts() functions, Interactive Programming		
<b>UNIT III</b>	<b>FUNCTIONS AND STRUCTURES</b>	<b>12</b>
Function Basics, Function Prototypes, Recursion – Storage Classes: Storage Classes and Visibility, Automatic or local variables, Global variables, Static variables, External variables - Structure – Union		
<b>UNIT IV</b>	<b>POINTERS</b>	<b>12</b>
Basics of Pointers, Pointers and One-dimensional Arrays, Pointer Arithmetic, Pointer Subtraction and Comparison, Similarities between Pointers and One-dimensional Arrays, Null pointers, Pointers as Function Arguments, Pointers and Strings, Pointers and two-dimensional arrays, Arrays of Pointers		
<b>UNIT V</b>	<b>FILE MANAGEMENT</b>	<b>12</b>
File Management in C – Command Line Arguments – Dynamic Memory Allocation – Linked List – Preprocessors		
<b>Reference (s)</b>		
1	ReemaThareja, “Programming in C”, Oxford University Press. 2011.	
2	Deitel and Deitel, “C How to Program”, Pearson Education. 2013,7th Edition	
3	Kamthane, A.N., “Programming with ANSI and Turbo C”, Pearson Education, Delhi, 2006.	
4	Mastering C- by K R Venugopal , Sudeep R Prasad McGraw Hill Education (India) Private Limited; Second edition 2015	
5	YashavantKanetkar, “Understanding Pointers In C”, 4th Revised & Updated Edition. 2011, BPB Publications	





Regulations 2018		Semester I	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC104T	OPERATING SYSTEMS	3	0	0	3

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	To be aware of the evolution and fundamental principles of operating system, processes and their communication
2	To understand the various operating system components like process management, memory management and
3	To know about file management and the distributed file system concepts in operating systems
4	To be aware of components of operating system with relevant case study

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Able to understand the operating system components and its services
CO2	An ability to apply the process scheduling
CO3	Ability to understand the methods and recovery of deadlock.
CO4	An ability to understand the file system management
CO5	Able to understand the operating system components and services with the recent OS

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	3	1	-	1.5	2	2
CO2	3	3	2	2	-	2	2	1
CO3	3	2	1.5	2	-	2	2	2
CO4	2	2	1	2	-	2	1	2
CO5	2	2	2	2	-	2	2	1
CO (Avg)	2.4	2.2	1.9	1.8	-	1.9	2	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





UNIT I	INTRODUCTION	9
Introduction -Types of operating systems-operating systems structures-Systems components-operating systems services-System calls-Systems programs- Processes: process concept- process scheduling-operation on processes-co-operating processes-Inter process communications-CPU Scheduling-Scheduling criteria-Scheduling algorithms-Multiple-processor Scheduling.		
UNIT II	PROCESS SYNCHRONIZATION	9
Process Synchronization –Critical Section problem – Semaphores-Classical problems of synchronization-critical regions-Monitors-Deadlock Characterization-Deadlock handling. Deadlock Prevention-Deadlock avoidance-Deadlock Detection-Deadlock Recovery – Threads-Multithreading Models.		
UNIT III	MEMORY MANAGEMENT	9
Memory Management-Swapping-Contiguous Memory allocation-Paging-Segmentation-Virtual Memory-Demand paging-Page Replacement-Thrashing.		
UNIT IV	DISK SCHEDULING AND DISTRIBUTED SYSTEMS	9
Disk Structures-Disk Scheduling-File Systems Interface-File concepts-Access methods Directory Structures - File System Implementation - File Systems structures-Directory Implementation- Allocation Methods-Free Space management		
UNIT V	CASE STUDIES	9
Linux System-design Principles- process management-File Systems-Windows 7- historydesign Principles –system components –Virtual machine OS.		
Reference (s)		
1	Abraham Silberschalz Peter B Galvin, G.Gagne, “Operating Systems Concepts”, 9th Edition, John Wiley & Sons, 2013.	
2	Andrew S.Tanenbaum, “Modern operating Systems”. Third Edition. PHI Learning Pvt. Ltd., 2008	
3	D M Dhamdhare, “ Operating Systems: A Concept-based Approach”, Second Edition, Tata McGraw-Hill Education, 2007.	
4	H M Deital, P J Deital and D R Choffnes, “Operating Systems”, 3rd edition, Pearson Education, 2011	
5	William Stallings, “Operating Systems: Internals and Design Principles”. Seventh Edition. Prentice Hall, 2011	







Regulations 2018		Semester I				Total Hours			45
Category	Course Code	Course Name	Hours / Week			C			
			L	T	P				
C	18PCAC105T	COMPUTER GRAPHICS	3	0	0	3			
<b>Prerequisite Course (s)</b>									
Nil									
<b>Course Objective (s):</b>									
The purpose of learning this course is to:									
1	To enable students to gain an understanding of the methods and applications of computer graphics								
2	Provide an opportunity for students to represent, design and implement two dimensional and three dimensional objects								
3	To understand the concepts of Visible Surface Determination								
<b>Course Outcome (s) (Cos):</b>									
At the end of this course, learners will be able to:									
CO1	Study basic graphics primitives and concepts								
CO2	Explain two and three dimensional concepts and their applications								
CO3	Identify all techniques related to modern graphics programming concepts								
CO4	Learn the concepts of hidden surfaces removal, lighting and libraries used is OpenGL								
<b>CO-PO Mapping</b>									
COS	Pos						PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	
CO1	2	1.5	1	-	2	2	2	2	
CO2	3	3	2	-	2	1	3	2	
CO3	3	2	3	-	2	2	3	3	
CO4	1	2	2	-	2	2	2	2	
CO (Avg)	2.25	2.12	2	-	2	1.75	2.5	2.25	

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>INTRODUCTION TO COMPUTER GRAPHICS &amp; SCAN CONVERSION</b>	10
Introduction - Overview of Computer Graphics, CRT, Raster Refresh, Random Refresh Displays, LCD displays, Line, Circle and Ellipse drawing algorithms, Point, Lines clipping algorithms		
<b>UNIT II</b>	<b>TWO-DIMENSIONAL TRANSFORMATIONS</b>	8
Two dimensional Geometric transformations – Translation, Rotation, Scaling, Reflection and Shearing, Combined Transformation, the Window to- Viewport Transformations.		
<b>UNIT III</b>	<b>THREE-DIMENSIONAL TRANSFORMATIONS</b>	9
Three dimensional Geometric transformation-Translation, Rotation, Scaling, Reflection, Shearing, Composite Transformation, Parallel and Perspective projections, View volumes for projections		
<b>UNIT IV</b>	<b>SOLID MODELING &amp; VISIBLE-SURFACE DETERMINATION</b>	9
Sweep Representations, Spatial-Partitioning Representations - Octree representation, B-Reps, Constructive Solid Geometry. Visible-Surface Algorithms-Back face removal, The Z-Buffer Algorithm, Scan-line method, Painter's algorithms, Area sub-division method, BSP trees, Visible-Surface Ray Tracing, comparison of the methods		
<b>UNIT V</b>	<b>ILLUMINATION AND SHADING &amp; GRAPHICS PROGRAMMING USING OPENGL</b>	9
Reflectance properties of surfaces, Ambient, Specular and Diffuse reflections, Phong's model, Gouraud shading, - Graphics programming using OPENGL, Features in OpenGL, OpenGL operations, Abstractions in OpenGL, 3D viewing pipeline, a few examples and demos		
<b>Reference (s)</b>		
1	D. Hearn and M. Pauline Baker, Computer Graphics (C Version), Pearson Education, 2nd Edition, 2004	
2	J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Computer Graphics - Principles and Practice, Second Edition in C, Pearson Education, 2003	
3	D. F. Rogers and J. A. Adams, Mathematical Elements for Computer Graphics, 2nd Edition, McGraw-Hill International Edition, 1990	
4	F. S. Hill Jr., Computer Graphics using OpenGL, Pearson Education, 2003	





Regulation 2018		Semester I		Total Hours			15								
Category	Course Code	Course Name	Hours / Week			C									
			L	T	P										
M	18LEM101T	CONSTITUTION OF INDIA	1	0	0	-									
<b>Prerequisite Course (s)</b>															
NIL															
<b>Course Objective (s):</b>															
The purpose of learning this course is to:															
1	Utilize the citizen's rights														
2	Utilize the basic citizen's fundamental rights of freedom of speech, expression, equality, religion and privacy														
3	Identify the Indian constitutional framework with union parliament, government and their functions and citizen's rights														
4	Utilize the States functionality and provisions for the betterment of the individual and society														
5	Identify the emergency provisions, the functions of election and public service commissions, identify the tax system														
6	Utilize the rights of a citizen both individual and as a society by understanding the constitutional provision and rights														
<b>Course Outcome (s) (COs):</b>															
At the end of this course, learners will be able to:															
CO1	Identify the basic provisions in the Indian constitution														
CO2	List the fundamental rights, rights to equality, freedom, religion, culture, education and the right against exploitation														
CO3	Identify the fundamental duties of the Union of India, President, Vice-President, Union Ministers and Parliament functions														
CO4	Identify the power of states, its legislature, Governors role and the state judiciary														
CO5	List the special provisions and functionality of election commission, public service commission, individual tax and GST														
CO6	Build knowledge on the various aspects in the Indian Constitution, its provisions and right of a citizen and the society														
<b>CO-PO Mapping</b>															
COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	2	3	3	3	-	3	-	-	-
CO2	-	-	-	-	-	-	2	3	3	3	-	3	-	-	-
CO3	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-
CO4	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-
CO5	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-
CO6	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-
CO (Avg)	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>INDIAN CONSTITUTION</b>	<b>3</b>
Meaning of the Constitution law and Constitutionalism- Historical perspective of the Constitution of India- Salient features and characteristics of the Constitution of India Citizenship- Scheme of the fundamental rights- Scheme of the Fundamental Duties and its legal status		
<b>UNIT II</b>	<b>FUNDAMENTAL RIGHTS</b>	<b>3</b>
The Directive Principles of State Policy- Scheme of the Fundamental Right to Equality- Scheme of the Fundamental Right to certain Freedom under Article 19- Scope of the Right to Life and Personal Liberty under Article 21- Union Government, Union Legislature (Parliament)- Lok Sabha and Rajya Sabha (with Powers and Functions), Union Executive		
<b>UNIT III</b>	<b>POWERS AND FUNCTIONS OF CENTRAL GOVERNMENT</b>	<b>3</b>
President of India (with Powers and Functions)- Prime Minister of India (with Powers and Functions) - Union Judiciary (Supreme Court)- Jurisdiction of the Supreme Court - State Government, Legislature, Legislative Assembly, Legislative Council- Powers and Functions of the State Legislature, State Executive- Governor of the State (with Powers and Functions)		
<b>UNIT IV</b>	<b>POWERS AND FUNCTIONS OF STATE GOVERNMENT</b>	<b>3</b>
The Chief Minister of the State (with Powers and Functions)- State Judiciary (High Courts) Union Territory, Panchayat, Municipality- Scheduled and Tribal Areas- Co-operative Societies Consumer Rights - Consumer Protection Act		
<b>UNIT V</b>	<b>POWERS AND FUNCTIONS OF ELECTION AND SERVICE COMMISSION</b>	<b>3</b>
Local Self Government – Constitutional Scheme in India-Emergency Provisions : National, President Rule, Financial Emergency - Election Commission of India (with Powers and Functions) - The Union Public Service Commission (with Powers and Functions) - Amendment of the Constitutional Powers and Procedure -Income Tax, Goods and Services Tax		
<b>Text Book (s)</b>		
NIL		
<b>Reference (s)</b>		
1	Durgadas Basu, Introduction to the Constitution of India, Lexis- Nexis, 2015	
2	Subash C Kashyap, Our Parliament, National Books Trust, 2011	
3	Kaushal Kumar Agarwal, India's No 1 book on Tax : Simple Language Advanced Problems: Income Tax, Kindle, 2017	
4	Vivek K R Agarwal, GST Guide for students: Making GST – Good and Simple Tax, Neelam Book House, 2017	





Regulations 2018		Semester I				Total Hours		30
Category	Course Code	Course Name	Hours / Week			C		
			L	T	P			
P	18PCAP101L	ALGORITHMS LABORATORY	0	0	4	2		
<b>Prerequisite Course (s)</b>								
Nil								
<b>Course Objective (s):</b>								
The purpose of learning this course is to:								
1	Understand and remember algorithms and its analysis procedures							
2	To design and implement various data structure algorithms							
3	Compute the complexity of various algorithms							
<b>Course Outcome (s) (Cos):</b>								
At the end of this course, learners will be able to:								
CO1	Implement operations like searching, insertion, deletion and traversing							
CO2	Able to implement linear and non linear data structures							
CO3	Implement searching / sorting techniques							
<b>CO-PO Mapping</b>								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	3	3	-	2	2	3	2
CO2	2	3	2	-	2	2	2	2
CO3	2	3	3	-	2	2	3	2
CO (Avg)	2.3	3	2.6	-	2	2	2.6	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





LIST OF EXPERIMENTS	30
<ul style="list-style-type: none"><li>• Quick Sort</li><li>• Binary Search</li><li>• Binary Tree Traversal</li><li>• Warshall's Algorithm</li><li>• Dijkstra's Algorithm</li><li>• Prim's Algorithm</li><li>• Dynamic Programming</li><li>• Backtracking</li><li>• Branch and Bound</li><li>• Strassen's Matrix Multiplication</li></ul>	





Regulations 2018		Semester I					Total Hours		30	
Category	Course Code	Course Name					Hours / Week			C
							L	T	P	
P	18PCAP102L	PROGRAMMING IN C LABORATORY					0	0	4	2
<b>Prerequisite Course (s)</b>										
Nil										
<b>Course Objective (s):</b>										
The purpose of learning this course is to:										
1	To develop programs in C using basic constructs.									
2	For develop applications in C using strings, pointers, functions, structures									
3	To develop applications in C using file processing									
<b>Course Outcome (s) (Cos):</b>										
At the end of this course, learners will be able to:										
CO1	Develop C programs for simple applications making use of basic constructs, arrays and strings.									
CO2	Develop C programs involving functions, recursion, pointers, and structures									
CO3	Design applications using sequential and random access file processing.									
<b>CO-PO Mapping</b>										
COS	Pos						PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2		
CO1	3	3	3	2	2	-	3	2		
CO2	3	3	2	2	2	-	3	3		
CO3	2	3	2	2	2	-	2	2		
CO (Avg)	2.6	3	2.3	2	2	-	2.6	2.3		

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





LIST OF EXPERIMENTS	30
<ul style="list-style-type: none"><li>• Operators and Evaluation of expressions</li><li>• Control Structures</li><li>• Arrays</li><li>• Strings</li><li>• Functions</li><li>• Pointers</li><li>• Structures and Unions</li><li>• Files</li><li>• Preprocessor directives</li><li>• Command line arguments</li></ul>	







Regulations 2018		Semester II			Total Hours		45	
Category	Course Code	Course Name	Hours / Week			C		
			L	T	P			
C	18PCAC106T	EMBEDDED SYSTEMS	3	0	0	3		
<b>Prerequisite Course (s)</b>								
Nil								
<b>Course Objective (s):</b>								
The purpose of learning this course is to:								
1	To understand the architecture of embedded processors, microcontrollers, and peripheral devices.							
2	To appreciate the nuances of programming micro-controllers in assembly for embedded systems.							
3	To understand the challenges in developing operating systems for embedded systems.							
4	To learn about programming these systems in high-level languages such as C.							
<b>Course Outcome (s) (Cos):</b>								
At the end of this course, learners will be able to:								
CO1	Able to understand the functionality of embedded computing							
CO2	Able to design and control Memory Input and Output							
CO3	Able incorporate enhanced features in the embedded systems through Operating Systems							
CO4	Able to design the programming using C							
CO5	Acquire the knowledge of design the Emulators,IoT using embedded tools							
<b>CO-PO Mapping</b>								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	3	-	-	1.5	2	2
CO2	3	3	2	-	-	2	2	1
CO3	3	2	2	-	-	2	2	2
CO4	2	2	1	-	-	2	1	2
CO5	2	2	2	-	-	2	2	1
CO (Avg)	2.4	2.2	2	-	-	1.9	2	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>EMBEDDED COMPUTING</b>	<b>9</b>
Challenges of Embedded Systems – Embedded system design process. Embedded processors – 8051 Microcontroller, ARM processor – Architecture, Instruction sets and programming.		
<b>UNIT II</b>	<b>MEMORY AND INPUT / OUTPUT MANAGEMENT</b>	<b>9</b>
Programming Input and Output – Memory system mechanisms – Memory and I/O devices and interfacing – Interrupt handling.		
<b>UNIT III</b>	<b>PROCESSES AND OPERATING SYSTEMS</b>	<b>9</b>
Multiple tasks and processes – Context switching – Scheduling policies – Interprocess communication mechanisms – Performance issues.		
<b>UNIT IV</b>	<b>EMBEDDED C PROGRAMMING</b>	<b>9</b>
Programming embedded systems in C – C-looping structures – Register allocation – Function calls – Pointer aliasing – structure arrangement – bit fields – unaligned data and endianness – inline functions and inline assembly – portability issues.		
<b>UNIT V</b>	<b>EMBEDDED SYSTEM DEVELOPMENT</b>	<b>9</b>
Meeting real time constraints – Multi-state systems and function sequences. Embedded software development tools – Emulators and debuggers. Introduction to Internet of Things - Design issues – Design methodologies – Case studies using IoT– Complete design of example systems.		
<b>Reference (s)</b>		
1	Andrew N Sloss, D. Symes, C. Wright, “ARM System Developers Guide”, Morgan Kauffman/ Elsevier, 2006.	
2	ArshdeepBahga, Vijay Madiseti, “Internet of Things – A hands-on approach”, Universities Press, 2015	
3	Muhammed Ali Mazidi, Janice GillispieMazidi and Rolin D. McKinlay, “The Microcontroller and Embedded Systems”, Pearson Education, Second edition, 2007	





Regulations 2018		Semester II				Total Hours		45	
Category	Course Code	Course Name				Hours / Week			C
						L	T	P	
C	18PCAC107T	DATA STRUCTURES				3	0	0	3
<b>Prerequisite Course (s)</b>									
Nil									
<b>Course Objective (s):</b>									
The purpose of learning this course is to:									
1	To understand the linear and non- linear data structures available in solving problems								
2	To know about the sorting and searching techniques and its efficiencies								
3	Using the data structures and algorithms in real time applications								
<b>Course Outcome (s) (Cos):</b>									
At the end of this course, learners will be able to:									
CO1	An ability to understand the concepts and structure of data stored								
CO2	An ability to understand the design, function and implementation of programming.								
CO3	An ability to employ existing ideas or adapting existing solutions to similar problems								
CO4	An ability to break down a large, complex problem into smaller, solvable problems.								
CO5	An ability to understand basic concepts related to programming.								
<b>CO-PO Mapping</b>									
COS	Pos						PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	
CO1	2	2	3	1	2.5	1.5	2	2	
CO2	3	3	2	2	2	2	2	1	
CO3	3	2	2	2	2	2	2	2	
CO4	2	2	1	2	2	2	1	2	
CO5	2	2	2	2	2	2	2	1	
CO (Avg)	2.4	2.2	2	1.8	2.1	1.9	2	2	

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Introduction to Data Structure – Abstract Data Types (ADT) – Primitive data structures – Arrays and its representation – Strings - Structures.		
<b>UNIT II</b>	<b>STACKS AND QUEUES</b>	<b>9</b>
Stack – Queue – Circular Queue – Applications of stack – Infix to postfix conversion – Applications of Queue – Linked Lists – Doubly Linked lists – Polynomial Addition		
<b>UNIT III</b>	<b>TREE STRUCTURES</b>	<b>9</b>
Trees – Terminology - Representation of Trees – Binary Tree – expression trees – Binary tree traversals – Applications of trees – Binary search tree – AVL trees –B-Trees		
<b>UNIT IV</b>	<b>SORTING AND INDEXING</b>	<b>9</b>
Bubble sort - Quick Sort - Insertion Sort – Heap sort – Hashing – Hashing functions		
<b>UNIT V</b>	<b>GRAPHS</b>	<b>9</b>
Definitions – Graph representation - Graph Traversals - Depth-first search – breadth-first search - applications of graphs – shortest path algorithms – minimum cost spanning tree		
<b>Reference (s)</b>		
1	E. Horowitz, S.Sahni and Dinesh Mehta, “Fundamentals of Data structures in C++”, University Press, 2007	
2	ReemaThareja, “Data Structures using C”, Oxford Press, 2012.	





Regulations 2018		Semester II				Total Hours		60	
Category	Course Code	Course Name				Hours / Week			C
						L	T	P	
C	18PCAC108T	<b>OBJECT ORIENTED PROGRAMMING</b>				4	0	0	4
<b>Prerequisite Course (s)</b>									
Nil									
<b>Course Objective (s):</b>									
The purpose of learning this course is to:									
1	To learn how C++ supports Object Oriented principles such as abstraction, polymorphism etc								
2	To understand and apply the principles hiding, localization and modularity in software development.								
3	Use the generic programming features of C++ including the STL								
4	Design and implement reliable and maintainable object-oriented applications of moderate complexity composed of several classes								
<b>Course Outcome (s) (Cos):</b>									
At the end of this course, learners will be able to:									
CO1	Able to understand and design the solution to a problem using object-oriented programming concepts.								
CO2	Able to use proper class protection mechanism to provide security.								
CO3	Able to demonstrate the use of virtual functions to implement polymorphism.								
CO4	Understand and implement the features of C++ including templates, exceptions and file handling for providing programmed solutions to complex problems								
CO5	Able to reuse the code with extensible Class types, User-defined operators and function Overloading.								
<b>CO-PO Mapping</b>									
COS	Pos						PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	
CO1	3	2	2	-	1	1	2	2	
CO2	3	3	2	-	2	2	2	1	
CO3	2	3	2	-	2	1	2	2	
CO4	3	2	1	-	2	2	2	2	
CO5	2	2	2	-	2	2	2	1	
CO (Avg)	2.6	2.4	1.8	-	1.8	1.6	2	1.6	

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING</b>	<b>12</b>
Object-Oriented Programming concepts – Encapsulation – Programming Elements – Program Structure – Enumeration Types – Functions and Pointers – Function Invocation – Overloading Functions – Scope and Storage Class – Pointer Types – Arrays and Pointers – Call-by-Reference – Assertions.		
<b>UNIT II</b>	<b>IMPLEMENTING ADTS AND ENCAPSULATION</b>	<b>12</b>
Aggregate Type struct – Structure Pointer Operators – Unions – Bit Fields – Data Handling and Member Functions – Classes – Constructors and Destructors – Static Member – this Pointer – reference semantics – implementation of simple ADTs.		
<b>UNIT III</b>	<b>POLYMORPHISM</b>	<b>12</b>
ADT Conversions – Overloading – Overloading Operators – Unary Operator Overloading – Binary Operator Overloading – Function Selection – Pointer Operators – Visitation – Iterators – containers – Sequence Containers - List – List Iterators – Associative Containers		
<b>UNIT IV</b>	<b>TEMPLATES AND FILE HANDLING</b>	<b>12</b>
Template Class – Function Templates – RTTI Templates - Class Templates – Parameterizing – STL- Algorithms – Function Adaptors – Streams and Formatted I/O – I/O Manipulations -File handling – Random Access.		
<b>UNIT V</b>	<b>INHERITANCE</b>	<b>12</b>
Derived Class – Typing Conversions and Visibility – Code Reuse – Virtual Functions – Templates and Inheritance – Run-Time Type Identifications – Exceptions – Handlers – Standard Exceptions.		
<b>Reference (s)</b>		
1	BhushanTrivedi, “Programming with ANSI C++”, Oxford Press, Second Edition, 2012.	
2	Bhave , “ Object Oriented Programming With C++”, Pearson Education , 2004	
3	E Balagurusamy, “Object oriented Programming with C++”, 3 Edition, 2006, Tata McGraw Hill	
4	HM Deitel and PJ Deitel “C++ How to Program”, Seventh Edition, 2010, Prentice Hall	
5	Kamthane,” Object Oriented Programming with ANSI and Turbo C++”, Pearson Education, 2003	





Regulations 2018		Semester II				Total Hours		45	
Category	Course Code	Course Name				Hours / Week			C
						L	T	P	
C	18PCAC109T	SOFTWARE ENGINEERING				3	0	0	3
<b>Prerequisite Course (s)</b>									
Nil									
<b>Course Objective (s):</b>									
The purpose of learning this course is to:									
1	To provide an insight into software life cycle and various software process models								
2	To estimate the resources for developing the application and to prepare the schedule								
3	To know the various designing concepts and notations for modeling the software.								
4	To prepare the test cases for the project, apply various testing techniques, strategies and metrics to evaluate the software.								
5	To construct software with high quality and reliability.								
<b>Course Outcome (s) (Cos):</b>									
At the end of this course, learners will be able to:									
CO1	Able to understand the problem domain to choose process models and to develop SRS								
CO2	Able to model software projects using appropriate design notations								
CO3	Able to measure the product and process performance using various metrics								
CO4	Able to evaluate the system with various testing techniques and strategies								
CO5	Able to analyze, design, verify, validate, implement, and maintain software systems.								
<b>CO-PO Mapping</b>									
COS	Pos						PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	
CO1	1.5	2	3	-	2	2	3	2	
CO2	3	3	2	-	2	2	3	2	
CO3	3	2	3	-	2	2	3	3	
CO4	1	2	2	-	2	2	2	2	
CO (Avg)	2.12	2.25	2.5	-	2	2	2.75		

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Software Engineering Paradigms – Waterfall Life Cycle Model – Spiral Model – Prototype Model – Agile Process Model – Unified Process Model - Planning – Software Project Scheduling – SRS - Case Study: Project Plan and SRS		
<b>UNIT II</b>	<b>SOFTWARE DESIGN</b>	<b>9</b>
Designing Concepts - Abstraction – Modularity – Software Architecture – Cohesion – Coupling – Dataflow Oriented Design - Jackson System Development - Real time and Distributed System Design – Designing for Reuse — Case Study : Design for any Application Oriented Project.		
<b>UNIT III</b>	<b>SOFTWARE TESTING AND MAINTENANCE</b>	<b>9</b>
Software Testing Fundamentals – Software Testing Strategies – Black Box Testing – White Box Testing – System Testing – Object Orientation Testing – State Based Testing - Testing Tools – Test Case Management – Types of Maintenance – Case Study: Testing Techniques		
<b>UNIT IV</b>	<b>SOFTWARE METRICS</b>	<b>9</b>
Scope – Classification of metrics – Measuring Process and Product attributes – Direct and Indirect measures – Cost Estimation - Reliability – Software Quality Assurance – Standards – Case Study for COCOMO model.		
<b>UNIT V</b>	<b>SCM AND VERSION CONTROL</b>	<b>9</b>
Need for SCM – Version Control – SCM process – Software Configuration Items – Taxonomy – Re Engineering – Reverse Engineering - Web Engineering - CASE Repository – Features.		
<b>Reference (s)</b>		
1	Ali Behforroz, Frederick J.Hudson, “Software Engineering Fundamentals”, Oxford Indian Reprint,2012.	
2	Jibitesh Mishra, Ashok Mohanty, “Software Engineering”. Pearson Education. First Edition. 2011	
3	Kassem A. Saleh, “Software Engineering”, First Edition, J.Ross Publishing, 2009	
4	PankajJalote, “An Integrated approach to Software Engineering”, Third Edition, Narosa Publications, 2011	
5	Roger S. Pressman, David Lowe. “Web Engineering: A Practitioner’s Approach”. Special Indian edition, McGrawHill, 2008.	





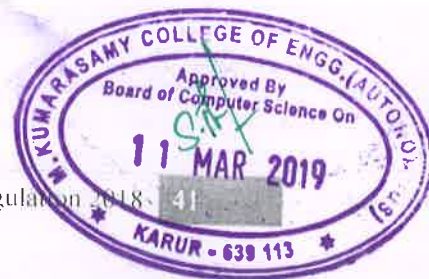


Regulations 2018		Semester II				Total Hours		45	
Category	Course Code	Course Name				Hours / Week			C
						L	T	P	
C	18PCAC110T	MULTIMEDIA SYSTEMS				3	0	0	3
<b>Prerequisite Course (s)</b>									
Nil									
<b>Course Objective (s):</b>									
The purpose of learning this course is to:									
1	To learn and understand technical aspect of multimedia systems								
2	To learn various multimedia authoring systems								
3	To understand various networking aspects used for multimedia applications								
4	To understand the standards available for different audio, video, text applications								
5	To learn the synchronization concepts in multimedia								
<b>Course Outcome (s) (Cos):</b>									
At the end of this course, learners will be able to:									
CO1	To develop, design and implement two and three dimensional graphical structures								
CO2	To enable students to acquire knowledge on Multimedia compression and animations								
CO3	To learn Creation, Management and Transmission of Multimedia objects								
<b>CO-PO Mapping</b>									
COS	Pos						PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	
CO1	2	1.5	1	2	2	2	2	2	
CO2	3	3	2	2	2	1	3	2	
CO3	3	2	3	2	2	2	3	3	
CO4	-	-	-	-	-	-	-	-	
CO (Avg)	2.6	2.16	2	2	2	1.6	2.6	2.33	

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>INTRODUCTION AND QOS</b>	<b>9</b>
QOS Requirements and Constraints - Concepts – Resources - Establishment Phase – Run -Time Phase - Management Architectures		
<b>UNIT II</b>	<b>OPERATING SYSTEMS</b>	<b>9</b>
Real-Time Processing – Scheduling – Interprocess Communication-Memory and Management – Server Architecture - Disk Management		
<b>UNIT III</b>	<b>FILE SYSTEMS AND NETWORKS</b>	<b>9</b>
Traditional and Multimedia File Systems-Caching Policy-Batching-Piggy backing-Ethernet-Gigabit Ethernet-Token Ring-100VG Any LAN-Fiber Distributed Data Interface (FDDI)- ATM Networks-MANWAN		
<b>UNIT IV</b>	<b>COMMUNICATION</b>	<b>9</b>
Transport Subsystem-Protocol Support for QOS-Transport of Multimedia-Computer Supported Cooperative Work-Architecture-Session Management-MBone Applications		
<b>UNIT V</b>	<b>SYNCHRONIZATION</b>	<b>9</b>
Synchronization in Multimedia Systems-Presentation-Synchronization Types-Multimedia Synchronization Methods-Case Studies-MHEG-MODE-ACME		
<b>Reference (s)</b>		
1	Ralf Steinmetz and KlaraNahrstedt, “Multimedia Systems”, Springer, I Edition 2004	
2	Ralf Steinmetz and KlaraNahrstedt , Media Coding and Content Processing. Prentice hall,2002	
3	Vaughan T, Multimedia, Tata McGraw Hill, 1999	
4	Mark J.B., Sandra K.M., Multimedia Applications Development using DVI technology,McGraw Hill, 1992	
5	K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovacovic, D. A. Milovacovic , Multimedia	
6	Communication Systems: Techniques, Standards, and Networks, Prentice Hall, 1st Edition,2002	
7	Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, Pearson, 2004	





Regulation 2018		Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM102T	VALUE EDUCATION	1	0	0	-

**Prerequisite Course (s)**

NIL

**Course Objective (s):**

The purpose of learning this course is to:

- 1 Connect the learners to their potential, identify their potential to create a new positive world
- 2 Analyze the merits and demerits of different educational systems. Identify the different systems of education
- 3 Draw attention towards the weaknesses they are susceptible to and inspire them through positive models
- 4 Instill a sense of professional ethics which help them develop a safe comfortable and prosperous society
- 5 Cultivate a spirit of willing accommodation in an increasingly diverse world
- 6 Strengthen, enhance the spirit of positivity and facilitate positive contribution in various spheres of life

**Course Outcome (s) (COs):**

At the end of this course, learners will be able to:

- |     |                                                                                                                           |
|-----|---------------------------------------------------------------------------------------------------------------------------|
| CO1 | Equipped with an awareness of their positive energy and power                                                             |
| CO2 | Identify the meaning of 'education'; have a clearer and better understanding in taking education to the masses            |
| CO3 | Assess their weaknesses; understand risks involved and rectify them through learning from positive and negative instances |
| CO4 | Realize their professional responsibilities                                                                               |
| CO5 | Acquire the required values in an expanding pluralistic world not be swept off their feet due to the rapid changes        |
| CO6 | Equip with better understanding of themselves, society they live. Identify responsibilities in creating a peaceful world  |

**CO-PO Mapping**

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	2	3	-	3	3	3	-	3	-	1	-
CO2	2	3	2	-	3	3	2	2	3	3	-	3	-	1	-
CO3	2	-	-	-	2	3	2	2	3	3	-	3	-	1	-
CO4	3	2	-	-	3	3	3	3	3	3	-	3	-	1	-
CO5	2	-	-	-	3	3	3	3	3	3	-	3	-	1	-
CO6	2	2	-	-	3	3	3	3	3	3	-	3	-	1	-
CO (Avg)	2.00	2.25	2.00	-	2.66	3	2.6	2.66	3	3	-	3	-	1	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





UNIT I	VISIONS FOR YOUTH	6
Introduction (Quiz) - Two speeches by great personalities (Oral presentations) - Quotes, proverbs relating to the power and potential of youth, Excerpts: Wings of Fire (Collecting proverbs highlighting the potential of youth) - Two news articles highlighting the initiatives for social causes by youth (Role play in a similar context) - One song exhibiting the positive energy of youth (Discussion on the song)		
UNIT II	YOUTH AND EDUCATION	6
Meaning and the significance of education (Brainstorming) - Overview of different (traditional, modern) educational systems (Debate) - Role of youth in education, Urban and Rural set up, dissemination (Student presentations) - Designing and framing educational curriculum and materials (Students' Presentation based on write ups) -The pressing challenges in current educational system (Collage Design)		
UNIT III	YOUTH AND SOCIETY	6
Need for social values in the present context (Poem – “Where the mind is without fear” . Write up on various instances from real life) - Individual and group behaviour. respect for others (Case study on recent happenings) - Civic sense, bullying-substance abuse, uses of expletives (Case study on recent happenings) - Hero worship, gender insensitivity moral policing (Case study on recent happenings) - Positive contribution by youth in promoting social welfare ( Short videos followed by discussions)		
UNIT IV	YOUTH AS PROFESSIONALS	6
Introduction to professional values (Brainstorming through visual cues) - Engineering societies in India (Quiz) - Challenges to be addressed by Engineers in India (Case Study) - Challenges in different sectors: agriculture (Case Study) - Challenges in different sectors: urban development, environment (Group activity (oral and written)) - Challenges in different sectors: sustainable development, cyber security (Case Study – from Newspapers)		
UNIT V	YOUTH IN PLURALISTIC SOCIETY	6
Introduction to pluralistic society, forces of globalization (Group Discussion) - Science and technology intercultural proximity (Narration of stories from various religions to illustrate the oneness of humanity) - Positive, Negative impact: religion, politics, gender, economic status, aesthetics (Discussion on “To Kill a Mocking Bird”) - Values required to live in a global society (Poster presentation on festivals of various religions) - Learning the etiquettes of various societies (Poster presentation on festivals of various religions) - Success of pluralistic society, enliven the society, religious harmony through literary (Writing the aspects of pluralistic society based on the text).		
<b>Reference (s)</b>		
1	Kalam, APJ Abdul. Wings of Fire: AN Autobiography of APJ Abdul Kalam. Ed. Sangam Books Ltd., 1999	
2	“Banaras Hindu University Speech” and “To Students”. The Voice of Truth. General Editor Shriman Narayan. Navajivan Publishing House. pp. 3-13 and pp. 425-30. www.mkgandhi.org	
3	Piroda, Sam. “Challenges in Science and Technology”.	
4	Thomas A Address to VTU Students by Narayana Murthy. <a href="https://www.karnataka.com/personalities/narayana-murthy/vtu-address-2006/">https://www.karnataka.com/personalities/narayana-murthy/vtu-address-2006/</a>	
5	World Economic forum. “India’s top 7 challenges from skills to water scarcity”	





Regulations 2018		Semester II				Total Hours		30
Category	Course Code	Course Name	Hours / Week			C		
			L	T	P			
P	18PCAP103L	DATA STRUCTURES LABORATORY	0	0	4	2		
<b>Prerequisite Course (s)</b>								
Design and Analysis of Algorithms								
<b>Course Objective (s):</b>								
The purpose of learning this course is to:								
1	To obtain in-depth practical knowledge in data structures.							
2	To apply concepts of data structures in solving real time problems							
<b>Course Outcome (s) (Cos):</b>								
At the end of this course, learners will be able to:								
CO1	Ability to identify and implement appropriate data structure for a given application.							
CO2	An ability to identify all the trade-offs involved in choosing static versus dynamic data structures							
CO3	Graduates will be able to understand the concepts of data structures and applications							
CO4	An ability to identify and implement appropriate data structures for a given application							
<b>CO-PO Mapping</b>								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	3	3	-	-	2	3	2
CO2	2	3	2	-	-	2	2	2
CO2	2	3	2	-	-	2	2	3
CO4	2	3	3	-	-	2	3	2
CO (Avg)	2.25	3	2.5	-	-	2	2.5	2.25

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





LIST OF EXPERIMENTS	30
<ul style="list-style-type: none"><li>• Operation on matrix using arrays</li><li>• Polynomial Addition using array</li><li>• Array implementation of stack</li><li>• Array implementation of Queue</li><li>• Infix to postfix conversion</li><li>• Singly Linked List operations</li><li>• Singly Linked List implementation of stack.</li><li>• Binary tree traversals</li><li>• Searching Techniques: Linear and Binary Search</li><li>• Quick sort</li><li>• Types of Inheritance</li><li>• Virtual Functions</li><li>• Exception Handling</li></ul>	





Regulations 2018		Semester II				Total Hours		30	
Category	Course Code	Course Name				Hours / Week			C
						L	T	P	
P	18PCAP104L	OBJECT ORIENTED PROGRAMMING LABORATORY				0	0	4	2
<b>Prerequisite Course (s)</b>									
Programming in C									
<b>Course Objective (s):</b>									
The purpose of learning this course is to:									
1	To develop skills in object oriented programming								
2	To learn generic data structures using templates								
3	To learn virtual functions and file handling in C++								
<b>Course Outcome (s) (Cos):</b>									
At the end of this course, learners will be able to:									
CO1	Develop programs in object oriented paradigm								
CO2	Implement data structure using C++								
CO3	Suggest appropriate data structure for any given data set								
CO4	Modify or suggest new data structure for an application.								
CO5	File handling in object oriented environment.								
<b>CO-PO Mapping</b>									
COS	Pos						PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	
CO1	2	2	3	-	-	1.5	2	2	
CO2	3	3	2	-	-	2	2	1	
CO3	3	2	2	-	-	2	2	2	
CO4	2	2	1	-	-	2	1	2	
CO5	2	2	2	-	-	2	2	1	
CO (Avg)	2.4	2.2	2	-	-	1.9	2	2	

1: Slight (Low)

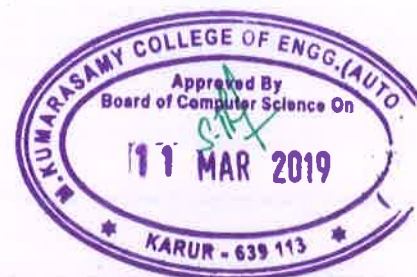
2: Moderate (Medium)

3: Substantial (High)





LIST OF EXPERIMENTS	30
<ul style="list-style-type: none"><li>• Enumeration and Function Overloading</li><li>• Scope and Storage class</li><li>• Stack and Queue</li><li>• Constructors and Destructors</li><li>• Static member and methods</li><li>• Bit fields</li><li>• Overloading using binary operator, friend and member function</li><li>• Overload unary operator in Postfix and Prefix form as member and friend function</li><li>• Iterators and Containers</li><li>• Function templates</li><li>• Template Class</li><li>• Types of Inheritance</li><li>• Virtual Functions</li><li>Exception Handling</li></ul>	







Regulations 2018		Semester III	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
F	18PMAF101T	Mathematical Foundations of Computer Applications	3	1	0	4

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	To familiarize the basic terms used in computer science
2	To improve the logical and mathematical ability of the student
3	Able to solve practical problems by learning the applications of set theory, Propositional Logic, Predicate Logic etc.,

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Find eigen values and eigen vectors of real symmetric and non-symmetric matrices.
CO2	Basic knowledge of set theory, functions and relations concepts needed for designing and solving problems
CO3	Design and solve Boolean functions for defined problems.
CO4	Logical operations and predicate calculus needed for computing skill
CO5	Apply the acquired knowledge of formal languages to the engineering areas like Compiler Design

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	1
CO3	3	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-
CO5	3	-	2	-	-	-	-	1
CO (Avg)	3	-	2	-	-	-	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





UNIT I	MATRIX ALGEBRA	9+3
Matrices - Rank of a matrix - Solving system of equations - Eigenvalues and Eigenvectors - Cayley - Hamilton theorem - Inverse of a matrix.		
UNIT II	BASIC SET THEORY	9+3
Basic definitions - Venn diagrams and set operations - Laws of set theory - Principle of inclusion and exclusion – Partitions - Permutation and combination.		
UNIT III	FUNCTIONS AND RELATIONS	9+3
Injective, Surjective, Bijective functions - composition, identity, inverse; Relations - properties of relations - closure operations on relations.		
UNIT IV	MATHEMATICAL LOGIC	9+3
Propositions and logical operators - Truth table - Propositions generated by a set - Equivalence and implication - Basic laws - Some more connectives - Functionally complete set of connectives - Normal forms - Proofs in propositional calculus - Predicate calculus		
UNIT V	FORMAL LANGUAGES	9+3
Languages and grammars - Phrase structure grammar - Classification of grammars -Pumping lemma for regular languages - Context free languages		
Reference (s)		
1	David Makinson, "Sets, Logic and Maths for Computing", Springer Indian Reprint, 2011	
2	Grimaldi, R.P and Ramana, B.V. "Discrete and Combinatorial Mathematics". 5th Edition. Pearson Education, 2006	
3	Hopcroft J.E and Ullman,J.D, "Introduction to Automata Theory, Languages and Computation", Narosa Publishing House, Delhi, 2002.	
4	Kenneth H. Rosen, "Discrete Mathematics and Its Applications", Tata McGraw Hill, 4th Edition, 2002.	
5	Sengadir, T. "Discrete Mathematics and Combinatorics" Pearson Education, New Delhi, 2009	
6	Trembley, J.P. and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, New Delhi, 2007	
7	Venkataraman, M.K., "Engineering Mathematics", 2nd Edition, Volume-II, National Publishing Company, 1989	





Regulations 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC201T	COMPUTER NETWORKS	3	0	0	3

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	To understand networking concepts and basic communication model.
2	To understand network architectures and components required for data communication.
3	To analyze the function and design strategy of physical, data link, network layer and transport layer.
4	To acquire knowledge of various application protocol standard developed for internet.

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Able to trace the flow of information from one node to another node in the network
CO2	Able to Identify the components required to build different types of networks
CO3	Able to understand the functionalities needed for data communication into layers
CO4	Able to choose the required functionality at each layer for given application
CO5	Able to understand the working principles of various application protocols.

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	1	2	2	2	2	2	2
CO2	2	1	2	2	2	2	3	1
CO3	2	2	2	2	2	2	2	2
CO4	2	2	1	1	1	1	1	2
CO5	2	2	2	2	2	2	2	1
CO (Avg)	2	1.6	1.8	1.8	1.8	1.8	2	1.6

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





UNIT I	NETWORK FUNDAMENTALS	9
Data Communication – physical structure – Topologies – The OSI model – TCP/IP protocol suite – Digital and Analog Transmission – Transmission Media – Modem standards.		
UNIT II	DATA LINK LAYER	9
Error Detection And Correction : Types of Errors- Single Bit and Multiple bit errors – VRC – LRC – CRC - checksum. Data Link Control And Protocols: Stop and Wait ARQ – Go-back-N ARQ- Selective Repeat ARQ – Connecting Devices: Repeaters, Hubs, Switches – Introduction to IEEE Project 802:Ethernet, Token Ring, FDDI-802.11.		
UNIT III	NETWORK LAYER	9
Internetworking – IP addressing – Subnetting- Classless IP addresses – ARP – RARP – ICMP – Routing – Distance Vector and Link State Routing, BGP.		
UNIT IV	TRANSPORT LAYER	9
Transport Services – Elements of Transport Protocols - UDP - Connection oriented, Reliable service – TCP – Connection establishment – TCP Congestion control – Transactional TCP		
UNIT V	APPLICATION LAYER	9
DNS – Remote Logging –FTP –WWW -SMTP–VOIP – Network Management Protocol: SNMP – HTTP.		
<b>Reference (s)</b>		
1	William Stallings, “Data and Computer Communication”, Prentice Hall, 2007	
2	Tanenbaum A. S, "Computer Networks", Prentice Hall, 2008.	
3	Comer E, "Internetworking with TCP/IP, Principles Protocols and Architecture", Prentice Hall, 2007	
4	Forouzan, “ Data Communication and Networking”, Fifth Edition . TMH 2012.	
5	James F. Kurose, Keith W. Ross, “Computer Networking: A Top-down Approach, Pearson Education, Limited, sixth edition, 2012.	





Regulations 2018		Semester III			Total Hours			60
Category	Course Code	Course Name	Hours / Week			C		
			L	T	P			
C	18MCAC202T	JAVA PROGRAMMING	4	0	0	4		
<b>Prerequisite Course (s)</b>								
Nil								
<b>Course Objective (s):</b>								
The purpose of learning this course is to:								
1	To understand the concept of Java Language, Exception Handling, Multithreading.							
2	To provide the knowledge about Abstract Windowing Toolkit (AWT) Package, Socket							
3	To Understand the Programming and Database connectivity.							
4	To Understand the OOPS concept & how to apply in programming.							
<b>Course Outcome (s) (Cos):</b>								
At the end of this course, learners will be able to:								
CO1	An ability to understand the concept of Object Oriented Programming.							
CO2	An ability to handle Exception							
CO3	An ability to design GUI components using AWT and Swings.							
CO4	An ability to write network programming and Database Connectivity.							
<b>CO-PO Mapping</b>								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	1	1	2	-	2	1	2	2
CO2	2	1	2	-	2	1	2	2
CO3	2	1	3	-	1	2	2	2
CO4	2	2	2	-	1	2	2	2
CO (Avg)	1.8	1.4	2.25	-	1.6	1.6	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





<b>UNIT I</b>	<b>JAVA FUNDAMENTALS</b>	<b>12</b>
Fundamentals of object oriented programming - JAVA Evolution – An overview of JAVA – Data Types, Variables and Arrays – Operators and Expressions – Control Statements.		
<b>UNIT II</b>	<b>OOPS IN JAVA</b>	<b>12</b>
Classes, Objects and methods: Class Fundamentals – Declaring Objects – Assigning object reference variables – Methods declaration – Constructors – method overloading – method overriding – this Keyword - static members – abstract methods and classes – Inner Classes – using final – finalize method. Inheritance: Basics – using super – Creating multilevel hierarchy – using final with inheritance.		
<b>UNIT III</b>	<b>JAVA CONCEPTS</b>	<b>12</b>
Interfaces and Packages : Interfaces - Packages – Access Protection – Importing packages Exception Handling : Fundamentals – types – multiple catch clauses – nested try – java’s built in exceptions – creating user exceptions . Multithreaded Programming : Java thread model – Creating thread - Priorities – Synchronization – Inter thread communication.		
<b>UNIT IV</b>	<b>COLLECTIONS</b>	<b>12</b>
String handling – Managing Input / Output Files in Java -Collections: Benefits of Collections - List, Set and Map Interfaces with implementation – Thread safe Collections – Iterators		
<b>UNIT V</b>	<b>JAVA NETWORKING</b>	<b>12</b>
Networking : Basics – Inet Address – TCP/IP client socket – URL – URL connection - TCP/IP server socket – Datagrams - Java Database connectivity(JDBC)		
<b>Reference (s)</b>		
1	Herbert Schildt, "Java The Complete Reference", Tata McGraw Hill, Fifthth Edition, 2002.	
2	E Balagurusamy, “Programming with JAVA”, McGraw Hill, Fourth Edition,2010	
3	Horstmann and Cornell, “Core Java”, Pearson Education, 2007	
4	Deitel and Deitel, “JAVA – How to Program”, Prentice Hall International Inc, 2007	
5	Ken Arnold, James Gosling, David Holmes, “The Java Programming Language”, Pearson Education, third Edition, 2007	





Regulations 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18MCAC203T	OBJECT ORIENTED ANALYSIS AND DESIGN	3	0	0	3

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	To provide a brief, hands-on overview of object-oriented concepts and its life cycle for software development
2	To learn for modelling the software and to design them using UML diagrams
3	To understand the problem domain and to identify the objects from the problem specification.
4	To understand, how to apply design axioms and corollaries for the classes and object relational systems.
5	To gain knowledge about open source tools for Computer Aided Software Engineering

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Able to understand the object oriented concepts and to apply object oriented life cycle model for a project.
CO2	Able to design static and dynamic models using UML diagrams.
CO3	Able to perform object oriented analysis to identify the objects from the problem specification.
CO4	Able to identify and refine the attributes and methods for designing the object oriented system
CO5	Able learn the open source CASE tools and to apply them in various domains.

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	1	-	2	2	2	2
CO2	2	3	3	-	2	1	2	2
CO3	2	2	2	-	2	1	2	2
CO4	2	2	2	-	1	1	1	2
CO5	2	2	3	-	2	2	3	2
CO (Avg)	2	2.2	2.2	-	1.8	1.4	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





UNIT I	INTRODUCTION	9
An overview – Object basics – Object state and properties – Behaviour – Methods – Messages – Information hiding – Class hierarchy – Relationships – Associations – Aggregations- Identity – Dynamic binding – Persistence – Meta classes – Object oriented system development life cycle.		
UNIT II	METHODOLOGY AND UML	9
Introduction – Survey – Rumbaugh, Booch, Jacobson methods – Unified modelling language – Static and Dynamic models – Rational Rose Suite - UML diagrams – Static diagram : Class diagram – Use case diagrams – Behaviour Diagram : Interaction diagram – State chart diagram – Activity diagram - Implementation diagram: Component diagram – Deployment diagram – example - Design of online railway reservation system using UML diagrams		
UNIT III	OBJECT ORIENTED ANALYSIS	9
Identifying Use case – Business object analysis – Use case driven object oriented analysis – Use case model – Documentation – Classification – Identifying object, relationships, attributes, methods – Super-sub class – A part of relationships Identifying attributes and methods – Object responsibility		
UNIT IV	OBJECT ORIENTED DESIGN	9
Design process and benchmarking – Axioms – Corollaries – Designing classes – Class visibility – Refining attributes – Methods and protocols – Object storage and object interoperability – Databases – Object relational systems – Designing interface objects – Macro and Micro level processes – The purpose of a view layer interface		
UNIT V	CASE TOOLS	9
Railway domain : Platform assignment system for the trains in a railway station - Academic domain : Student Marks Analysing System - ATM system - Stock maintenance - Quiz System - E-mail Client system - Cryptanalysis – Health Care Systems. Use Open source CASE Tools: StarUML/ UML Graph for the above case studies.		
Reference (s)		
1	Ali Bahrami, “Object Oriented System Development”, McGraw Hill International Edition, 2008	
2	Brahma Dathan, SarnathRamnath, “Object-Oriented Analysis, Design and Implementation”. Universities Press, 2010	
3	Bernd Bruegge, Allen H. Dutoit, Object Oriented Software Engineering using UML, Patterns and Java, Pearson 2004	
4	Craig Larman, Applying UML and Patterns – An Introduction to Object-Oriented Analysis and Design and Iterative Development”, 3rd Edition, Pearson Education, 2005	
5	Grady Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Language User Guide”, Addison Wesley Long man, 1999	







Regulations 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC204T	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	To understand the fundamentals of data models and conceptualize and depict a database system using ER diagram
2	To make a study of SQL and relational database design.
3	To know about data storage techniques and query processing.
4	To impart knowledge in transaction processing, concurrency control techniques and recovery procedures

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Understand the basic concepts of the database and data models
CO2	Design a database using ER diagrams and map ER into Relations and normalize the relations
CO3	Acquire the knowledge of query evaluation to monitor the performance of the DBMS.
CO4	Develop a simple database applications using normalization.
CO5	Acquire the knowledge about different special purpose databases and to critique how They differ from traditional database systems.

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	1	1	-	1	2	1	2
CO2	2	3	1	-	1	2	3	1
CO3	2	2	3	-	1	2	2	2
CO4	2	3	3	-	2	1	3	2
CO5	2	1	1	-	2	2	2	1
CO (Avg)	1.8	2	1.8	-	1.5	1.8	2.2	1.6

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





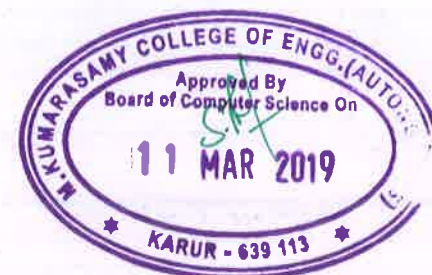
<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
File systems versus Database systems – Data Models – DBMS Architecture – Data Independence – Data Modeling using Entity – Relationship Model		
<b>UNIT II</b>	<b>RELATIONAL MODEL AND QUERY EVALUATION</b>	<b>9</b>
Relational Model Concepts – Relational Algebra – SQL – Basic Queries – Sub queries – Views – Constraints		
<b>UNIT III</b>	<b>DATABASE DESIGN</b>	<b>9</b>
Relational Model , Decomposition, Functional Dependencies, Multivalued Dependencies, Normal forms		
<b>UNIT IV</b>	<b>FILES AND INDEXING</b>	<b>9</b>
File operations – Indexing : B+ tree – Hashing Techniques : Static Hashing – Dynamic Hashing – Query Processing		
<b>UNIT V</b>	<b>TRANSACTION PROCESSING</b>	<b>9</b>
Transaction concepts, Concurrent Execution, Serializability, Recoverability, Concurrency Control, Lock based protocol, Deadlock handling		
<b>Reference (s)</b>		
1	Abraham Silberschatz, Henry F.Korth and S.Sundarshan “Database System Concepts”, Sixth Edition, McGraw Hill, 2010.	
2	C.J. Date, “An Introduction to Database Systems”, Eight Edition, Pearson Education Delhi, 2003	
3	Frank. P. Coyle, “XML, Web Services And The Data Revolution”, Pearson Education, 2012.	
4	Lee Chao, “Database Development and Management”, Auerbach Publications, 2010	
5	Peter Rob, Carlos coronel , “Database System Concepts” , Ceange Learning 2008	





Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	18PCAP201L	JAVA PROGRAMMING LABORATORY	0	0	4	2
<b>Prerequisite Course (s)</b>						
Object Oriented Programming						
<b>Course Objective (s):</b>						
The purpose of learning this course is to:						
CO1	To gain the practical knowledge in Java Programming concepts.					
CO2	To introduce the Abstract window Tool Kit, Thread and Socket Programming problems.					
CO3	To understand and apply the fundamentals core java, packages, database connectivity for computing					
CO4	To enhance the knowledge to server side programming					
<b>Course Outcome (s) (Cos):</b>						
At the end of this course, learners will be able to:						
CO1	Apply the Object Oriented features of Java for programming on the internet					
CO2	Implement, compile, test and run Java program					
CO3	An ability to implement overloading, overriding, packages and string concepts					
CO4	An ability to implement the exception handling.					
CO5	An ability to implement data base connectivity and threads					

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





CO-PO Mapping								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	3	2	-	1	2	3	2
CO2	2	3	2	-	2	2	2	2
CO3	3	2	1	-	1	2	2	2
CO4	3	2	1	-	1	1	3	3
CO5	2	1	2	-	2	2	2	2
CO (Avg)	2.4	2.2	1.6	-	1.4	1.8	2.4	2.2

### List of Experiments

java program to implement the following concepts

1. Java classes and Objects
2. Constructor overloading and overriding concepts
3. Method overloading and overriding concepts.
4. Inheritance
5. Interfaces
6. Packages
7. Exception Handling
8. Multithreading Concepts
9. Applet applications
10. Event Handling
11. String Handling
12. Files (I/O Packages)
13. Chat application using datagrams
14. Remote Method Invocation
15. Database Connectivity





Regulations 2018		Semester III	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	18PCAP202L	DBMS LABORATORY	0	0	4	2

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	To understand the concepts of DBMS.
2	To familiarize with SQL queries.
3	To write stored procedures in DBMS.
4	To learn front end tools to integrate with databases.

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Design and Implement databases
CO2	Design and Implement applications that have GUI and access databases for backend connectivity

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	-	3	2	-	-	-	2	-
CO2	-	3	2	-	-	-	2	-
CO (Avg)	-	3	1.2	-	-	-	2	-





### List of Experiments

1. Creation of base tables and views
2. Data Manipulation INSERT, DELETE and UPDATE in Tables. SELECT, Sub Queries and
3. Data Control Commands
4. High level language extensions – PL/SQL or Transact SQL – Packages
5. Use of Cursors, Procedures and Functions
6. Embedded SQL or Database Connectivity
7. Oracle or SQL Server Triggers – Block Level – Form Level Triggers
8. Working with Forms, Menus and Report Writers for a application project in any domain
9. Front-end tools -- Visual Basic/Developer 2000





Regulation 2018		Semester III	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM201L	COMPETENCIES IN SOCIAL SKILLS	0	0	2	1

**Course Objective (s):** The purpose of learning this course is to:

1	To sharpen problem solving skill and to improve thinking capability of the students
2	To hone soft skill and analytical ability of students
3	To engage learners in using language purposefully and cooperatively
4	To expertise the writing and presentation skill to fulfill the corporate expectations

**Course Outcome (s) (Cos):** At the end of this course, learners will be able to:

CO1	Students should be able to solve both analytical and logical problems in an effective manner
CO2	Students can design and deliver information in a proper manner
CO3	Presentation skills of students will be improved individually as well as a team member

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	-	-	-	-	2	-	-
CO2	2	-	-	-	-	2	-	-
CO3	2	-	-	-	-	2	-	-
CO (Avg)	1.2	-	-	-	-	1.2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





UNIT I	Module - 1	6
<b>Aptitude:</b> Coding & Decoding - Direction Sense Test. <b>Communication:</b> Self-Introduction and SWOT analysis - Letter writing - types.		
UNIT II	Module - 2	6
<b>Aptitude:</b> Venn Diagrams - Data Interpretation. <b>Communication:</b> Phrasal verbs - Voice of Valluvar.		
UNIT III	Module - 3	6
<b>Aptitude:</b> Averages. <b>Communication:</b> Idioms and Phrases - Skits.		
UNIT IV	Module - 4	6
<b>Aptitude:</b> Time and Distance - Problems on Trains. <b>Communication:</b> Prefix/Suffix - Root words - Adjectives - JAM (Extempore Speech).		
UNIT V	Module - 5	6
<b>Aptitude:</b> Clocks & Calendars. <b>Communication:</b> Homophones - Frame Tales.		
Text Book (s)		
1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015	
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015	







Regulations 2018		Semester IV				Total Hours		60
Category	Course Code	Course Name	Hours / Week			C		
			L	T	P			
C	18PCAC205T	MOBILE APPLICATION DEVELOPMENT (Industry Recommended Course)	4	0	0	4		
<b>Prerequisite Course (s)</b>								
Nil								
<b>Course Objective (s):</b>								
The purpose of learning this course is to:								
1	To understand the concept of Android platform							
2	To know about User interface in Mobile Applications							
3	To learn the concept of Data handling, Graphics and Animation							
4	To gain knowledge of Testing in Mobile Applications							
5	To analyse distribution of Mobile Application into market							
<b>Course Outcome (s) (Cos):</b>								
At the end of this course, learners will be able to:								
CO1	Appreciate the Mobility Landscape							
CO2	Familiarize with Mobile Apps development aspects							
CO3	Design and develop mobile apps, using Android as development platform. with key focus on user experience design, native data handling and background tasks and notifications							
CO4	Appreciation of nuances such as native hardware play, location awareness, graphics and multimedia							
CO5	Perform testing, signing, packaging and distribution of mobile apps							
<b>CO-PO Mapping</b>								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	-	-	-	-	-	-	2
CO2	3	-	-	-	-	-	-	2
CO3	2	2	3	-	-	-	3	2
CO4	2	-	2	-	-	-	-	2
CO5	2	2	2	-	-	-	-	2
CO (Avg)	2.2	2	2.3	-	-	-	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





<b>UNIT I</b>	<b>GETTING STARTED WITH MOBILITY</b>	<b>12</b>
Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, setting up the mobile app development environment along with an emulator. a case study on Mobile app development		
<b>UNIT II</b>	<b>BUILDING BLOCKS OF MOBILE APPS</b>	<b>12</b>
App user interface designing – mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity- states and life cycle, interaction amongst activities. App functionality beyond user interface - Threads, Async task, Services – states and life cycle, Notifications, Broadcast receivers, Telephony and SMS APIs		
<b>UNIT III</b>	<b>NATIVE DATA HANDLING AND SPRUCING UP MOBILE APPS</b>	<b>12</b>
Native data handling – on-device file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet) Graphics and animation – custom views, canvas, animation APIs, multimedia – audio/video playback and record, location awareness, and native hardware access (sensors such as accelerometer and gyroscope)		
<b>UNIT IV</b>	<b>TESTING MOBILE APPS</b>	<b>12</b>
Debugging Mobile Apps, White box testing, Black box testing, and test automation of mobile apps, JUnit for Android, Robotium, MonkeyTalk		
<b>UNIT V</b>	<b>TAKING APPS TO MARKET</b>	<b>12</b>
Versioning, signing and packaging mobile apps, distributing apps on mobile market place		
<b>Reference (s)</b>		
1	Anubhav Pradhan, Anil V Deshpande, "Mobile Apps Development", First Edition, 2013	
2	Barry Burd, "Android Application Development All in one for Dumnries". Seconcl Edition, John Wiley & Sons Inc.,2015	
3	Lauren Darcey, Shane Conder, "Teach Yourself Android Application Development In 24 Hours". SAMS Publication	
4	<a href="https://google-developer-training.github.io/android-developer-fundamentals-courseconcepts-v2/">https://google-developer-training.github.io/android-developer-fundamentals-courseconcepts-v2/</a>	
5	<a href="https://google-developer-training.github.io/android-developer-fundamentals-courseconcepts/en1">https://google-developer-training.github.io/android-developer-fundamentals-courseconcepts/en1</a> ,	





Regulations 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC206T	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3

**Prerequisite Course (s)**

Computer Networks

**Course Objective (s):**

The purpose of learning this course is to:

- 1 To understand the basics of cryptography
- 2 Learn to find the vulnerabilities in programs and to overcome them
- 3 Know the different kinds of security threats in networks and its solution
- 4 Know the different kinds of security threats in databases and solutions available
- 5 Learn about the models and standards for security

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

- CO1 Apply cryptographic algorithms for encrypting and decryption for secure data transmission
- CO2 Understand the program threats and apply good programming practice
- CO3 Get the knowledge about the security services available for internet and web applications
- CO4 Understand data vulnerability and SQL injection
- CO5 Gain the knowledge of security models and published standards

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	2	2	2
CO3	2	2	3	2	2	2	2	2
CO4	2	2	2	1	1	2	2	2
CO5	2	2	2	2	2	2	2	2
CO (Avg)	2	2	2.2	1.8	1.8	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





<b>UNIT I</b>	<b>ELEMENTARY CRYPTOGRAPHY</b>	<b>9</b>
Terminology and Background – Substitution Ciphers – Transpositions – Making Good Encryption Algorithms- Data Encryption Standard- AES Encryption Algorithm – Public Key Encryption – Cryptographic Hash Functions – Key Exchange – Digital Signatures		
<b>UNIT II</b>	<b>PROGRAM SECURITY</b>	<b>9</b>
Secure programs – Non-malicious Program Errors – Viruses – Targeted Malicious code – Controls Against Program Threat – Control of Access to General Objects – User Authentication – Good Coding Practices – Open Web Application Security Project Flaws		
<b>UNIT III</b>	<b>SECURITY IN NETWORKS</b>	<b>9</b>
Threats in networks – Virtual Private Networks – PKI – SSL – IPSec – Content Integrity – Access Controls – Honeypots – Traffic Flow Security – Firewalls – Intrusion Detection Systems – Secure e-mail		
<b>UNIT IV</b>	<b>SECURITY IN DATABASES</b>	<b>9</b>
Security requirements of database systems – Reliability and Integrity in databases – Redundancy – Recovery – Concurrency/ Consistency – Monitors – Sensitive Data – Types of disclosures – Inference-finding and confirming SQL injection		
<b>UNIT V</b>	<b>SECURITY MODELS AND STANDARDS</b>	<b>9</b>
Secure SDLC – Security architecture models – Bell-La Padula Confidentiality Model – Biba Integrity Model – Graham-Denning Access Control Model – Harrison-Ruzzo-Ulman Model – Secure Frameworks – COSO – CobiT – Security Standards - ISO 27000 family of standards – NIST		
<b>Reference (s)</b>		
1	Education Charles P. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, Fourth Edition, Pearson, 2007	
2	Michael Whitman, Herbert J. Mattord, “Management of Information Security”, Third Edition, Course Technology, 2010	
3	Michael Howard, David LeBlanc, John Viega, “24 Deadly Sins of Software Security: Programming Flaws and How to Fix Them”, First Edition, McGrawHill Osborne Media, 2009	
4	Matt Bishop, “Computer Security: Art and Science”, First Edition, Addison- Wesley, 2002	
5	William Stallings, “Cryptography and Network Security : Principles and Practices”, Fifth Edition, Prentice Hall, 2010	





Regulations 2018		Semester IV			Total Hours			45
Category	Course Code	Course Name	Hours / Week			C		
			L	T	P			
C	18PCAC207T	DATA MINING	3	0	0	3		
<b>Prerequisite Course (s)</b>								
Database Management Systems								
<b>Course Objective (s):</b>								
The purpose of learning this course is to:								
1	Be familiar with the concepts of data warehouse and data mining,							
2	Be acquainted with the tools and techniques used for Knowledge Discovery in Databases.							
3	Understand various techniques involved in Data Mining							
<b>Course Outcome (s) (Cos):</b>								
At the end of this course, learners will be able to:								
CO1	Able to describe the data warehouse architecture							
CO2	Able to describe the data mining basic concepts							
CO3	Illustrate the mining techniques like association, classification and clustering on transactional databases							
<b>CO-PO Mapping</b>								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	-	-	-	-	2	-	-
CO2	2	-	-	-	-	2	-	-
CO3	2	-	3	-	-	-	-	-
CO (Avg)	2	-	3	-	-	2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





<b>UNIT I</b>	<b>INTRODUCTION TO DATA WAREHOUSING</b>	<b>9</b>
Components of data warehouse, Datawarehouse Architecture and Infrastructure – OLAP		
<b>UNIT II</b>	<b>INTRODUCTION TO DATA MINING</b>	<b>9</b>
KDD vs Data mining , DBMS vs Data mining , Issues and Challenges - <b>Preprocessing</b> – Concepts , Discretization , Feature extraction & Selection , Missing data , Post processing , Attribute Oriented Induction		
<b>UNIT III</b>	<b>ASSOCIATION AND CLASSIFICATION TECHNIQUES</b>	<b>9</b>
Introduction Association Rules , Apriori algorithm , FP tree growth algorithm - Introduction to Classification , Constructing decision tree – ID3 algorithm , Pruning		
<b>UNIT IV</b>	<b>CLUSTERING TECHNIQUES</b>	<b>9</b>
Introduction to Clustering , Partitioning Method – K Means algorithm - Hierarchical Method , Density Based Method – DBSCAN method , Conceptual clustering		
<b>UNIT V</b>	<b>MINING APPLICATIONS</b>	<b>9</b>
Spatial data mining, Temporal data mining, Sequence mining, Text mining, Visual data mining, Web mining		
<b>Reference (s)</b>		
1	Jiawei Han, MichelineKamper, Data Mining: Concepts and Techniques Morgan Kaufman, 2007, ISBN: 1-55860-489-8. Chap1-3, 5-10	
2	K.P.Soman, ShyamDiwakar, V.Ajay, “Insight into Data Mining – Theory and Practice”, Prentice Hall of India, 2009	
3	ArunK.Pujari, “Data Mining Techniques”, Universities Press, 2010	
4	M.H Dunham, “Data Mining: Introductory and advanced topics”, Pearson Education, 2006.	





Regulations 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC208T	SOFTWARE PROJECT MANAGEMENT	3	0	0	3

**Prerequisite Course (s)**

Software Engineering, Object Oriented Analysis and Design

**Course Objective (s):**

The purpose of learning this course is to:

- |   |                                                            |
|---|------------------------------------------------------------|
| 1 | To analyze risk in software design and quality             |
| 2 | To plan, design, develop and validate the software project |

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

- |     |                                                                                          |
|-----|------------------------------------------------------------------------------------------|
| CO1 | Explain a process model for a software project Development                               |
| CO2 | Apply Project Management and Requirement analysis, Principles to S/W project development |
| CO3 | Analyze the cost estimate and problem complexity using various estimation techniques     |
| CO4 | Generate test cases using the techniques using white box and black box testing           |

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	1	2	2	2	1	2
CO2	2	3	2	3	3	2	2	1
CO3	2	2	2	2	2	2	2	2
CO4	2	2	2	2	2	1	1	2
CO (Avg)	1.6	1.8	1.75	1.8	1.8	1.4	1.2	1.4

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





UNIT I	SOFTWARE PROCESS AND LIFE CYCLE MODELS	9
Introduction to Software Engineering, Software Process, Life cycle models: water fall, incremental, spiral, WINWIN spiral, evolutionary, prototyping, object oriented, Aspect oriented, Agile Process Models		
UNIT II	REQUIREMENTS ENGINEERING TASKS	9
Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document. Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management. Data Modelling, OO analysis		
UNIT III	SOFTWARE PROJECT MANAGEMENT	9
Software Project Management: Estimation, LOC and FP Based Estimation, COCOMO Model, Project Scheduling: Scheduling, Earned Value Analysis - Risk Management		
UNIT IV	SOFTWARE DESIGN	9
Design process: Design concepts, Data design elements: Pattern based Software Design		
UNIT V	SOFTWARE TESTING	9
Software testing strategies: fundamentals, Internal and external views of Testing-white box testing, black box testing, Regression Testing, Unit Testing, Integration Testing		
Reference (s)		
1	Roger Pressman, Software Engineering: A Practitioners Approach, (8th Edition), McGraw Hill, 2015	
2	Eric J. Braude and Micheal E. Bernstein, Software Engineering Modern Approach, second edition, Wiley, 2011	
3	Ian Somerville, Software Engineering, 9th edition, Addison Wesley, 2011	







Regulations 2018		Semester IV	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC209T	WEB PROGRAMMING	4	0	0	4

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

- 1 To understand the concepts and architecture of the World Wide Web.
- 2 To understand and practice markup languages
- 3 To understand and practice embedded dynamic scripting on client side Internet Programming
- 4 To understand and practice web development techniques on client-side.
- 5 To understand and practice PHP with HTML

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

- CO1 Create a basic website using HTML and Cascading Style Sheets
- CO2 Design and implement dynamic web page with validation using JavaScript objects and by applying different event handling mechanisms.
- CO3 Design rich client presentation using AJAX
- CO4 Design and implement simple web page in PHP, and to present data in XML format.
- CO5 Design front end web page and connect to the back end databases

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	1	1	2	2	2
CO2	2	3	2	1	1	2	2	1
CO3	2	3	3	1	1	2	2	1
CO4	2	3	3	1	1	1	2	2
CO5	2	3	2	1	1	2	2	2
CO (Avg)	2	2.8	2.4	1.2	1.2	2	2	1.6

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





UNIT I	INTRODUCTION TO WWW	12
Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol - Overview of HTTP, HTTP request – response — Generation of dynamic web pages		
UNIT II	UI DESIGN	12
Markup Language (HTML5): Basics of Html -Syntax and tags of Html- Introduction to HTML5 - Semantic/Structural Elements -HTML5 style Guide and Coding Convention– Html Svg and Canvas – Html API's - Audio & Video - Drag/Drop - Local Storage - Web socket API– Debugging and validating Html. <b>Cascading Style Sheet (CSS3):</b> The need for CSS – Basic syntax and structure Inline Styles – Embedding Style Sheets - Linking External Style Sheets - Introduction to CSS3 – Backgrounds - Manipulating text - Margins and Padding - Positioning using CSS		
UNIT III	OVERVIEW OF JAVASCRIPT	12
Introduction - Core features - Data types and Variables - Operators, Expressions, and Statements Functions - Objects - Array, Date and Math Related Objects - Document Object Model - Event Handling - Controlling Windows & Frames and Documents - Form validations		
UNIT IV	ADVANCED FEATURES OF JAVASCRIPT	12
Browser Management and Media Management – Classes – Constructors – Object-Oriented Techniques in JavaScript – Object constructor and Prototyping - Sub classes and Super classes – Introduction to JSON – JSON Structure –Introduction to jQuery –Introduction to AJAX-Bootstrap - Bootstrap components		
UNIT V	PHP	12
Introduction - How web works - Setting up the environment (LAMP server) - Programming basics Print/echo - Variables and constants – Strings and Arrays – Operators. Control structures and looping structures – Functions – Reading Data in Web Pages - Embedding PHP within HTML - Establishing connectivity with MySQL. Database		
Reference (s)		
1	David Flanagan, “JavaScript: The Definitive Guide, Sixth Edition”, O'Reilly Media, 2011	
2	Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel. “Internet and World Wide Web - How To Program”, Fifth Edition, Pearson Education, 2011	
3	James Lee, BrentWare , “Open Source Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP” AddisonWesley, Pearson 2009	
4	Thomas A. Powell, “HTML & CSS: The Complete Reference”, Fifth Edition, 2010	
5	Thomas A Powell, Fritz Schneider, “JavaScript: The Complete Reference”, Third Edition, Tata McGraw Hill, 2013	
6	Thomas A Powell, “Ajax: The Complete Reference”. McGraw Hill. 2008	





Regulations 2018		Semester IV	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
p	18PCAP203L	MOBILE APPLICATION DEVELOPMENT LABORATORY	0	0	4	2

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	Know the components and structure of mobile application development frameworks like Android /windows /ios
2	Understand how to work with various mobile application development frameworks
3	Learn the basic and important design concepts and issues of development of mobile applications
4	Understand the capabilities and limitations of mobile devices
5	Write applications for the platforms used, simulate them, and test them on the mobile hardware where possible

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Install and configure Android application development tools
CO2	Design and develop user Interfaces for the Android platform
CO3	Apply Java programming concepts to Android application development
CO4	Familiar with technology and business trends impacting mobile applications
CO5	Competent with the characterization and architecture of mobile applications

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	-	2	2	1	-	-	-	-
CO2	2	1	3	1	-	-	3	-
CO3	2	2	3	1	-	-	2	-
CO4	2	2	2	2	-	-	1	2
CO5	2	1	2	1	-	-	-	2
CO (Avg)	2	2	2.2	1	-	-	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





### List of Experiments

1. Develop an application that uses Layout Managers.
2. Develop an application that uses event listeners.
3. Develop an application that uses Adapters , Toast.
4. Develop an application that makes use of database.
5. Develop an application that makes use of RSS Feed.
6. Implement an application that implements Multi-threading.
7. Develop a native application that uses GPS location information.
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message.
10. Develop a game application





Regulations 2018		Semester IV	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	18PCAP204L	WEB PROGRAMMING LABORATORY	0	0	4	2

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

- |   |                                                                                                                                         |
|---|-----------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Try and develop the most important technologies that are being used today by web developers to build a wide variety of web applications |
| 2 | To build web applications using proven developer tools and message formats                                                              |
| 3 | To understand and practice web development techniques on client-side                                                                    |
| 4 | Web applications using technologies such as HTML, CSS, Javascript, AJAX, JQuery and JSON                                                |

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

- |     |                                                                                                                 |
|-----|-----------------------------------------------------------------------------------------------------------------|
| CO1 | Develop simple web applications using scripting languages                                                       |
| CO2 | Implement server side and client side programming develop web applications with various web technology concepts |
| CO3 | Design a Web application using various technologies such as AJAX, JQuery and JSON                               |
| CO4 | Develop an application for social media using HTML5, CSS3, JQuery, AJAX & PHP                                   |

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	3	-	1	2	3	2
CO2	2	2	3	-	1	2	2	2
CO3	2	3	3	-	1	2	3	2
CO4	2	2	3	-	1	2	3	2
CO (Avg)	1.6	2.25	2.4	-	0.8	1.6	2.75	1.6

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





### List of Experiments

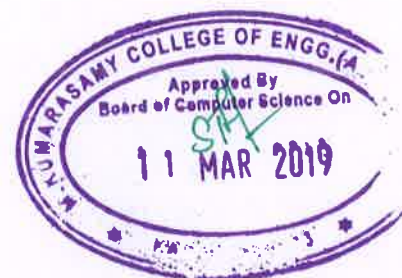
1. Create your own Resume using HTML 5 Tags .
2. Debug and validate your HTML document ( Resume ) using W3C validator and fix the issues ([https://validator.w3.org/#validate\\_by\\_upload](https://validator.w3.org/#validate_by_upload)) .
3. Add Styles to your Resume using CSS 3 Properties
  - a) Add External, Internal and Inline CSS styles to know the priority
  - b) Add CSS3 Animation to your profile
4. a) Add functionalities that use any 2 of HTML 5 API"s  
b) Create a student Registration form for Job Application and validate the form fields using JavaScript
5. Create a CGPA Calculator in Web Brower using HTML, CSS and JavaScript. Use functions in JavaScript
6. Create an online Event Registration form and validate using JQuery
7. Using PHP and MySQL, develop a program to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings
8. Develop a Social Media Web Application using HTML5, CSS3, JQuery, AJAX & PHP
9. Create a Single Page application allowing to search for a movie and displaying the trailer, poster for various movies (Use Bootstrap and JQuery for designing the User Interface )
10. Construct a JSON Structure for a bookstore and validate it using JSON Validator such as <http://jsonlint.com/> and parse the Json file to list the books under the category "Fiction". Use Javascript or JQuery for parsing





Regulation 2018		Semester IV				Total Hours			30
Category	Course Code	Course Name	Hours / Week			C			
			L	T	P				
M	18MBM202L	CRITICAL AND CREATIVE THINKING SKILLS	0	0	2	1			
<b>Course Objective (s):</b> The purpose of learning this course is to:									
1	To focus on listening, speaking, & writing skills through audio & video sessions								
2	To hone soft skill and analytical ability of students								
3	To overcome the fear in group communication and to provide the effective communication								
4	To expertise intelligible pronunciation, stress and intonation patterns								
<b>Course Outcome (s) (Cos):</b> At the end of this course, learners will be able to:									
CO1	Students can be able to solve both analytical and logical problems in an effective manner								
CO2	Students can demonstrate an ability to design and deliver messages								
CO3	The quality of student's communication with practical experience is improved								
<b>CO-PO Mapping</b>									
COS	Pos						PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	
CO1	2	-	-	-	-	2	-	-	
CO2	2	-	-	-	-	2	-	-	
CO3	2	-	-	-	-	2	-	-	
CO (Avg)	1.2	-	-	-	-	1.2	-	-	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





UNIT I	Module - 1	6
<b>Aptitude:</b> Time and Work - Pipes and Cisterns. <b>Communication:</b> Sentence Pattern - Debate.		
UNIT II	Module - 2	6
<b>Aptitude:</b> Boats and Streams. <b>Communication:</b> Tenses and voices - Tech Talk.		
UNIT III	Module - 3	6
<b>Aptitude:</b> Problems on Ages - Probability <b>Communication:</b> Analogies - Biography.		
UNIT IV	Module - 4	6
<b>Aptitude:</b> Data sufficiency - Logical Puzzles. <b>Communication:</b> Punctuation - Connection.		
UNIT V	Module - 5	6
<b>Aptitude:</b> Mensuration. <b>Communication:</b> Preposition - News of the Week.		
Text Book (s)		
1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015	
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S Chand & Company Limited, 2015	







Regulations		Semester V	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC301T	INTERNET OF THINGS	4	0	0	4
<b>Prerequisite Course (s)</b>						
Nil						
<b>Course Objective (s):</b>						
The purpose of learning this course is to:						
1	To understand the fundamentals of Internet of Things					
2	To learn about the basics of IOT protocols.					
3	To build a small low cost embedded system using Raspberry Pi.					
4	To apply the concept of Internet of Things in the real world scenario.					
<b>Course Outcome (s) (Cos):</b>						
At the end of this course, learners will be able to:						
CO1	Understand the fundamentals of IoT					
CO2	Describe IoT Architecture					
CO3	Analyze various protocols for IoT					
CO4	Deploy an IoT application using Raspberry PI and Arduino					
CO5	Analyze applications of IoT in real time scenario.					

CO-PO Mapping								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	2	2	1	2	-
CO2	2	2	3	2	2	2	2	-
CO3	2	2	2	1	3	2	2	2
CO4	2	2	3	1	1	1	1	2
CO5	2	2	2		2	2	2	2
CO (Avg)	2	2	2.4	1.6	2	1.6	1.8	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>INTRODUCTION TO IoT</b>	<b>12</b>
Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology		
<b>UNIT II</b>	<b>IoT ARCHITECTURE</b>	<b>12</b>
M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture		
<b>UNIT III</b>	<b>IoT PROTOCOLS</b>	<b>12</b>
Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – CoAP - Security		
<b>UNIT IV</b>	<b>BUILDING IoT WITH RASPBERRY PI &amp; ARDUINO</b>	<b>12</b>
Building IOT with RASPBERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Raspberry Pi Interfaces - Arduino.		
<b>UNIT V</b>	<b>CASE STUDIES AND REAL-WORLD APPLICATIONS</b>	<b>12</b>
Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - Amazon Web Services for IoT.		
<b>Reference (s)</b>		
1	Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach, Universities Press, 2015	
2	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011.	
3	Honbo Zhou, —The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012.	
4	Jan Ho"ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos. Stefan Avesand, David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.	
5	Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012	





Regulations 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC302T	DATA ANALYTICS	3	0	0	3

**Prerequisite Course (s)**

Data Mining

**Course Objective (s):**

The purpose of learning this course is to:

1	To Learn the basics of Big Data
2	To understand the data analytic life cycle
3	To learn the R Programming to export and import the data set
4	To learn the exploratory data analysis through graphical representation
5	To learn and understand the given case study

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	To explain about Big Data
CO2	To explain the data analytic life cycle
CO3	To export and import the data set to understand the types of variables
CO4	To apply the data visualization graphical methods like Barchart, Dox plot, Scatter plot to the given data set
CO5	To analyse the given case study through data analytic life cycle phases

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	2	2	1	-	-
CO2	2	2	3	2	2	2	-	-
CO3	-	2	2	-	-	-	-	-
CO4	2	2	3	-	-	-	1	-
CO5	2	2	2	-	-	-	-	-
CO (Avg)	2	2	2.4	2	2	1.5	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>INTRODUCTION TO BIG DATA</b>	<b>9</b>
Big Data Overview – State of the Practice in Analytics – Key roles for the New Big Data Eco System – Examples of Big Data Analytics		
<b>UNIT II</b>	<b>DATA ANALYTIC LIFE CYCLE</b>	<b>9</b>
Data Analytics Life Cycle : Discovery, Data Preparation, Model Planning, Model Building, Communicate Results – Operationalize - Types of Variables		
<b>UNIT III</b>	<b>INTRODUCTION TO R</b>	<b>9</b>
R Graphical User Interface – Data import and export – Attribute and Data Types – Types of Data Analytics		
<b>UNIT IV</b>	<b>EXPLORATORY DATA ANALYSIS</b>	<b>9</b>
Visualization before analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – Data Exploration versus presentation		
<b>UNIT V</b>	<b>CASE STUDY</b>	<b>9</b>
Global Innovation Network and Analysis (GINA) : Phase 1,2,3,4,5,6		
<b>Reference (s)</b>		
1	David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big Data Analytics”, EMC Education Series, John Wiley, ISBN: 978-1-118-87613-8, 2015	
2	Thomas A.Ruler, “Data Analytics – Models and Algorithms for Intelligent Data Analysis”, Springer Vieweg, 2012	





Regulations		Semester V	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAC303T	<b>SOFTWARE TESTING AND QUALITY ASSURANCE</b>	3	1	0	4
<b>Prerequisite Course (s)</b>						
Software Project Management						
<b>Course Objective (s):</b>						
The purpose of learning this course is to:						
1	To know the behaviour of the testing techniques and to design test cases to detect the errors in the software					
2	To get insight into the levels of testing in the user environment					
3	To understand standard principles to check the occurrence of defects and its removal					
4	To learn the functionality of automated testing tools to apply in the specialized environment					
5	To understand the models and metrics of software quality and reliability					
<b>Course Outcome (s) (Cos):</b>						
At the end of this course, learners will be able to:						
CO1	Able to test the software by applying various testing techniques.					
CO2	Able to debug the project and to test the entire computer based systems at all levels.					
CO3	Able to test the applications in the specialized environment using various automation tools.					
CO4	Able to evaluate the web applications using bug tracking tools.					
CO5	Able to apply quality and reliability metrics to ensure the performance of the software.					

CO-PO Mapping								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	1	2	2	1	2	2	2
CO2	2	2	2	1	1	2	2	2
CO3	2	2	2	1	2	2	2	2
CO4	2	2	1	1	1	1	2	2
CO5	2	2	2	2	2	2	2	2
CO (Avg)	2.2	1.8	1.8	1.4	1.4	1.8	2	2

1: Slight (Low)

2: Moderate (Medium)





UNIT I	TESTING TECHNIQUES & TEST CASE DESIGN	12
Using White Box Approach to Test design - Test Adequacy Criteria – Static Testing Vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Their Role in White box Based Test Design – Code Complexity Testing – Evaluating Test Adequacy Criteria. Test Case Design Strategies – Using Black Box Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis – Decision tables – Equivalence Class Partitioning – Statebased testing – Cause-effect graphing – Error guessing – Compatibility testing – User documentation testing – Domain testing – Case study for Control Flow Graph and Statebased Testing.		
UNIT II	LEVELS OF TESTING	12
The Need for Levels of Testing- Unit Test Planning –Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording Results – Integration Tests – Designing Integration Tests – Integration Test Planning – Scenario Testing – Defect Bash Elimination. System Testing – Acceptance testing – Performance testing – Regression Testing - Internationalization testing - Ad-hoc testing – Alpha, Beta Tests- Testing OO systems – Usability and Accessibility Testing – Configuration Testing - Compatibility Testing – Testing the documentation – Website Testing - Case Study for Unit and Integration Testing.		
UNIT III	TESTING FOR SPECIALIZED ENVIRONMENT	12
Definitions - Reason for software standards - Benefits - Establishing standards - Guidelines - Types of reviews - Inspection of objectives - Basic inspection principles - The conduct of inspection - Inspection training.		
UNIT IV	TEST AUTOMATION	12
Selecting and Installing Software Testing Tools - Software Test Automation – Skills needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Tracking the Bug – Debugging – Case study using Bug Tracking Tool.		
UNIT V	SOFTWARE TESTING AND QUALITY METRICS	12
Six-Sigma – TQM - Complexity Metrics and Models – Quality Management Metrics - Availability Metrics - Defect Removal Effectiveness - FMEA - Quality Function Deployment – Taguchi Quality Loss Function – Cost of Quality. Case Study for Complexity and Object Oriented Metrics		
Reference (s)		
1	Adithya P. Mathur, “ Foundations of Software Testing – Fundamentals algorithms and techniques”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008	
2	Boris Beizer, “ Software Testing Techniques” , Dream Tech Press, 2009	
3	Dale H. Besterfield , “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint (2011).	
4	Edward Kit, “ Software Testing in the Real World – Improving the Process” , Pearson Education, 1995	
5	Glenford J. Myers. Tom Badgett. Corey Sandler. “The Art of Software Testing” . 3rd Edition John Wiley & Sons Publication, 2012	





6	Illene Burnstein, “ Practical Software Testing”, Springer International Edition, Chennai. 2003.
7	Naresh Chauhan , “Software Testing Principles and Practices ” Oxford University Press , New Delhi ,2010
8	Ron Patton, “Software Testing”, Second Edition, Pearson Education, 2009
9	Renu Rajani,Pradeep Oak, “Software Testing – Effective Methods, Tools and Techniques”, Tata McGraw Hill,2004
10	Srinivasan Desikan and Gopalaswamy Ramesh, “Software Testing – Principles and Practices”, Pearson Education, 2009
11	Stephan Kan, “Metrics and Models in Software Quality”, Addison – Wesley, Second Edition, 2004
12	William Perry, “Effective Methods of Software Testing”, Third Edition, Wiley Publishing.





Regulations		Semester V	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAP301L	IOT LABORATORY	0	0	4	2
<b>Prerequisite Course (s)</b>						
Nil						
<b>Course Objective (s):</b> The purpose of learning this course is to:						
1	Understand the concepts of Internet of Things and can able to build IoT applications.					
2	Understand how to program on embedded and mobile platforms					
3	Understand how to communicate with other mobile devices using various communication platforms such as Bluetooth and Wi-Fi.					
4	Understand how to make sensor data available on the Internet.					
<b>Course Outcome (s) (Cos):</b> At the end of this course, learners will be able to:						
CO1	Understand the concepts of Internet of Things					
CO2	Analyze basic protocols in wireless sensor network					
CO3	Design IoT applications in different domain and be able to analyze their performance					
CO4	Implement basic IoT applications on embedded platform					
CO5	Work as a team and create end-to-end IoT applications.					

CO-PO Mapping								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	-	-	3	2	2
CO2	2	2	2	-	-	2	2	2
CO3	2	2	3	-	-	2	2	2
CO4	2	2	2	-	-	2	2	2
CO5	2	2	2	-	2	2	2	2
CO (Avg)	2	2	2.2	-	0.4	2.2	2.2	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial







### List of Experiments

1. Hello World with mbed environment
2. Attaching a sensor and an actuator
3. Connecting a communication module
4. Creating a virtual device and communicating with it through Device
5. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
6. Configuring the Gateway.
7. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
8. To install MySQL database on Raspberry Pi and perform basic SQL queries.
9. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
10. program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.





Regulations 2018		Semester V	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	18PCAP302L	DATA ANALYTICS LABORATORY	0	0	4	2
<b>Prerequisite Course (s)</b>						
Nil						
<b>Course Objective (s):</b>						
The purpose of learning this course is to:						
1	To import and export data sheet					
2	To learn the data analytic methods by using any tool					
<b>Course Outcome (s) (Cos):</b>						
At the end of this course, learners will be able to:						
CO1	Able to analyze the given data set by using the given technique					

CO-PO Mapping								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	-	-	2	2	2
CO (Avg)	2	2	2	-	-	2	2	2

1: Slight (Low)                      2: Moderate (Medium)                      3: Substantial (High)





LIST OF EXPERIMENTS	30
<ul style="list-style-type: none"><li>• Introduction to Python / R / Any tool for Data Analytics</li><li>• Logic, Control Flow, Filtering</li><li>• Loop Data Structures</li><li>• Cleaning Data</li><li>• Exploratory Data Analysis in Cleaning Data</li><li>• Statistical Exploratory Data Analysis</li><li>• Building data frames</li><li>• Manipulating data frames</li></ul> <p>Applying any of the following techniques</p> <ul style="list-style-type: none"><li>• Clustering Technique</li><li>• Association Rules</li><li>• Decision Tree</li></ul>	





Regulations		Semester V	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	18PCAP303L	SOFTWARE TESTING LABORATORY	0	0	4	2

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	To apply various testing techniques and to detect the errors in the software.
2	To generate and apply the test cases using the automated testing tool
3	To learn the functionality of automated testing tools to apply in the specialized environment

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Able to test the software by applying various testing techniques.
CO2	Able to debug the project and to test the entire computer based systems at all levels.
CO3	Able to test the applications in the specialized environment using various automation tools.
CO4	Able to evaluate the web applications using bug tracking tools.
CO5	Able to apply quality and reliability metrics to ensure the performance of the software

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	-	1	-	-	-	-	-	-
CO2	-	3	2	-	-	-	-	-
CO3	2	2	1	-	2	-	-	-
CO4	2	1	2	-	1	-	-	-
CO5	2	1	2	-	2	-	-	-
CO (Avg)	2	1.6	1.6	-	1.5	-	-	-

1: Slight (Low)

2: Moderate (Medium)

Substantial (High)





### List of Experiments

1. Using Selenium IDE, Write a test suite containing minimum 4 test cases.
2. Install Selenium server and demonstrate it using a script in Java/PHP.
3. Write and test a program to login a specific web page.
4. Write and test a program to update 10 student records into table into Excel file.
5. Write and test a program to select the number of students who have scored more than 60 in any one subject (or all subjects)
6. Write and test a program to provide total number of objects present / available on the page
7. Write and test a program to get the number of list items in a list / combo box.
8. Write and test a program to count number of check boxes on the page checked and unchecked count





Regulations		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18PCAE001T	AD HOC AND SENSOR NETWORKS	3	0	0	3

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	Understand the design issues in ad hoc and sensor networks.
2	Learn the different types of MAC protocols.
3	Be familiar with different types of adhoc routing protocols.
4	Be expose to the TCP issues in adhoc networks.

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Explain the concepts, network architectures and applications of ad hoc and wireless sensor networks
CO2	Analyze the protocol design issues of ad hoc and sensor networks
CO3	Discuss the sensor characteristics and wsn layer protocols
CO4	Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues
CO5	Evaluate the QoS related performance measurements of ad hoc and sensor networks

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	-	-	-	-	-	-
CO2	3	3	2	-	-	-	2	-
CO3	3	-	-	-	-	-	-	-
CO4	2	2	1	-	2	-	1	-
CO5	2	2	2	2	2	-	-	-
CO (Avg)	2.4	2.2	1.9	1.8	2.1	-	2	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.		
<b>UNIT II</b>	<b>MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS</b>	<b>9</b>
Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11		
<b>UNIT III</b>	<b>ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS</b>	<b>9</b>
Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions- TCP over Ad hoc wireless Networks.		
<b>UNIT IV</b>	<b>WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS</b>	<b>9</b>
Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.		
<b>UNIT V</b>	<b>WSN ROUTING, LOCALIZATION &amp; QOS</b>	<b>9</b>
Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.		
<b>Reference (s)</b>		
1	C. Siva Ram Murthy, and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols”, Prentice Hall Professional Technical Reference, 2008.	
2	Carlos De Moraes Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: History and Applications”, World Scientific Publishing Company, 2006.	
3	Feng Zhao and Leonides Guibas, “Wireless Sensor Networks”, Elsevier Publication – 2002.	
4	Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”. Wiley, 2005	
5	Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks- Technology, Protocols, and Applications”, John Wiley, 2007.	





Regulations		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18PCAE002T	GAME PROGRAMMING	3	0	0	3

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	To get subsequent understanding of game design and development, which includes the processes, mechanics, and issues in game design, game engine development, modeling, techniques, handling situations, and logic.
2	To create interactive games

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Illustrate an understanding of the concepts behind game programming techniques.
CO2	Implement game programming techniques to solve game development tasks.
CO3	Construct a basic game engine using open-source programming libraries.

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-
CO2	2	2	2	-	2	-	3	-
CO3	2	2	1.5	-	2	-	2	2
CO (Avg)	2.3	2.3	1.75	-	2	-	2.5	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)







UNIT I	GRAPHICS FOR GAME PROGRAMMING	9
Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics-based Simulation.		
UNIT II	GAME DESIGN PRINCIPLES	9
Game Logic, Game AI, Path Finding, Game Theory, Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection.		
UNIT III	GAMING ENGINE DESIGN	9
Renderers, Software Rendering, Hardware Rendering, and Controller based animation. Spatial Sorting, Level of detail, collision detection, standard objects, and physics.		
UNIT IV	GAMING PLATFORMS AND FRAMEWORKS	9
Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DX Studio, Unity.		
UNIT V	GAME DEVELOPMENT	9
Developing 2D and 3D interactive games using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.		
Reference (s)		
1	Andy Harris, "Beginning Flash Game Programming For Dummies", For Dummies; Updated Edition, 2005.	
2	David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" Morgan Kaufmann, 2nd Edition, 2006	
3	Dino Dini, "Essential 3D Game Programming", Morgan Kaufmann, 1st Edition, 2012	
4	Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", Prentice Hall 1st Edition, 2006	
5	Eric Lengyel, "Mathematics for 3D Game Programming and Computer Graphics", 3rd. Edition, Course Technology PTR, 2011	
6	Jason Gregory, "Game Engine Architecture", A K Peters, 2009.	
7	JungHyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 1st Edition, 2011	
8	Mike McShaffrfy, "Game Coding Complete", 3 <sup>rd</sup> Edition, Charles River Media, 2009.	
9	Jonathan S. Harbour, "Beginning Game Programming". Course Technology PTR, 3rd Edition, 2009	
10	Jeannie Novak, "Game Development Essentials", 3rd Edition, Delmar Cengage Learning, 2011.	
11	John Hattan, "Beginning Game Programming: A GameDev.net Collection" Course Technology PTR, 1st Edition, 2009	





Regulations		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18PCAE003T	<b>SERVICE ORIENTED ARCHITECTURE</b>	3	0	0	3

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

- 1 To learn XML concepts and exposed to build applications based on XML
- 2 To gain knowledge about SOAP, HTTP and UDDI to create web services
- 3 To understand the SOA architecture and principles of Service Oriented Architecture.
- 4 To learn about the role of SOA in J2EE, .NET and web services.
- 5 To know about the Cloud Computing architecture and services.

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

- CO1 Able to know the structure of XML and to design and store data in XML.
- CO2 Able to apply SOAP , HTTP and UDDI services in the web applications.
- CO3 Able to apply SOA architecture and the underlying design principles for the web projects
- CO4 Able to understand the role of SOA in J2EE and .NET.
- CO5 Able to know the cloud computing architecture and the types of clouds

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	-	-	-	-	2	-	-
CO2	2	-	2	-	-	2	2	-
CO3	2	2	1	-	-	2	2	-
CO4	2	-	-	-	-	1	-	-
CO5	2	-	-	-	-	2	2	-
CO (Avg)	2	0.4	0.6	-	-	1.8	1.2	-

1: Slight (Low)                      2: Moderate (Medium)                      3: Substantial (High)





UNIT I	XML AND WEB SERVICES	9
XML structure – Elements – Creating Well-formed XML - Name Spaces – Schema Elements, Types, Attributes – XSL Transformations – Parser – Web Services Overview – Architecture.		
UNIT II	WSDL, SOAP and UDDI	9
WSDL - Overview Of SOAP – HTTP – XML-RPC – SOAP: Protocol – Message Structure – Intermediaries – Actors – Design Patterns And Faults – SOAP With Attachments – UDDI.		
UNIT III	SOA BASICS	9
Roots of SOA – Characteristics of SOA - Comparing SOA to client-server and distributed internet architectures – Anatomy of SOA- How components in an SOA interrelate - Principles of service orientation – Service Layers.		
UNIT IV	SOA in J2EE and .NET	9
SOA platform basics – SOA support in J2EE – Java API for XML-based web services (JAX- WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC) – JAX-RS SOA support in .NET – ASP.NET web services.		
UNIT V	CLOUD COMPUTING	9
Vision of Cloud computing – Cloud Definition – Characteristics and Benefits – Virtualization – Cloud computing Architecture – Cloud Reference Model, Types of Clouds – Cloud Platforms in Industry.		
Reference (s)		
1	Dan woods and Thomas Mattern, “Enterprise SOA designing IT for Business Innovation”, O’REILLY, First Edition, 2006.	
2	Frank. P. Coyle, “XML, Web Services And The Data Revolution”, Pearson Education, 2002	
3	Heather Williamson, “XML, The Complete Reference”, McGraw Hill Education, 2012.	
4	Newcomer, Lomow, “Understanding SOA with Web Services”, Pearson Education, 2009.	
5	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, McGraw Hill Education, 2013.	
6	Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services. An Architect’s Guide”, Pearson Education, 2009	
7	Thomas Erl, “Service-Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2008.	





Regulations		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18PCAE004T	<b>INTELLIGENT INFORMATION RETRIEVAL</b>	3	0	0	3

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	To Introduce design, implementation and evaluation of information retrieval systems
2	To understand a emerging technologies to build the next generation of intelligent systems
3	To study about IR Models
4	To understand a personalized search tools and Web information systems.

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Able to Define and Explain the fundamentals of IR Models
CO2	Able to Understand the technologies of IR
CO3	Able to Apply the models of Classification
CO4	Able to Analyze and demonstrate the retrieval models, algorithms, and system implementations

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	-	-	-	-	2	-	-
CO2	3	-	-	-	-	-	-	-
CO3	3	2	3	-	-	-	3	-
CO4	1	2	2	-	-	2	2	-
CO (Avg)	2.25	2	2.5	-	-	2	2.5	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>BASICS OF INFORMATION RETRIEVAL</b>	<b>11</b>
Boolean retrieval - The term vocabulary and posting lists - Scoring, term weighting and the vector space model - Computing scores in a complete search system - Evaluation in information retrieval.		
<b>UNIT II</b>	<b>IR MODELS</b>	<b>8</b>
XML Retrieval - Probabilistic information retrieval: Review - Ranking principle - Binary independence model - Language models for information retrieval: Language models - query likelihood model.		
<b>UNIT III</b>	<b>TEXT CLASSIFICATION AND SVM MODEL</b>	<b>9</b>
Text classification and Naïve Bayes : Text classification problem - Naïve Bayes text classification - Bernoulli model - Properties of Naïve Bayes - Feature selection. Support vector machines and Machine learning on documents : SVM models - machine learning methods.		
<b>UNIT IV</b>	<b>CLUSTERING AND MATRIX DECOMPOSITIONS</b>	<b>9</b>
Flat Clustering : problem statement - K-means - Hierarchical clustering: agglomerative clustering - Centroid clustering- Divisive clustering - Matrix decompositions and latent semantic indexing.		
<b>UNIT V</b>	<b>WEB SEARCH AND IR</b>	<b>8</b>
Web search basics - Web crawling and indexes : Overview - Crawling - Link analysis : Pagerank.		
<b>Reference (s)</b>		
1	Christopher Manning, Prabhakar Raghavan and Hinrich Schutze. " Introduction to Information Retrieval", Cambridge University Press. 2012.	
2	Ricardo Baeza - Yates, BerthierRibeiro - Neto, Modern Information Retrieval: The concepts and Technology behind Search (ACM Press Books), Second Edition 2011	





Regulations		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18PCAE005T	<b>OPERATIONS RESEARCH</b>	3	0	0	3

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	To provide the concept and an understanding of basic concepts in Operations Research Techniques for Analysis and Modelling in Computer Applications.
2	To understand , develop and solve mathematical model of linear programming problems.
3	To understand , develop and solve mathematical model of Transport and assignment problems
4	To Understand network modeling for planning and scheduling the project activities.

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Understand and apply linear, integer programming to solve operational problem with constraints.
CO2	Apply transportation and assignment models to find optimal solution in warehousing and Travelling
CO3	To prepare project scheduling using PERT and CPM
CO4	Identify and analyze appropriate queuing model to reduce the waiting time in queue
CO5	Able to use optimization concepts in real world problems

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-
CO5	2	-	-	-	-	-	-	-
CO (Avg)	2.2	-	-	-	-	-	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>LINEAR PROGRAMMING MODELS</b>	<b>9</b>
Mathematical Formulation - Graphical Solution of linear programming models – Simplex method – Artificial variable Techniques- Variants of Simplex		
<b>UNIT II</b>	<b>TRANSPORTATION AND ASSIGNMENT MODELS</b>	<b>9</b>
Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution - degeneracy – Mathematical formulation of assignment models – Hungarian Algorithm – Variants of the Assignment problem		
<b>UNIT III</b>	<b>INTEGER PROGRAMMING MODELS</b>	<b>9</b>
Formulation – Gomory’s IPP method – Gomory’s mixed integer method – Branch and bound technique.		
<b>UNIT IV</b>	<b>SCHEDULING BY PERT AND CPM</b>	<b>9</b>
Network Construction – Critical Path Method – Project Evaluation and Review Technique – Resource Analysis in Network Scheduling		
<b>UNIT V</b>	<b>QUEUEING MODELS</b>	<b>9</b>
Characteristics of Queuing Models – Poisson Queues - $(M / M / 1) : (FIFO / \infty / \infty)$ , $(M / M / 1) : (FIFO / N / \infty)$ , $(M / M / C) : (FIFO / \infty / \infty)$ , $(M / M / C) : (FIFO / N / \infty)$ models		
<b>Reference (s)</b>		
1	Taha H.A., “Operations Research : An Introduction “ 8 th Edition, Pearson Education, 2008.	
2	A.M.Natarajan, P.Balasubramani, A.Tamilarasi, “Operations Research”, Pearson Education, Asia, 2005.	
3	Prem Kumar Gupta, D.S. Hira, “Operations Research”, S.Chand & Company Ltd, New Delhi, 3rd Edition , 2008.	
4	John W. Chinneck “Feasibility and Infeasibility in Optimization Algorithms and Computational Methods’ Springer, 2008.	
5	Ravindran, Phillips, Solberg, ”Operations Research: Principles And Practice”, 2ND ED, John Wiley & Sons, 01-Jul-2007	
6	Ibe, O.C. “Fundamentals of Applied Probability and Random Processes”, Elsevier, U.P., 1st Indian Reprint, 2007.	
7	Gross, D. and Harris, C.M., “Fundamentals of Queueing Theory”, Wiley Student, 3rd Edition, New Jersey, 2004.	





Regulations		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAE006T	BIO INFORMATICS	3	0	0	3

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	Exposed to the need for Bioinformatics technologies
2	Be familiar with the modeling techniques
3	Learn microarray analysis
4	Exposed to Pattern Matching and Visualization

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Able to Develop models for biological data.
CO2	Apply pattern matching techniques to bioinformatics data – protein data genomic data.
CO3	Apply modeling for bioinformatics.
CO4	Apply pattern matching and visualization
CO5	Apply micro array technology for genomic expression study

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	3	-	-	-	2	-
CO2	3	3	2	-	-	-	2	-
CO3	3	2	2	-	-	-	2	-
CO4	2	2	1	-	-	-	1	-
CO5	2	2	2	-	-	-	-	-
CO (Avg)	2.4	2.2	2	-	-	-	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)







<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Need for Bioinformatics technologies – Overview of Bioinformatics technologies Structural bioinformatics – Data format and processing – Secondary resources and applications – Role of Structural bioinformatics - Biological Data Integration System.		
<b>UNIT II</b>	<b>DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS</b>	<b>9</b>
Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bioinformatics.		
<b>UNIT III</b>	<b>MODELING FOR BIOINFORMATICS</b>	<b>9</b>
Hidden Markov modeling for biological data analysis – Sequence identification – Sequence classification – multiple alignment generation – Comparative modeling –Protein modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks - Molecular modeling – Computer programs for molecular modeling.		
<b>UNIT IV</b>	<b>PATTERN MATCHING AND VISUALIZATION</b>	<b>9</b>
Gene regulation – motif recognition – motif detection – strategies for motif detection – Visualization – Fractal analysis – DNA walk models – one dimension – two dimension – higher dimension – Game representation of Biological sequences – DNA, Protein, Amino acid sequences.		
<b>UNIT V</b>	<b>MICROARRAY ANALYSIS</b>	<b>9</b>
Microarray technology for genome expression study – image analysis for data extraction – preprocessing – segmentation – gridding – spot extraction – normalization, filtering – cluster analysis – gene network analysis – Compared Evaluation of Scientific Data Management Systems – Cost Matrix – Evaluation model - Benchmark – Tradeoffs.		
<b>Reference (s)</b>		
1	Yi-Ping Phoebe Chen (Ed), "Bioinformatics Technologies". First Indian Reprint, Springer Verlag, 2007.	
2	Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education, 2003.	
3	Arthur M Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2005	





Regulations		Semester		Total Hours			45	
Category	Course Code	Course Name	Hours / Week			C		
			L	T	P			
E	18PCAE007T	SOCIAL NETWORK ANALYSIS	3	0	0	3		
<b>Prerequisite Course (s)</b>								
Nil								
<b>Course Objective (s):</b>								
The purpose of learning this course is to:								
1	To understand the components of the social network.							
2	To model and visualize the social network.							
3	To mine the users in the social network.							
4	To understand the evolution of the social network.							
5	To know the applications in real time systems.							
<b>Course Outcome (s) (Cos):</b>								
At the end of this course, learners will be able to:								
CO1	Work on the internals components of the social network							
CO2	Model and visualize the social network							
CO3	Mine the behaviour of the users in the social network							
CO4	Predict the possible next outcome of the social network							
CO5	Apply social network in real time applications							
<b>CO-PO Mapping</b>								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	-	-	-	-	-	-	-
CO2	2	2	1	-	-	2	2	-
CO3	2	2	1	2	-	-	2	-
CO4	2	2	1	-	-	-	-	-
CO5	2	2	2	-	2	-	-	-
CO (Avg)	2	1.2	1.25	1.4	2	2	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





UNIT I	INTRODUCTION	9
Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.		
UNIT II	MODELING AND VISUALIZATION	9
Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix- Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.		
UNIT III	MINING COMMUNITIES	9
Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.		
UNIT IV	EVOLUTION	9
Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models.		
UNIT V	APPLICATIONS	9
A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection		
<b>Reference (s)</b>		
1	Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, —Computational Social Network Analysis: Trends, Tools and Research Advances, Springer, 2012	
2	Borko Furht, —Handbook of Social Network Technologies and Applications, Springer, 1 st edition, 2011	
3	Charu C. Aggarwal, —Social Network Data Analytics, Springer, 2014	
4	Giles, Mark Smith, John Yen, —Advances in Social Network Mining and Analysis, Springer, 2010.	
5	Guandong Xu , Yanchun Zhang and Lin Li, —Web Mining and Social Networking Techniques and applications, Springer, 1st edition, 2012	
6	Peter Mika, —Social Networks and the Semantic Web, Springer, 1st edition, 2010	





Regulations		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18PCAE008T	PRINCIPLES OF COMPILER DESIGN	3	0	0	3

**Prerequisite Course (s)**

Nil

**Course Objective (s):**

The purpose of learning this course is to:

1	To make the students to understand the principals involved in compiler design
2	To understand the design of a simple compiler.
3	To Apply the implementation of a compiler.

**Course Outcome (s) (Cos):**

At the end of this course, learners will be able to:

CO1	Able to describe the design of a compiler and the phases of program translation from source code.
CO2	Able to Apply the source code to executable code and the files produced by these phases
CO3	Able to explain lexical analysis phase and its underlying formal models such as finite automata and their connection to language definition through regular expressions
CO4	Able to design the grammars and also explain syntax analysis phase and identify the similarities and differences among various parsing techniques
CO5	Able to use formal attributed grammars for specifying the syntax and semantics of programming languages and able to identify the effectiveness of optimization.

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	-	-	-	-	2	-	-
CO2	2	2	3	-	1	-	2	-
CO3	2	-	-	-	-	2	-	-
CO4	2	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-
CO (Avg)	2	2	3	-	1	2	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





<b>UNIT I</b>	<b>INTRODUCTION TO COMPILERS</b>	<b>7</b>
Compilers - Analysis - Synthesis model of compilation - Analysis of the source program - The phases of a compiler - Cousins of the compiler - Compiler construction tools - Error handling.		
<b>UNIT II</b>	<b>LEXICAL ANALYZER</b>	<b>10</b>
Lexical analysis - Role of lexical analyzer - Tokens, Patterns and lexemes - Input buffering - Specification of tokens - Regular expressions - Recognition of tokens - Transition diagrams - Implementing a transition diagram - Finite Automata - Regular expression to NFA - Conversion of NFA to DFA - Applications of finite automata for recognizing tokens.		
<b>UNIT III</b>	<b>SYNTAX ANALYZER</b>	<b>10</b>
Syntax analysis - Role of parser - Context-free grammars - Derivations - Writing a grammar - Top Down parsing - Recursive descent parsing - Predictive parsers - Non-recursive predictive parsers - Construction of predictive parsing tables - Bottom up parsing - Handles - Shift reduce parser - Operator-precedence parsing. LR parsers - Canonical collection of LR (0) items - Constructing SLR parsing tables.		
<b>UNIT IV</b>	<b>INTERMEDIATE CODE GENERATION</b>	<b>10</b>
Syntax directed translation - Syntax directed definitions - Synthesized attributes - Inherited attributes - Intermediate code generation - Intermediate language - Construction of syntax trees - DAG - Bottom-Up evaluation of S attributed definitions - Implementations - Assignment statements - Boolean expressions - Back patching.		
<b>UNIT V</b>	<b>CODE OPTIMIZATION &amp; CODE GENERATION</b>	<b>8</b>
Principle sources of optimization - Optimization of basic blocks - Loops in flow graphs - Introduction to global data flow analysis. Issues in design of code generator - Target machine - Time storage management - Basic blocks and flow graphs - Code generation algorithm - DAG representation - Peephole optimization.		
<b>Reference (s)</b>		
1	Alfred V. Aho, Ravi Sethi and Jeffrey D Ullman, "Compilers, Principles, Techniques and Tools", Addison Wesley Longman (Singapore Pvt. Ltd.), 2011.	
2	Alfred V. Aho, Jeffrey D Ullman, "Principles of Compiler Design", Addison Wesley, 1988.	
3	Jean Paul Tremblay, Paul G Sorenson, "The Theory & Practice of Compiler Writing", International student edition, 1985.	
4	David Gries, "Compiler Construction for Digital Computers", Wiley International Edition, 1971	
5	William A Barrett, Rodney M Bates, David A Gustafson, John D Couch, "Compiler Construction, Theory & Practice", Galgotia publications Pvt. Ltd., New Delhi, 2nd edition, 1986.	
6	David Galles, "Modern Compiler Design", Pearson Education, 2008	
7	Steven S. Muchnick, "Advanced Compiler Design & Implementation", Morgan Kaufmann Publishers, 2000.	
8	Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", Pearson Education, 2008	





Regulations		Semester	Total Hours			45		
Category	Course Code	Course Name	Hours / Week			C		
			L	T	P			
E	18PCAE009T	MACHINE LEARNING TECHNIQUES	3	0	0	3		
<b>Prerequisite Course (s)</b>								
Nil								
<b>Course Objective (s):</b>								
The purpose of learning this course is to:								
1	To introduce the basic concepts and techniques of Machine Learning.							
2	To have a thorough understanding of the Supervised and Unsupervised learning techniques							
3	To study the various probability based learning techniques							
4	To understand graphical models of machine learning algorithms							
<b>Course Outcome (s) (Cos):</b>								
At the end of this course, learners will be able to:								
CO1	Able to Distinguish between, supervised, unsupervised and semi-supervised learning							
CO2	Apply the appropriate machine learning strategy for any given problem							
CO3	Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem							
CO4	Design systems that uses the appropriate graph models of machine learning							
CO5	Modify existing machine learning algorithms to improve classification efficiency							
<b>CO-PO Mapping</b>								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	-	-	-	-	-
CO2	2	2	2	-	-	-	2	-
CO3	2	2	2	-	-	-	-	-
CO4	2	3	2	-	-	-	2	-
CO5	2	2	2	-	-	-	-	-
CO (Avg)	2	2.2	2	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





UNIT I	INTRODUCTION	9
Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.		
UNIT II	LINEAR MODELS	9
Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back- Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.		
UNIT III	TREE AND PROBABILISTIC MODELS	9
Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map		
UNIT IV	DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS	9
Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process		
UNIT V	GRAPHICAL MODELS	9
Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods		
Reference (s)		
1	Ethem Alpaydin, —Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014	
2	Jason Bell. —Machine learning – Hands on for Developers and Technical Professionals, First Edition, Wiley, 2014	
3	Peter Flach, —Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.	
4	Stephen Marsland, —Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014	
5	Tom M Mitchell, —Machine Learning, First Edition, McGraw Hill Education, 2013.	





Regulations 2018		Semester I	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18PCAE010T	AGILE METHODOLOGY FOR SOFTWARE DEVELOPMENT (Industry Recommended Course)	3	0	0	3

**Prerequisite Course (s)**

Software Engineering

**Course Objective (s):**

The purpose of learning this course is to:

1	To learn about the basic concepts of Agile Software Process
2	To gain knowledge in the area of various Agile Methodologies
3	To know the principles of Agile Testing
4	To develop Agile Software Process
5	To understand the Industrial trends of Agile Technologies for Project Development

**Course Outcome (s) (Cos):** At the end of this course, learners will be able to:

CO1	Understand the background and driving forces for taking an Agile approach to software development
CO2	Understand the business value of adopting Agile approaches
CO3	Understand the Agile development practices and Drive development with unit tests using Test Driven Development
CO4	Apply design principles and refactoring to achieve Agility, Deploy automated build tools, version control and continuous integration
CO5	Perform testing activities within an Agile project

**CO-PO Mapping**

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	-	-	-	-	-		
CO2	2	-	-	-	2	-		
CO3	2	2	2	-	-	-		
CO4	2	3	2	3	3	-		
CO5	2	2	2	2	-	-		
CO (Avg)	2	2.3	2	2.5	2.5	-	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)







UNIT I	Fundamentals of Agile	9
<p>The Genesis of Agile, Introduction and background, Agile Manifesto and Principles. Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools</p>		
UNIT II	Agile Scrum Framework	9
<p>Introduction to Scrum, Project phases, Agile Estimation, Planning game. Product backlog. Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management</p>		
UNIT III	Agile Testing	8
<p>The Agile life cycle and its impact on testing, Test-Driven Development (TDD), x Unit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester</p>		
UNIT IV	Agile Software Design and Development	10
<p>Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control</p>		
UNIT V	Industry Trends	9
<p>Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies</p>		
<b>Reference (s)</b>		
1	Agile Software Development with Scrum By Ken Schwaber, Mike Beedle Publisher: Pearson	
2	Agile Testing: A Practical Guide for Testers and Agile Teams By Lisa Crispin, Janet Gregory Publisher: Addison Wesley Agile Software Development, Principles, Patterns and Practices By Robert C. Martin Publisher: Addison Wesley Hall	
3	Agile Software Development. Principles, Patterns and Practices By Robert C. Martin Publisher: Addison Wesley Agile Software Development: The Cooperative Game By Alistair Cock burn Publisher: Addison Wesley User Stories Applied: For Agile Software By Mike Cohn Publisher: Addison Wesley	





Regulations		Semester		Total Hours			45	
Category	Course Code	Course Name	Hours / Week			C		
			L	T	P			
E	18PCAE011T	<b>CLOUD COMPUTING</b>	3	0	0	3		
<b>Prerequisite Course (s)</b>								
Nil								
<b>Course Objective (s):</b>								
The purpose of learning this course is to:								
1	To introduce the broad perceptive of cloud architecture and model							
2	To understand the concept of Virtualization and design of cloud Services							
3	To understand the features of cloud simulator							
4	To apply different cloud programming model as per need.							
5	To learn to design the trusted cloud Computing system							
<b>Course Outcome (s) (Cos):</b>								
At the end of this course, learners will be able to:								
CO1	Compare the strengths and limitations of cloud computing							
CO2	Identify the architecture, infrastructure and delivery models of cloud computing							
CO3	Apply suitable virtualization concept.							
CO4	Choose the appropriate cloud player, Programming Models and approach.							
CO5	Address the core issues of cloud computing such as security, privacy and interoperability.							
<b>CO-PO Mapping</b>								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	-	2	-	2	-
CO2	2	2	1	-	1	-	2	-
CO3	2	2	2	-	1	-	2	-
CO4	2	1	1	-	1	-	1	-
CO5	2	2	2	-	2	-	2	-
CO (Avg)	2	1.8	1.6	-	1.4	-	1.8	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





UNIT I	CLOUD ARCHITECTURE AND MODEL	9
Technologies for Network-Based System – System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture. Cloud Models:- Characteristics– Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Public vs Private Cloud –Cloud Solutions - Cloud ecosystem – Service management – Computing on demand.		
UNIT II	VIRTUALIZATION	9
Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation		
UNIT III	CLOUD INFRASTRUCTURE AND IoT	9
Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources-Enabling Technologies for the Internet of Things – Innovative Applications of the Internet of Things		
UNIT IV	PROGRAMMING MODEL	9
Parallel and Distributed Programming Paradigms – MapReduce, Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack, Aneka, CloudSim.		
UNIT V	SECURITY IN THE CLOUD	9
Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Security Monitoring – Security Architecture Design – DataSecurity – Application Security – Virtual Machine Security - Identity Management and Access Control – Autonomic Security.		
<b>Reference (s)</b>		
1	George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in theCloud” O’Reilly	
2	GautamShroff,Enterprise Cloud Computing,Cambridge University Press,2011	
3	James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005	
4	John W.Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010	
5	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From ParallelProcessing to the Internet of Things”, Morgan Kaufmann Publishers, 2012	
6	Kumar Saurabh, “Cloud Computing – insights into New-Era Infrastructure”, Wiley India,2011	
7	Katarina Stanoevska-Slabeva, Thomas Wozniak, Santi Ristol, “Cloud Computing and Cloud Computing – A Business Perspective on Technology and Applications”, Springer	
8	Michael Miller, Cloud Computing,Que Publishing,2008	
9	Nick Antonopoulos, Cloud computing,Springer Publications,2010	
10	Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing, A Practical Approach”, TMH, 2009	





Regulations		Semester	Total Hours			45		
Category	Course Code	Course Name	Hours / Week			C		
			L	T	P			
E	18PCAE012T	HUMAN AND COMPUTER INTERACTION	3	0	0	3		
<b>Prerequisite Course (s)</b>								
Nil								
<b>Course Objective (s):</b>								
The purpose of learning this course is to:								
1	This course is intended to familiarize students with basic concepts of how human perceives and interacts with computers, focuses on psychological and physiological aspects of interface design, graphical user interface design.							
<b>Course Outcome (s) (Cos):</b>								
At the end of this course, learners will be able to:								
CO1	Interpret the contributions of human factors and technical constraints on Human-Computer interaction							
CO2	Apply Human-computer Interaction techniques and methods to the design of software							
CO3	Practice in developing Human-Computer Interfaces with respect to usability							
<b>CO-PO Mapping</b>								
	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	-	-	-	2	-	-
CO2	2	2	1	1	-	-	2	-
CO3	2	1	2	-	-	-	1	-
CO (Avg)	1.2	1.6	1	0.6	-	2	1.5	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)





<b>UNIT I</b>	<b>FOUNDATIONS</b>	<b>9</b>
Introduction-human memory-thinking reasoning and problem solving-text entry devices-display devices controls, sensors and special devices.		
<b>UNIT II</b>	<b>MODELS OF INTERACTION</b>	<b>9</b>
Ergonomics-interaction styles-context of interaction-paradigms for interaction-design. golden rule of design user focus-navigation design.		
<b>UNIT III</b>	<b>SCREEN DESIGN AND LAYOUT</b>	<b>9</b>
Usability engineering-principles to support usability-guidelines-golden rules and heuristics-universal design principles-multi-model interaction-design for diversity.		
<b>UNIT IV</b>	<b>SOCIO FACTOR</b>	<b>9</b>
Organizational issues and stakeholders requirements-capturing requirements-task decomposition. knowledge-based analysis-entity-relationship based techniques.		
<b>UNIT V</b>	<b>DIALOG NOTATIONS AND DESIGN</b>	<b>9</b>
Dialog-dialog design notations-diagrammatic notations-textual dialog notations-dialog semantics-dialog analysis and design.		
<b>Reference (s)</b>		
1	Human Computer Interaction, Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, Pearson Education, 3rd Edition, 2004.	





Regulations		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18PCAE013T	BLOCKCHAIN TECHNOLOGY	3	0	0	3
<b>Prerequisite Course (s)</b>						
Nil						
<b>Course Objective (s):</b>						
The purpose of learning this course is to:						
1	To Introduce block chain technology and Cryptocurrency					
2	To understand a technologies borrowed in blockchain technology					
3	To study about block chain models					
4	To understand a reality of blockchain technology					
<b>Course Outcome (s) (Cos):</b>						
At the end of this course, learners will be able to:						
CO1	Define and Explain the fundamentals of Blockchain					
CO2	Illustrate the technologies of blockchain					
CO3	Decribe the models of blockchain					
CO4	Analyze and demonstrate the Ethereum					
CO5	Analyze and demonstrate Hyperledger fabric					

CO-PO Mapping								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	-	-	-	-	2	-	-
CO2	2	2	3	-	-	2	-	-
CO3	2	2	-	-	-	2	-	-
CO4	2	2	-	-	-	2	-	-
CO5	2	2	-	-	-	2	-	-
CO (Avg)	2	2	3	-	-	2	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Basic Cryptographic primitives used in Blockchain – Secure, Collision-resistant hash functions, digital signature, public key cryptosystems, zero-knowledge proof systems. Need for Distributed Record Keeping, Modelling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Why Nakamoto Came up with Blockchain based cryptocurrency?		
<b>UNIT II</b>	<b>TECHNOLOGIES BORROWED IN BLOCKCHAIN</b>	<b>9</b>
Hash pointers, Consensus, Byzantine Models of fault tolerance, digital cash etc. Bitcoin blockchain - Wallet - Blocks - Merkle Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin. Bitcoin, the challenges, and solutions		
<b>UNIT III</b>	<b>MODELS FOR BLOCKCHAIN</b>	<b>9</b>
Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models ( PoW + PoS). Bitcoin scripting language and their use		
<b>UNIT IV</b>	<b>ETHEREUM VIRTUAL MACHINE (EVM)</b>	<b>9</b>
Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts. Some attacks on smart contracts		
<b>UNIT V</b>	<b>REALITY OF BLOCKCHAIN TECHNOLOGY</b>	<b>9</b>
Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain. Beyond Cryptocurrency – applications of blockchain in cyber security, integrity of information, E-Governance and other contract enforcement mechanisms. Limitations of blockchain as a technology, and myths vs. reality of blockchain technology		
<b>Reference (s)</b>		
1	S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, "Blockchain Technology: Cryptocurrency and Applications" Oxford University Press, 2019	
2	Arvind Narayanan et. Al., "Bitcoin and cryptocurrency technologies: a comprehensive introduction", Princeton University Press, 2016	
3	J.A.Garay et al, "The bitcoin backbone protocol - analysis and applications", EUROCRYPT LNCS VOL 9057, ( VOLII ), pp 281-310, 2015	
4	R.Pass et al, " Analysis of Blockchain protocol in Asynchronous networks", EUROCRYPT, 2017	
5	R.Pass et al, " Fruitchain, a fair blockchain", PODC, 2017	





Regulations		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18PCAE014T	CYBER FORENSICS	3	0	0	3
<b>Prerequisite Course (s)</b>						
Nil						
<b>Course Objective (s):</b>						
The purpose of learning this course is to:						
1	To learn computer forensics					
2	To become familiar with forensics tools					
3	To learn to analyze and validate forensics data To learn to analyze and validate forensics data					
<b>Course Outcome (s) (Cos):</b>						
At the end of this course, learners will be able to:						
CO1	Understand the basics of computer forensics					
CO2	Apply a number of different computer forensic tools to a given scenario					
CO3	Analyze and validate forensics data					
CO4	Identify the vulnerabilities in a given network infrastructure					
CO5	Implement real-world hacking techniques to test system security					

CO-PO Mapping								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	-
CO2	2	-	2	-	-	-	-	-
CO3	2	-	2	-	-	-	-	-
CO4	2	-	2	-	-	-	-	-
CO5	2	2	2	2	-	-	2	-
CO (Avg)	2.2	2	2	2	-	-	2	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)







UNIT I	INTRODUCTION TO COMPUTER FORENSICS	9
Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques – Incident and incident response methodology – Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. – Forensics Technology and Systems – Understanding Computer Investigation – Data Acquisition.		
UNIT II	EVIDENCE COLLECTION AND FORENSICS TOOLS	9
Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.		
UNIT III	ANALYSIS AND VALIDATION	9
Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics		
UNIT IV	ETHICAL HACKING	9
Introduction to Ethical Hacking – Footprinting and Reconnaissance – Scanning Networks – Enumeration – System Hacking – Malware Threats – Sniffing		
UNIT V	ETHICAL HACKING IN WEB	9
Social Engineering – Denial of Service – Session Hijacking – Hacking Web servers – Hacking Web Applications – SQL Injection – Hacking Wireless Networks – Hacking Mobile Platforms.		
<b>Reference (s)</b>		
1	Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, —Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.	
2	CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015	
3	John R.Vacca, —Computer Forensics, Cengage Learning, 2005	
4	MarjieT.Britz, —Computer Forensics and Cyber Crime: An Introduction. 3rd Edition. Prentice Hall, 2013.	
5	AnkitFadia — Ethical Hacking Second Edition, Macmillan India Ltd, 2006	
6	Kenneth C.Brancik —Insider Computer Fraud Auerbach Publications Taylor & Francis Group–2008.	





Regulations		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18PCAE015T	<b>BUSINESS INTELLIGENCE</b>	3	0	0	3
<b>Prerequisite Course (s)</b>						
Nil						
<b>Course Objective (s):</b>						
The purpose of learning this course is to:						
1	To introduce the business concepts					
2	To understand the concept of intelligent techniques and stages					
3	To understand the project planning and requirements					
4	To develop the business intelligence projects and to make timely and better decisions.					
5	To evaluate ETL tools					
<b>Course Outcome (s) (Cos):</b>						
At the end of this course, learners will be able to:						
CO1	Able to apply Business Intelligence methods and techniques					
CO2	Able to identify the techniques in addressing strategic business problems in organizations					
CO3	Able to make better decisions by conducting in-depth analysis to both technical and business problems.					
CO4	Analyze legal and ethical principles applied to contexts and environments of data science and decision making					
CO5	Able to Analyze the relationship between price and cost as determinants of supply and demand.					

CO-PO Mapping								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	-	-	-	1	2
CO2	2	3	2	-	2	2	2	1
CO3	2	2	-	-	2	2	2	2
CO4	2	2	2	1	1	-	1	2
CO5	2	2	-	-	-	-	-	-
CO (Avg)	2	2.2	2	1	1.6	2	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





UNIT I	BASICS OF BUSINESS INTELLIGENCE	10
Business intelligence: Definition - Effective and timely decisions - data, information and knowledge – role of mathematical models - BI architectures. Decision Support Systems: Definition - Representation of the decision-making process - Evolution of information systems - - development of DSS. Mathematical models for decision making: Structure - development of a model - classes of models.		
UNIT II	BUSINESS INTELLIGENCE STAGES AND STEPS	9
BI definition - BI decision support initiatives - development approaches - engineering stages and the development steps - parallel development tracks - BI project team structure. Business Case Assessment: justification-drivers-Business Analysis issues - Risk assessment - activities -Deliverables - roles.		
UNIT III	BI PROJECT PLANNING AND REQUIREMENTS DEFINITION	8
BI project : managing - defining - planning - activities - deliverables - roles. Project Requirements Definition:General and specific requirements - activities - deliverables - roles.		
UNIT IV	DATA ANALYSIS AND APPLICATION PROTOTYPING	9
Data Analysis : Business focused data analysis - top-down logical data modeling - bottom up source data analysis - data cleansing - activities - deliverables-roles. Prototyping : Purpose - best practices - types - building successful prototypes - application prototyping activities - deliverables - roles.		
UNIT V	DATABASE DESIGN AND ETL DESIGN	9
Differences in database design - logical and physical database design - activities - deliverables - roles.ETL Design: Implementation strategies - Preparing for ETL process - Designing the extract programs,transformation programs, load programs, ETL process flow - Evaluating ETL tools - activities – deliverables - roles.		
Reference (s)		
1	Carlo Vercellis, "Business Intelligence: Data mining and Optimization for Decision Making", JohnWiley and Sons, 2009.	
2	Larissa T.Moss and Shaku Atre, "Business Intelligence Roadmap: The Complete project lifecycle for decision support applicatons", Addison Wesley, 2003.	
3	Efraim Turban, Ramesh Sharda, Dursun Delen and Janine E. Aronson, "Business Intelligence - AManagerial Approach", Second Edition, Pearson Prentice Hall, 2010.	





Regulations		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18PCAE016T	<b>DISTRIBUTED SYSTEMS</b>	3	0	0	3
<b>Prerequisite Course (s)</b>						
Nil						
<b>Course Objective (s):</b>						
The purpose of learning this course is to:						
1	To introduce the concept of distributed system architecture					
2	To understand the concept of resource management					
3	To understand the various fault tolerant techniques					
4	To apply different cloud programming model as per need.					
5	To learn to design the trusted cloud Computing system					
<b>Course Outcome (s) (Cos):</b>						
At the end of this course, learners will be able to:						
CO1	Able to Define and Explain the fundamentals of distributed system					
CO2	Able to Understand the technologies of distributed system					
CO3	Able to Articulate advantages and disadvantages of various models for a distributed system.					
CO4	Able to Analyze various distributed operating system characteristics					
CO5	Able to Identify appropriate complexity measures and analyze solutions to Fault tolerance in distributed environment					

CO-PO Mapping								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-
CO5	2	-	-	-	-	-	-	-
CO (Avg)	2.2	-	-	-	-	-	-	-

1: Slight (Low)

2: Moderate (Medium)





<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>7</b>
Characterization of Distributed Systems : Example of Distributed Systems,Resource Sharing and Web,Challenges-System Models:Architectural Models and Functional Models-Distributed Objects and Remote Invocation : Communication between Distributed Objects,RPC,Events and Notifications.		
<b>UNIT II</b>	<b>OPERATING SYSTEM SUPPORT</b>	<b>8</b>
Introduction-Operating System Layer-Protection-Process and Threads-Communication and Invocation-OS Architecture. Introduction-File Service Architecture-Sun Network File System.		
<b>UNIT III</b>	<b>NAME SERVICES</b>	<b>12</b>
Name Services and DNS-Directory and Discovery Services-Global Name Service-X.500 Directory Service. Clocks, Events and Process States-Synchronization-Logical time and Logical Clocks-Global States.Distributed Mutual Exclusion-Elections-Multicast Communication.		
<b>UNIT IV</b>	<b>DISTRIBUTED TRANSACTION MANAGEMENT</b>	<b>12</b>
Transaction and Concurrency Control: Transactions, Nested Transactions, Locks, Optimistic Concurrency Control, Time Stamp Ordering, Comparison of Methods for Concurrency Control-Distributed Transaction :Flat and Nested, Atomic Commit Protocols, Concurrency Control, Distributed Deadlock, Transaction Recovery-Replication: System model and Group Communication, Fault Tolerant Services, Highly Available Services, Transactions with Replicated Data.		
<b>UNIT V</b>	<b>DISTRIBUTED SHARED MEMORY</b>	<b>6</b>
Design and Implementation Issues, Sequential and Release Consistency-Other Consistency Models		
<b>Reference (s)</b>		
1	George Colouris, Jean Dollimore and Tim KindBery, "Distributed Systems,Concepts and Design",Pearson Education 2004.	
2	Andrew S Tanenbaum, Maarten Van Steen, "Distributed Systems, Principles and Paradigms",Pearson Asia 2004.	
3	Sloman M Kramer J, "Distributed System and Computer Networks", Prentice Hall of India, 1990.	

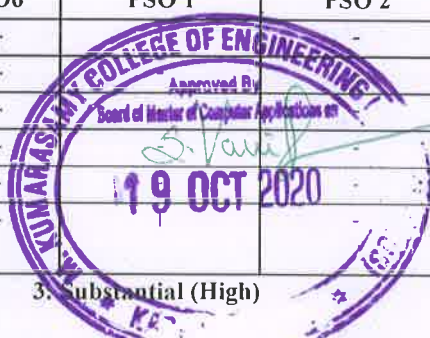




Regulations 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18PCAE017T	ADVANCED DATABASES	3	0	0	3
<b>Prerequisite Course (s)</b>						
Nil						
<b>Course Objective (s):</b>						
The purpose of learning this course is to:						
1	To know about the different databases					
2	To understand the fundamentals of database technology					
3	To understand a way to store and retrieve Database information conveniently and efficiently					
4	To have an introductory knowledge about the emerging trends in the area of distributed DB, XML, Mobile, Multimedia databases					
<b>Course Outcome (s) (Cos):</b>						
At the end of this course, learners will be able to:						
CO1	Ability to Design of database for any given problem					
CO2	Ability to understand the practical problems of Concurrency control and its solutions					
CO3	Apply query evaluation techniques and query optimization techniques.					
CO4	Develop transaction processing systems with concurrency control.					
CO5	Design and develop a database application system as part of a team.					

CO-PO Mapping								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-
CO (Avg)	2	2	1	-	-	-	-	-

1: Slight (Low)                      2: Moderate (Medium)                      3: Substantial (High)





UNIT I	PARALLEL AND DISTRIBUTED DATABASES	9
Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Three Tier Client Server Architecture- Case Studies.		
UNIT II	OBJECT AND OBJECT RELATIONAL DATABASES	9
Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational feature sin SQL/Oracle –Case Studies.		
UNIT III	XML DATABASES	9
XML Databases: XML Data Model – DTD - XML Schema - XML Querying – Web Databases – JDBC – Information Retrieval – Data Warehousing – Data Mining		
UNIT IV	MOBILE DATABASES	9
Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols- Mobile Database Recovery Schemes		
UNIT V	MULTIMEDIA DATABASES	9
Multidimensional Data Structures – Image Databases – Text/Document Databases- Video Databases – Audio Databases – Multimedia Database Design.		
Reference (s)		
1	R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education/Addison Wesley, 2007	
2	Thomas Cannolly and Carolyn Begg, “ Database Systems, A Practical Approach to Design, Implementation and Management”. Third Edition. Pearson Education. 2007	
3	Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Fifth Edition, McGraw Hill, 2006	
4	V.S.Subramanian, “Principles of Multimedia Database Systems”, Harcourt India Pvt Ltd., 2001.	
5	Vijay Kumar, “ Mobile Database Systems”, John Wiley & Sons, 2006.	





Regulations		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18PCAE0181	<b>OPTIMIZATION TECHNIQUES</b>	3	0	0	3
<b>Prerequisite Course (s)</b>						
Nil						
<b>Course Objective (s):</b>						
The purpose of learning this course is to:						
1	To understand different forms of intermediate languages and analyzing programs					
2	To understand optimizations techniques for single program blocks					
3	To apply optimizations on procedures and low level code					
4	To explore and enhance inter procedural optimizations					
5	To enhance resource utilization					
<b>Course Outcome (s) (Cos):</b>						
At the end of this course, learners will be able to:						
CO1	Identify the different optimization techniques that are possible for a sequence of code					
CO2	Design performance enhancing optimization techniques					
CO3	Manage procedures with optimal overheads					
CO4	Ensure better utilization of resources					
CO5	Use classical optimization techniques and numerical methods of optimization.					

CO-PO Mapping								
COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	2	-
CO3	2	1	-	1	-	-	2	-
CO4	2	-	2	-	-	-	2	-
CO5	2	-	2	-	-	-	-	-
CO (Avg)	2	1	2	1	-	-	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)







<b>UNIT I</b>	<b>INTERMEDIATE REPRESENTATION OF PROGRAMS AND ANALYSIS</b>	<b>9</b>
Structure of an Optimizing Compiler – Compiler Construction tools - LIR, MIR, HIR – DAG – Syntax Tree – Postfix – Control Flow Analysis – Iterative Data Flow Analysis – Static Single Assignment – Basic Block Dependence DAGs – Alias Analysis.		
<b>UNIT II</b>	<b>LOCAL AND LOOP OPTIMIZATIONS</b>	<b>9</b>
Early Optimizations: Constant-Expression Evaluation - Scalar Replacement of Aggregates - Algebraic Simplifications and Re-association - Value Numbering - Copy Propagation - Sparse Conditional Constant Propagation. Redundancy Elimination: Common - Subexpression Elimination - Loop-Invariant Code Motion - Partial-Redundancy Elimination - Redundancy Elimination and Reassociation - Code Hoisting. Loop Optimizations: Induction Variable Optimizations - Unnecessary Bounds Checking Elimination.		
<b>UNIT III</b>	<b>PROCEDURE OPTIMIZATION AND SCHEDULING</b>	<b>9</b>
Procedure Optimizations: Tail Call Optimization and Tail-Recursion Elimination - Procedure Integration - In-Line Expansion - Leaf-Routine Optimization and Shrink Wrapping. Code Scheduling: Instruction Scheduling - Speculative Loads and Boosting - Speculative Scheduling - Software Pipelining - Trace Scheduling - Percolation Scheduling. Control-Flow and Low-Level Optimizations : Unreachable-Code Elimination - Straightening - If Simplifications - Loop Simplifications -Loop Inversion – Un-switching - Branch Optimizations - Tail Merging or Cross Jumping - Conditional Moves - Dead-Code Elimination - Branch Prediction - Machine Idioms and Instruction Combining.		
<b>UNIT IV</b>	<b>INTER PROCEDURAL OPTIMIZATION</b>	<b>9</b>
Symbol table – Runtime Support - Interprocedural Analysis and Optimization: Interprocedural ControlFlow Analysis - The Call Graph - Interprocedural Data-Flow Analysis - Interprocedural Constant Propagation - Interprocedural Alias Analysis - Interprocedural Optimizations - Interprocedural Register Allocation - Aggregation of Global References.		
<b>UNIT V</b>	<b>OPTIMIZING FOR MEMORY</b>	<b>9</b>
Register Allocation: Register Allocation and Assignment - Local Methods - Graph Coloring – Priority Based Graph Coloring - Other Approaches to Register Allocation. Optimization for the Memory Hierarchy: Impact of Data and Instruction Caches - Instruction-Cache Optimization - Scalar Replacement of Array Elements - Data-Cache Optimization – Scalar vs. Memory-Oriented Optimizations.		
<b>Reference (s)</b>		
1	Steven Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufman Publishers	
2	Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques, and Tools" Addison Wesley, Second Edition, 2007.	
3	Andrew W. Appel, Jens Palsberg, "Modern Compiler Implementation in Java", Cambridge University Press, Second Edition, 2007.	
4	Keith Cooper, Linda Torczon, "Engineering a Compiler", Morgan Kaufmann, Second Edition	
5	Randy Allen and Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence Based Approach", Morgan Kaufman, 2002.	

