Holy Cross College (Autonomous), Nagercoil

Kanyakumari District, Tamil Nadu.
Accredited with A+ by NAAC - IV cycle – CGPA 3.35

Affiliated to
Manonmaniam Sundaranar University, Tirunelveli

Semester I - IV
Guidelines & Syllabus

DEPARTMENT OF COMPUTER SCIENCE

2023-2026
(With effect from the academic year 2024-2025)

Issued from
THE DEANS' OFFICE

Vision

To provide a high-quality postgraduate education in computer science that prepares students for productive careers and lifelong learning.

Mission

1. To demonstrate proficiency in problem-solving techniques using the computer.
2. To demonstrate proficiency in at least two high-level programming languages and two operating systems
3. To show the ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
4. To show the ability to function effectively on teams to accomplish a common goal.
5. To sensitize the students to the social realities around them with the vision of making them responsible citizen.

Graduate Attributes

Graduates of our College develop the following attributes during the course of their studies.

- **Creative thinking:**
  Equipping students with hands-on-training through skil based courses and promote startup.
- **Personality development:**
  Coping with increasing pace and change of modern life through value education, awareness on human rights, gender issues and giving counselling for the needful.
- **Environmental consciousness and social understanding:**
  Reflecting upon green initiatives and understanding the responsibility to contribute to the society; promoting social and cultural diversity through student training and service learning programmes.
- **Communicative competence:**
  Offering effective communication skills in both professional and social contexts through bridge courses and activities of clubs and committees.
- **Aesthetic skills:**
  Engaging mind, body and emotions for transformation through fine arts, meditation and exercise; enriching skills through certificate courses offered by Holy Cross Academy.
- **Research and knowledge enrichment:**
  Getting in-depth knowledge in the specific area of study through relevant core papers; ability to create new understanding through the process of critical analysis and problem solving.
- **Professional ethics:**
  Valuing honesty, fairness, respect, compassion and professional ethics among students. The students of social work adhere to the *National Association of Social Workers Code of Ethics*
- **Student engagement in the learning process:**
  Obtaining extensive and varied opportunities to utilize and build upon the theoretical and empirical knowledge gained through workshops, seminars, conferences, industrial visits and summer internship programmes.
- **Employability:**
  Enhancing students in their professional life through Entrepreneur development, Placement & Career guidance Cell.
- **Women empowerment and leadership:**
  Developing the capacity of self-management, team work, leadership and decision making through gender sensitization programmes.

Programme Educational Objectives (PEOs)

PEO	Upon completion of M.Sc Computer Science Degree Programme, the graduates will be able to:	Mapping with Mission
PEO1	apply scientific and computational technology to solve socio ecological issues and pursue research.	**M1, M2**
PEO2	continue to learn and advance their career in industry both in private and public sectors	**M4 & M5**
PEO3	develop leadership, teamwork, and professional abilities to become a more cultured and civilized person and to tackle the challenges in serving the country.	**M2, M5 & M6**

Programme Outcomes (POs)

POs	Upon completion of M.Sc. Degree Programme, the graduates will be able to:	Mapping with PEOs
PO1	apply their knowledge, analyze complex problems, think independently, formulate and perform quality research.	**PEO1 & PEO2**
PO2	carry out internship programmes and research projects to develop scientific and innovative ideas through effective communication.	**PEO1, PEO2 & PEO3**
PO3	develop a multidisciplinary perspective and contribute to the knowledge capital of the globe.	**PEO 2**
PO4	develop innovative initiatives to sustain ecofriendly environment	**PEO1, PEO 2**
PO5	through active career, team work and using managerial skills guide people to the right destination in a smooth and efficient way.	**PEO 2**
PO6	employ appropriate analysis tools and ICT in a range of learning scenarios, demonstrating the capacity to find, assess, and apply relevant information sources.	**PEO1, PEO 2 & PEO3**
PO7	learn independently for lifelong to execute professional, social and ethical responsibilities promoting sustainable development.	**PEO3**

Programme Specific Outcomes (PSOs)

PSOs	Upon completion of M.Sc. Degree Programme, the graduates will be able to:	Mapping with POs
PSO1	apply profound knowledge to analyze and design software and systems containing hardware and software components of varying complexity.	**PO1**
PSO2	apply mathematical model, algorithmic principles, and	**PO2**

	computer science theory in the design of real-time applications	
PSO3	apply knowledge of computing to produce effective designs and solutions for specific problems.	**PO4 & PO7**
PSO4	identify, analyze, design, optimize and implement system solutions using appropriate algorithms of varying complexity.	**PO5 & PO 6**
PSO5	work in multidisciplinary teams in small- and large-scale projects by utilizing modern software tools and emerging technologies to develop complex products for the societal needs.	**PO3**

Mapping of PO'S and PSO'S

POs	**PSO1**	**PSO 2**	**PSO3**	**PSO4**	**PSO5**
PO1	S	S	M	S	S
PO2	S	M	S	S	S
PO3	S	M	M	S	M
PO4	S	S	M	S	S
PO5	S	S	S	M	S
PO6	M	S	S	M	S
PO7	S	S	M	S	S

1. Eligibility

(i) **For Admission:** A pass in B.Sc Computer Science as per the norms of Manonmaniam Sundaranar University, Tirunelveli

Passing Minimum

Minimum pass mark in each course is 50.

ii)Degree

The candidates shall have subsequently undergone the prescribed Programme of study in Holy Cross College (Autonomous) affiliated to the Manonmaniam Sundaranar University for a period of not less than two academic years comprising four semesters, passed the examinations prescribed and fulfilled such conditions as have been prescribed there of.

2. Duration: Duration of the programme: 2 Years

Components

Courses	**No of Courses**	**Maximum marks**	**Total Marks**
Core Courses	8	100	800
Core Lab Courses	4	100	400
Core Research Project	1	100	100
Elective courses	7	100	700
Elective Lab Course	1	100	100
		Total	**2100**

Course Structure

(i) **Curricular Courses:**

Distribution of Hours and Credits

Course	**SEMESTER**				**Total**	
	I	**II**	**III**	**IV**	**Hours**	**Credits**

Core Theory Core Lab Course	6(5) + 6(4) 5(3)	6(5)+ 6(5) 6(4)	6(5) + 6(5) 6(5)	6(5) + 6 (5) 6(5)	71	56
Elective Course	5 (3) + 5 (3)	4 (3) + 4 (3)	4(3)	4 (3)+ 4(3)	30	21
Elective Lab Course	3(2)				3	2
Core Research Project		-	5(4)		5	4
Skill Enhancement Course		4 (2)	3 (2)	4 (2)	11	6
Internship			(2)		-	2
Total	**30 (20)**	**30 (22)**	**30 (26)**	**30 (23)**	**120**	**91**

(ii) **Co-curricular Courses**

Course	**SEMESTER**				**Total**
	I	**II**	**III**	**IV**	**Credits**
Life Skill Training –I	-	(1)	-	-	1
Life Skill Training –II	-	-	-	(1)	1
Field Project	(1)		-		1
Specific Value-Added Courses	(1)		(1)		2
Generic Value-Added Courses		(1)		(1)	2
MOOC		(1)		(1)	2
Community Engagement Activity (UBA)		(1)			1

Total Number of Hours =120
Total Number of Credits =91 + (10)

Non-academic courses are mandatory and conducted outside the regular working hours.

Courses Offered

SEMESTER I

Course Code	**Title of the Course**	**Credits**	**Hours / Week**
SP231CC1	Core Course I: Analysis & Design of Algorithms	5	6
SP231CC2	Core Course II: Object Oriented Analysis and Design & C++	4	6
SP231CP1	Core Lab Course: Algorithm and OOPS Lab	3	5
SP231EC1	Elective Course I: a) Python Programming	3	5
SP231EC2	Elective Course I: b) Multimedia and its Applications		
SP231EC3	Elective Course I: c) Embedded System		
SP231EC4	Elective Course II: a) Advanced Software Engineering	3	5
SP231EC5	Elective Course II: b) Internet of Things		
SP231EC6	Elective Course II: c) Critical Thinking, Design Thinking and Problem Solving		
SP231EP1	Elective Lab Course I: Python Programming Lab	2	3
	Total	**20**	**30**

SEMESTER II

Course Code	Title of the Course	Credits	Hours / Week
SP232CC1	Core Course III: Data Mining and Warehousing	5	6
SP232CC2	Core Course IV: Advanced Java Programming	5	6
SP232CP1	Core Lab Course II: Advanced Java Programming Lab	4	6
SP232EC1	Elective Course III: Advanced Operating Systems	3	4
SP232EC2	Elective Course III: Mobile Computing		
SP232EC3	Elective Course III: c) Block Chain Technology		
SP232EC4	Elective Course IV: a) Artificial Intelligence and Machine Learning	3	4
SP232EC5	Elective Course IV: b) Web Services		
SP232EC6	Elective Course IV: c) Robotic Process Automation for Business		
SP232SE1	Skill Enhancement Course I: Practical: Data Mining Lab using R	2	4
	Total	**22**	**30**

SEMESTER III

Course Code	Title of the Course	Credits	Hours / Week
SP233CC1	Core Course V: Digital Image Processing	5	6
SP233CC2	Core Course VI: Cloud Computing	5	6
SP233CP1	Core Lab Course III: Digital Image Processing Lab using MATLAB	5	6
SP233RP1	Core Research Project	4	5
SP233EC1	Elective Course V: a) Introduction to Research Methodology in Computer Science	3	4
SP233EC2	Elective Course V: b) Data Science and Analytics		
SP233EC3	Elective Course V: c) Soft Computing		
SP233SE1	Skill Enhancement Course II: Cloud Computing Lab	2	3
SP233IS1	Internship	2	-
	Total	**26**	**30**

SEMESTER IV

Course Code	Title of the Course	Credits	Hours / Week
SP234CC1	Core Course VII: Big Data Analytics	5	6
SP234CC2	Core Course VIII: Software Project Management	5	6
SP234CP1	Core Lab Course IV: Web Application Development Lab	5	6
SP234EC1	Elective Course VI: a) Wireless Sensor Networks	3	4
SP234EC2	Elective Course VI: b) Bio Informatics		
SP234EC3	Elective Course VI: c) Network Security and Cryptography		

SP234EC4	Elective Course VII: a) Principles of Programming Languages	3	4
SP234EC5	Elective Course VII: b) Advanced Database Systems		
SP234EC6	Elective Course VII: c) Principles of Compiler Design		
SP234SE1	Skill Enhancement Course III: Soft Skill Development Lab	2	4
	Total	**23**	**30**
	Total	**91**	**120**

Co-curricular Courses

Semester	Code	Title of the Course	Credit
I & II	PG23LST1	Life Skill Training	1
II & IV	-	MOOC	1+1
II	PG232CE1	Community Engagement Activity (UBA)	1
III & IV	PG23LST2	Life Skill Training	1
I	SP231FP1	Field Project	1
I & III	SP231V01 / SP233V01	Specific Value-added Course	1+1
II & IV	GVAC2401-	Generic Value-added Course	1+1
		Total	**10**

Specific Value Added Course

Semester	Title of the Course	Course Code
I	Website Creation	SP231V01
I	Digital Forensics	SP231V02
III	SET/NET Coaching For Computer Science	SP233V01
III	Script Using java Script	SP233V02

Self-Learning Course:

Semester	Title of the Course	Course Code
III	3D Animation And Modelling Using Blender	SP233SL1
IV	Web Designing With Bootstrap And Jquery	SP234SL1

Examination Pattern

Curricular Courses:

i) Core Course / Elective Course

Internal: External–25:75

Continuous Internal Assessment (CIA)

Internal Components and Distribution of Marks

Components	Marks
Internal test (2) (40 marks)	10
Quiz (2) (20 marks)	5
Seminar (10 marks)	5
Assignment: (Model Making, Exhibition, Role Play, Group Discussion, Problem Solving, Class Test, Open Book Test (Minimum three items per course) (30 marks)	5
Total	**25**

Question Pattern

Internal Test	Marks	External Exam	Marks
Part A 4 x 1 (No choice)	4	Part A 10 x 1 (No choice)	10
Part B 2 x 6 (Internal choice)	12	Part B 5 x 6 (Internal choice)	30
Part C 2 x 12 (Internal choice)	24	Part C 5 x 12 (Internal choice)	60
Total	**40**	**Total**	**100**

ii) Core Lab Course:

Ratio of Internal and External= 25:75

Total: 100 marks

Internal Components and Distribution of Marks

Internal Components	Marks
Performance of the Experiments	10
Regularity in attending practical and submission of records	5
Record	5
Model exam	5
Total	**25**

Question pattern

External Exam	Marks
Major Practical	75
Minor Practical / Spotters /Record	
Total	**75**

iii) Core Research Project:

Ratio of Internal and External **25: 75**

Internal (Supervisor)	Marks
I Review	5
II Review	5
Report	15
External (External Examiner)	
Report	40
Viva-voce (individual, open viva-voce)	35
Total	**100**

iv) Skill Enhancement Course

Ratio of Internal and External = 2**5: 75**

Internal Components and Distribution of Marks

Components	Marks
Internal test (2) – (40 marks)	10
Quiz (2) – (20 marks)	5
Assignment: (Model Making, Exhibition, Role Play, Album, Group Activity (Mime, Skit, Song) (Minimum three items per course)	10
Total	**25**

Question Pattern

Internal Test	Marks	External Exam	Marks
Part A 2 x 2 (No Choice)	4	Part A 5 x 2 (No Choice)	10

Part B 3 x 4 (Open choice **Three** out of **Five**)	12	Part B 5 x 4 (Open choice any **Five** out **of Eight**)	20
Part C 1 x 9 (Open choice O**ne** out of **Three**)	9	Part C 5 x 9 (Open choice any **Five** out **of Eight**)	45
Total	**25**	**Total**	**75**

v) Internship

Components	**Marks**
Industry Contribution	50
Report & Viva-voce	50
Total	**100**

Co-Curricular Courses:

(i) Life Skill Training

Internal Component

Components		**Marks**
Life Skill Training -I	Album (20 pages)	30
	Group Activity (Group of 5 students)	20
	Total	**50**
Life Skill Training -II	Case Study (30 pages)	50
	Total	**50**

External Component

Written Test	Five out of Seven (5 x 10)	50
	Total	**50**

(ii) Field Project:

Components	**Marks**
Field Work	50
Field Project Report & Viva-voce	50
Total	**100**

(iii) Specific Value-Added Courses & Generic Value-Added Courses:

Components	**Marks**
Internal	25
External	75
Total	**100**

(iv) Community Engagement Activity-UBA

Internal Component	
Component	**Marks**
Attendance (Field Work)	30
Participation	20
Total	**50**

External Component

Component	**Marks**
Group Project Report/ Case Study (10-15 pages in print)	50
Total	**50**

(v) Self Learning Course

Internal Test	Marks	External Exam	Marks
Part A 2 x 2 (No Choice)	4	Part A 5 x 2 (No Choice)	10
Part B 3 x 4 (Open choice **Three** out of **Five**)	12	Part B 5 x 4 (Open choice any **Five** out **of Eight**)	20
Part C 1 x 9 (Open choice O**ne** out of **Three**)	9	Part C 5 x 9 (Open choice any **Five** out **of Eight**)	45
Total	**25**	**Total**	**75**

Outcome Based Education (OBE)

(i) Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No.	Level	Parameter	Description
1	KI	Knowledge/Remembering	It is the ability to remember the previously learned
2	K2	Comprehension/Understanding	The learner explains ideas or concepts
3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analysing	The learner distinguishes among different parts
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis /Creating	The learner creates a new product or point of view

(ii) Weightage of K – levels in Question Paper

Number of questions for each cognitive level:

Assessment	Cognitive Level	KI			K2			K3			K4, K5, K6			Total
Internal Test	Part	A	B	C	A	B	C	A	B	C	A	B	C	
	No. of Questions	1	1	-	-	-	-	1	-	1	2	1	1	8
External Examination	Part	A	B	C	A	B	C	A	B	C	A	B	C	
	No. of Questions	3	-	1	3	1	1	1	2	1	3	2	2	20

The levels of assessment are flexible and it should assess the cognitive levels and outcome attainment.

Evaluation

i. The performance of a student in each Course is evaluated in terms of percentage of marks with a provision for conversion to grade points.

ii. Evaluation for each Course shall be done by a Continuous Internal Assessment (CIA) by the Course teacher as well as by an end semester examination and will be consolidated at the end of the semester.

iii. There shall be examinations at the end of each semester, for odd semesters in October / November; for even semesters in April / May.

iv. A candidate who does not pass the examination in any course (s) shall be permitted to re-appear in such failed course (s) in the subsequent examination to be held in October / November or April / May. However, candidates who have arrears in Practical Examination(s) shall be permitted to re-appear for their arrears only along with Regular Practical examinations in the respective semester.

v. Viva- voce: Each candidate shall be required to appear for Viva-voce Examination in defense of the Project.

vi. The results of all the examinations will be published in the College website.

Conferment of the Master's Degree

A candidate shall be eligible for the conferment of the Degree of Master of Arts / Science/ Commerce only if the minimum required credits for the programme thereof (91 +10 credits) is earned.

Grading System

For a semester examination:

Calculation of Grade Point Average for End Semester Examination:

$$GPA = \frac{\text{Sum of the multiplication of grade points by the credits of the course}}{\text{Sum of the credits of the courses (passed) in a semester}}$$

For the entire programme:

Cumulative Grade Point Average (CGPA) $\Sigma_n\Sigma_i C_{ni}G_{ni} / \Sigma_{ni}\Sigma_i C_{ni}$

$$CGPA = \frac{\text{Sum of the multiplication of grade points by the credits of the entire programme}}{\text{Sum of the credits of the courses of the entire programme}}$$

where

C_i - Credits earned for course i in any semester

G_i - Grade point obtained for course i in any semester

n - semester in which such courses were credited

Final Result

Conversion of Marks to Grade Points and Letter Grade

Range of Marks	Grade Points	Letter Grade	Description
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
00-49	0.0	U	Re-Appear
ABSENT	0.0	AAA	ABSENT

Overall Performance

CGPA	Grade	Classification of Final Results
9.5-10.0	O+	First Class – Exemplary*
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction*
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0and above but below 6.5	A	
5.5and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
0.0 and above but below 5.0	U	Re-appear

*The candidates who have passed in the first appearance and within the prescribed semester are eligible.

SEMESTER I

CORE COURSE I: ANALYSIS & DESIGN OF ALGORITHMS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP231CC1	6	-	-	-	5	6	90	25	75	100

Pre-requisite:

Understand the concepts of Basic Data Structures & Algorithms

Learning Objectives:

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

Course Outcomes

On the successful completion of the course, student will be able to:		
1	get knowledge about algorithms and determines their time complexity.	**K1, K2**
2	gain good understanding of Greedy method and its algorithm.	**K2, K3**
3	able to describe about graphs using dynamic programming technique.	**K3, K4**
4	demonstrate the concept of backtracking &branch and bound technique.	**K5, K6**
5	explore the traversal and searching technique and apply it for trees and graphs.	**K6**

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

Units	Contents	No. of Hours
I	**Introduction**: - Algorithm Definition and Specification – Space complexity- Time Complexity- Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree - Binary Search Tree - Heap – Heapsort- Graph.	**18**
II	**Basic Traversal And Search Techniques**: Techniques for Binary Trees- Techniques for Graphs -Divide and Conquer: - General Method – Binary Search – Merge Sort – Quick Sort.	**18**
III	**The Greedy Method**: - General Method–Knapsack Problem Minimum Cost Spanning Tree– Single Source Shortest Path	**18**
IV	**Dynamic Programming**- General Method–Multistage Graphs–All Pair Shortest Path–Optimal Binary Search Trees – 0/1 Knapsacks – Traveling Salesman Problem – Flow Shop Scheduling.	**18**
V	**Back tracking**: -General Method–8-Queens Problem–Sum of Subsets–Graph Coloring – Hamiltonian Cycles – Branch and Bound: - The Method – Traveling Salesperson.	**18**
	Total	**90**

Self Study	Stacks and Queues, Quick Sort,Traveling Salesperson

Textbook

1. Ellis Horowitz.“*Computer Algorithms*”, Galgotia Publications
2. Alfred V.Aho, John E.Hopcroft, Jeffrey D.Ullman, "*Data Structures and Algorithms*".

Reference Book

1. Goodrich, *Data Structures & Algorithms in Java*, (Third edition). Published by Wiley
2. Skiena, 2008.*The Algorithm Design Manual* (Second Edition), Springer.

3. Anany Levith, 2003. *Introduction to the Design and Analysis of algorithm*, Pearson Education Asia.
4. Robert Sedgewick, Phillipe Flajolet. 1996. *An Introduction to the Analysis of Algorithms*, Addison-Wesley Publishing Company

Web Resources

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	2	3	1	3	3	3	3
CO4	3	3	2	3	3	3	3	3	3	2	3	2
CO5	3	2	2	2	2	2	2	2	2	1	2	1
Total	**15**	**14**	**13**	**15**	**15**	**13**	**15**	**12**	**14**	**12**	**14**	**12**
Average	**3**	**2.8**	**2.6**	**3**	**3**	**2.6**	**3**	**2.4**	**2.8**	**2.4**	**2.8**	**2.4**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER I

CORE COURSE II: OBJECT ORIENTED ANALYSIS AND DESIGN & C++

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP231CC2	6		-	-	4	6	90	25	75	100

Pre-requisite:

Basics of C++ and Object-Oriented Concepts.

Learning Objectives:

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

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the concept of object-oriented development and modelling techniques	**K1, K2**
2	gain knowledge about the various steps performed during object design	**K2, K3**
3	abstract object-based views for generic software systems	**K3**
4	link OOAD with C++ language	**K4, K5**
5	apply the basic concept of OOPs and familiarize to write C++ program	**K5, K6**

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

Units	Contents	No. of Hours
I	**The Object Model:** The Evolution of the Object Model – Elements of the Object Model – Applying the Object Model. Classes and Objects: The Nature of an Object – Relationship among Objects**.**	**18**
II	**Classes and Object**: Nature of Class – Relationship Among classes – The Interplay of classes and Objects. Classification: The importance of Proper Classification –identifying classes and objects –Key Abstractions and Mechanism.	**18**
III	**Introduction to C+:** Input and output statements in C++-Declarations-control structures– Functions in C++.	**18**
IV	**Inheritance and overloading:** Classes an Objects–Constructors and Destructors–operators overloading–Type Conversion- Inheritance – Pointers and Arrays.	**18**
V	**Memory Management Operators** -Polymorphism–Virtual functions–Files– Exception Handling – String Handling -Templates.	**18**
	Total	**90**

Self Study	Relationship among Objects, Key Abstractions and Mechanism, Exception Handling

Textbooks

1. Grady Booch. *Object Oriented Analysis and Design with Applications.* (Second Edition) Pearson Education.
2. Ashok N. Kamthane. 2003. *Object Oriented Programming with ANSI & Turbo C++*.First Indian Print, Pearson Education.

Reference Books

Balagurusamy. 2003.*Object Oriented Programming with C++*. (Second Edition). TMH.

Web Resources

1. https://onlinecourses.nptel.ac.in/noc19_cs48/preview
2. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/
3. https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	2	3	3	3
CO2	2	3	2	3	3	3	2	3	2	3	1	3
CO3	3	3	2	3	3	3	3	2	2	3	2	3
CO4	3	3	3	1	2	2	3	3	1	2	1	3
CO5	3	3	3	3	3	3	13	2	3	2	3	2
Total	**14**	**15**	**13**	**13**	**14**	**14**	**2.6**	**13**	**10**	**13**	**10**	**14**
Average	**2.8**	**3**	**2.6**	**2.6**	**2.8**	**2.8**	**3**	**2.6**	**2**	**2.6**	**2**	**2.8**

S-Strong (3) M-Medium (2) L-Low (1)

SEMESTER I

CORE LAB COURSE I: ALGORITHM AND OOPS LAB

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP231CP1	-		5	-	3	5	75	25	75	100

Prerequisite:

Basic Programming of C++language

Learning Objectives:

1. This course covers the basic data structures like Stack, Queue, Tree, List.
2. This course enables the students to learn the applications of the data structures using various techniques
3. It also enables the students to understand C++language with respect to OOAD concepts

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the concepts of object oriented with respect to C++	**K1, K2**
2	able to understand and implement OOPS concepts	**K3, K4**
3	implementation of data structures like Stack, Queue, Tree, List using C++	**K4, K5**
4	application of the data structures for Sorting, Searching using different techniques.	**K5, K6**
5	create an application using inheritance	**K5, K6**

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

Contents

1. Write a program to solve the tower of Hanoi using recursion.
2. Write a program to traverse through binary search tree using traversals.
3. Write a program to perform various operations on stack using linked list.
4. Write a program to perform various operation in circular queue.
5. Write a program to sort an array of an elements using quick sort.
6. Write a program to solve number of elements in ascending order using heap sort.
7. Write a program to solve the knapsack problem using greedy method
8. Write a program to search for an element in a tree using divide& conquer strategy.
9. Write a program to place the 8 queens on an 8X8 matrix so that no two queens Attack.
10. Write a C++ program to perform Virtual Function
11. Write a C++ program to perform Parameterized constructor
12. Write a C++ program to perform Friend Function
13. Write a C++ program to perform Function Overloading
14. Write a C++program to perform Single Inheritance
15. Write a C++program to perform Employee Details using files.

Textbooks

1. Goodrich. *Data Structures &Algorithms in Java.* Wiley3rd edition.
2. Skiena.2008. *The Algorithm Design Manual* (Second Edition), Springer.

Reference Books

1. Anany Levith. 2003. *Introduction to the Design and Analysis of algorithm*, Pearson Education Asia.
2. Robert Sedgewick, Phillipe Flajolet,. 1996. *An Introduction to the Analysis of Algorithms*, Addison-Wesley Publishing Company.

Web Resources

1. https://onlinecourses.nptel.ac.in/noc19_cs48/preview
2. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/
3. https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO 1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO1	PSO 2	PSO 3	PSO 4	PSO5
CO1	3	3	2	3	2	3	3	2	2	2	3	2
CO2	3	3	2	2	3	3	3	3	2	3	2	3
CO3	2	2	3	3	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	2	2	2	3	3	3	1
CO5	3	3	2	3	2	2	2	3	1	2	3	2
Total	**14**	**14**	**11**	**14**	**11**	**13**	**13**	**11**	**9**	**13**	**14**	**9**
Average	**2.8**	**2.8**	**2.3**	**2.8**	**2.2**	**2.6**	**2.6**	**2.3**	**2.1**	**2.6**	**2.8**	**7.5**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER I

ELECTIVE COURSE I: a) PYTHON PROGRAMMING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP231EC1	5	-	-	-	3	5	75	25	75	100

Pre-requisite:

Basics of any OO Programming Language

Learning Objectives:

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

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the basic concepts of Python Programming	**K1, K2**
2	understand File operations, Classes and Objects	**K2, K3**
3	acquire Object Oriented Skills in Python	**K3, K4**
4	develop web applications using Python	**K5**
5	develop Client Server Networking applications	**K5, K6**

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

Units	Contents	No. of Hours
I	**Python:** Introduction – Numbers – Strings – Variables – Lists – Tuples – Dictionaries–Sets– Comparison.	**15**
II	**Code Structures:** if, else if, and else – Repeat with while – Iterate with for – Comprehensions – Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try and except – User Exceptions.	**15**
III	**Modules, Packages, and Programs:** Standalone Programs – Command-Line Arguments – Modules and the import Statement – The Python Standard Library. **Objects and Classes:** Define a Class with class – Inheritance – Override a Method – Add a Method – Get Help from Parent with super–Inself Defense –Get and Set Attribute Values with Properties –Name Mangling for Privacy – Method Types – Duck Typing – Special Methods –Composition.	**15**
IV	**Data Types:** Text Strings Binary Data. **Storing and Retrieving Data:** File Input/Output– Structured Text Files – Structured Binary Files - Relational Databases – No SQL Data Stores. **Web:** Web Clients –Web Servers–Web Services and Automation	**15**
V	**Systems:** Files–Directories–Programs and Processes– Calendars and Clocks. **Concurrency:** Queues– Processes–Threads–Green Threads and event–twisted–Redis. **Networks:** Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – ZeroMQ –Internet Services – Web Services and APIs – Remote Processing – Big Fat Data and Map Reduce – Working in the Clouds.	**15**
	Total	**75**

Textbooks

1. Bill Lubanovic. 2014. *Introducing Python* (First Edition). O'Reilly, Second Release,2014.
2. MarkLutz, 2013. *Learning Python* (Fifth Edition). O'Reilly.

Reference Books

1. David M. Beazley. 2009 .*Python Essential Reference (*FourthEdition). Developer's Library
2. Sheetal Taneja,Naveen Kumar, *Python Programming –A Modular Approach*. Pearson Publications.

Web Resources

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	1	3	3	3	3
CO4	3	3	2	3	3	2	3	3	3	2	3	2
CO5	3	2	2	2	2	2	2	2	2	1	2	1
Total	**15**	**14**	**13**	**15**	**15**	**13**	**15**	**12**	**14**	**12**	**14**	**12**
Average	**3**	**2.8**	**2.6**	**3**	**3**	**2.6**	**3**	**2.4**	**2.8**	**2.4**	**2.8**	**2.4**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER I

ELECTIVE COURSE I: b) MULTIMEDIA AND ITS APPLICATIONS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP231EC2	5	-	-	-	3	5	75	25	75	100

Pre-requisite:

Basics of Multimedia

Learning Objectives:

1. To introduce the students the concepts of Multimedia, Images &Animation.
2. To introduce Multimedia authoring tools
3. To understand the role of Multimedia ibn Internet
4. To know about High Definition Television and Desktop Computing–Knowledge based Multimedia systems

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the basic concepts of Multimedia	**K1, K2**
2	demonstrate multimedia authoring tools	**K2, K3**
3	analyze the concepts of Sound, Images, Video &Animation	**K3, K4**
4	apply and analyze the role of Multimedia in Internet and real time applications	**K5**
5	analyze multimedia applications using HDTV	**K5, K6**

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

Textbooks

Units	Contents	No. of Hours
I	What is Multimedia? –Introduction to making Multimedia–Macintosh and Windows Production platforms – Basic Software tools.	**15**
II	Making Instant Multimedia –Multimedia authoring tools–Multimedia building blocks –Text– Sound.	**15**
III	Images–how to create image, Text coloring Animation: Animating the images-motion- Video: Create videos of images.	**15**
IV	Multimedia and the Internet –The Internet and how it works–Tools for World Wide Web– Designing for the World Wide Web.	**15**
V	High Definition Television and Desktop Computing –Knowledge based Multimedia systems.	**15**
	Total	**75**

1. Tay Vaughan, "*Multimedia making it work*", Fifth Edition, Tata McGraw Hill.
2. John F. Koegel Bufford, "*Multimedia Systems*", Pearson Education.

Reference Books

1. Judith Jeffloate, 2003, "Multimedia in Practice (Technology and Applications)", PHI.

Web Resources

1. https://www.tutorialspoint.com/multimedia/index.htm
2. https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm
3. https://nptel.ac.in/courses/117/105/117105083/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	1	3	3	3	3
CO4	3	3	2	3	3	2	3	3	3	2	3	2
CO5	3	2	2	2	2	2	2	2	2	1	2	1
Total	**15**	**14**	**13**	**15**	**15**	**13**	**15**	**12**	**14**	**12**	**14**	**12**
Average	**3**	**2.8**	**2.6**	**3**	**3**	**2.6**	**3**	**2.4**	**2.8**	**2.4**	**2.8**	**2.4**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER I

ELECTIVE COURSE I: c) EMBEDDED SYSTEM

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP231EC3	5	-	-	-	3	5	75	25	75	100

Pre-requisite:

Basics of Micro Controller

Learning Objectives:

1. Present the introduction to 8051 Microcontroller Instruction Set, concepts on RTOS &Software tools.
2. Gain knowledge about the embedded software development.
3. Learn about Microcontroller and software tools in the embedded systems.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the concept of 8051 microcontroller	**K1, K2**
2	understand the Instruction Set and Programming	**K2, K3**
3	analyze the concepts of RTOS	**K3, K4**
4	analyze and design various real time embedded systems using RTOS	**K5**
5	debug the malfunctioning system using various debugging techniques	**K5, K6**

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

Units	Contents	No. of Hours
I	8051 Microcontroller: Introduction- 8051 Architecture-Input/Output Pins, Ports and Circuits- External Memory - Counters / Timers - Serial Data Input / Output –Interrupts	**15**
II	Instruction Set and Programming Moving Data-Addressing Modes-Logical operations- Arithmetic Operation-Jump and Call Instructions-Simple Program. Applications: Keyboard Interface- Display Interface-Pulse Measurements-DIA and AID Conversions-Multiple Interrupts.	**15**
III	CONCEPTS ON RTOS: Introduction to RTOS-Selecting an RTOS-Task and Task states - Tasks and data- Semaphores and shared data. MORE operating systems services: Interrupt Process communication - Message Queues, Mailboxes and pipes- Timer Functions-Events - Memory Management-Interrupt Routines in an RTOS Environment.	**15**
IV	Basic Design using a RTOS: Principles - Encapsulating semaphores and Queues-Hard real time scheduling considerations-Saving memory space and power- introductions to RTL &QNX.	**15**
V	SOFTWARE TOOLS: software Development Tools: Hosts and Target Machines- Linker/Locators for Embedded software-getting Embedded software into the Target systems. Debugging Techniques: Testing on your Host machine -Instruction set simulators- The assert macro- using laboratory tools.	**15**
	Total	**75**

Text books

1. David E.Simon, 2003."*An Embedded Software primer* "Pearson Education Asia.
2. Kenneth J Ayala, "*The 8051 Microcontroller and Architecture programming and application*", Second Edition, Penram International.

Reference Books

1. RajKamal, 2003, "*Embedded Systems – Architecture, programming and design*", Tata McGraw– Hill

Web Resources

1. https://www.javatpoint.com/embedded-system-tutorial
2. https://onlinecourses.nptel.ac.in/noc20_cs14/preview
3. https://www.tutorialspoint.com/embedded_systems/index.htm

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	1	3	3	3	3
CO4	3	3	2	3	3	2	3	3	3	2	3	2
CO5	3	2	2	2	2	2	2	2	2	1	2	1
Total	**15**	**14**	**13**	**15**	**15**	**13**	**15**	**12**	**14**	**12**	**14**	**12**
Average	**3**	**2.8**	**2.6**	**3**	**3**	**2.6**	**3**	**2.4**	**2.8**	**2.4**	**2.8**	**2.4**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER I

ELECTIVE COURSE II: a) ADVANCED SOFTWARE ENGINEERING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP231EC4	5	-	-	-	3	5	75	25	75	100

Pre-requisite:

Basics of Software Engineering &SPM

Learning Objectives:

1. To introduce Software Engineering, Design, Testing and Maintenance.
2. Enable the students to learn the concepts of Software Engineering.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand about Software Engineering process	**K1, K2**
2	understand about Software project management skills, design and quality management	**K2, K3**
3	analyze on Software Requirements and Specification	**K3, K4**
4	analyze on Software Testing, Maintenance and Software Re-Engineering	**K4, K5**
5	design and conduct various types and levels of software quality for a software project	**K5, K6**

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

Units	Contents	No. of Hours
I	**Introduction**: The Problem Domain – Software Engineering Challenges - Software Engineering Approach – Software Processes: Software Process – Characteristics of a Software Process – Software Development Process Models – Other software processes.	15
II	**Software Requirements Analysis and Specification**: Requirement engineering – Type of Requirements – Feasibility Studies – Requirements Elicitation – Requirement Analysis – Requirement Documentation – Requirement Validation – Requirement Management – SRS - Formal System Specification – Axiomatic Specification – Algebraic Specification - Case study: Student Result management system. Software Quality Management –Software Quality, Software Quality Management System, ISO 9000, SEI CMM.	15
III	**Software Project Management:** Responsibilities of a software project manager – Project planning – Metrics for Project size estimation – Project Estimation Techniques – Empirical Estimation Techniques – COCOMO – Halstead‟s software science – Staffing level estimation – Scheduling– Organization and Team Structures – Staffing – Risk management – Software Configuration Management – Miscellaneous Plan.	15
IV	**Software Design:** Outcome of a Design process – Characteristics of a good software design – Cohesion and coupling - Strategy of Design – Function Oriented Design – Object Oriented Design - Detailed Design - IEEE Recommended Practice for Software Design Descriptions.	15
V	**Software Testing:** A Strategic approach to software testing – Terminologies – Functional testing– Structural testing – Levels of testing – Validation testing -	15

	Regression testing – Art of Debugging–Testingtools-Metrics-ReliabilityEstimation.SoftwareMaintenance -Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities	
	Total	**75**

Text books

1. Pankaj Jalote, Narosa, *An Integrated Approach to Software Engineering*(Third Edition)Publishing House, Delhi.
2. Fundamentals of Software Engineering (Third Edition)–Rajib Mall, PHI Publication,

Reference Books

1. K.K.Agarwal and Yogesh Singh. *Software Engineering* (Third Edition)–,New Age International Publishers.
2. R.S.Pressman.*A Practitioners Approach-Software Engineering*, McGraw Hill.
3. Carlo Ghezzi, M.Jarayeri, D. Manodrioli, *Fundamentals of Software Engineering*, PHI Publication.

Web Resources

1. https://www.javatpoint.com/software-engineering-tutorial
2. https://onlinecourses.swayam2.ac.in/cec20_cs07/preview
3. https://onlinecourses.nptel.ac.in/noc19_cs69/preview

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	3	3	3	2	3	2	3
CO3	2	3	3	3	3	3	3	2	2	3	2	3
CO4	3	3	3	2	2	2	3	3	2	2	2	3
CO5	3	3	3	3	3	2	2	3	3	2	3	2
Total	**14**	**15**	**13**	**13**	**14**	**13**	**15**	**14**	**10**	**13**	**10**	**14**
Average	**2.8**	**3**	**2.6**	**2.6**	**2.8**	**2.6**	**3**	**2.8**	**2**	**2.6**	**2**	**2.8**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER I

ELECTIVE COURSE II: b) INTERNET OF THINGS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP231EC5	5	-	-	-	3	5	75	25	75	100

Pre-requisite:

Basics of Sensors & its Applications

Learning Objectives:

1. About Internet of Things where various communicating entities are controlled and managed for decision making in the application domain.
2. Enable students to learn the Architecture of IoT and IoT Technologies
3. Developing IoT applications and Security in IoT, Basic Electronics for IoT, Arduino IDE, Sensors and Actuators Programming NODEMCU using Arduino IDE.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand about IoT, its Architecture and its Applications	**K1, K2**
2	understand basic electronics used in IoT & its role	**K2, K3**
3	develop applications with C using Arduino IDE	**K4**
4	analyze about sensors and actuators	**K5, K6**
5	design IoT in real time applications using today's internet &wireless technologies	**K6**

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

Units	Contents	No. of Hours
I	Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT– Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT	**15**
II	Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage – Binary Calculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation	**15**
III	Programming Fundamentals with C using Arduino IDE: Installing and Setting up the Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.	**15**
IV	Sensors and Actuators: Analog and Digital Sensors–Interfacing temperature senso ultrasound sensor and infrared (IR) sensor with Arduino– Interfacing LED and Buzzer with Arduino	**15**
V	Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (Thing Speak).	**15**
	Total	**75**

Textbooks

1. Arshdeep Bahga, ,Vijay Madisetti, 2014 "Internet of Things: A Hands-On Approach". ISBN: 978-0996025515
2. Boris Adryan, Dominik Obermaier, Paul Fremantle, "The Technical Foundations of IoT", Artech Houser Publishers, 2017

Reference Books

1. Michael Margolis,2011, "*Arduino Cook book*",O"Reilly.
2. Marco Schwartz, 2016 ,"*Internet of Things with ESP 8266*",Packt Publishing.
3. Dhivya Bala, 2018, "*ESP 8266:Step by Step Tutorial for ESP 8266 IoT, Arduino NODE MCU Dev. Kit*", 2018.

Web Resources

1. https://onlinecourses.nptel.ac.in/noc20_cs66/preview
2. https://www.javatpoint.com/iot-internet-of-things
3. https://www.tutorialspoint.com/internet_of_things/index.htm

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	3	3	3	2	3	2	3
CO3	2	3	3	3	3	3	3	2	2	3	2	3
CO4	3	3	3	2	2	2	3	3	2	2	2	3
CO5	3	3	3	3	3	2	2	3	3	2	3	2
Total	**14**	**15**	**13**	**13**	**14**	**13**	**15**	**14**	**10**	**13**	**10**	**14**
Average	**2.8**	**3**	**2.6**	**2.6**	**2.8**	**2.6**	**3**	**2.8**	**2**	**2.6**	**2**	**2.8**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER I

ELECTIVE COURSE II: c) CRITICAL THINKING, DESIGN THINKING AND PROBLEM SOLVING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP231EC6	5	-	-	-	3	5	75	25	75	100

Pre-requisite:

Basics of Logical &Reasoning Skills

Learning Objectives:

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

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the concepts of Critical thinking and its related technology	**K1, K2**
2	focus on the explicit development of critical thinking and problem solving skills	**K2, K3**
3	apply design thinking in problems	**K3, K4**
4	make a decision and take actions based on analysis	**K4, K5**
5	analyze the concepts of Thinking patterns, Problem solving & Reasoning in real time applications	**K5, K6**

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

Units	Contents	No. of Hours
I	**Critical Thinking**: Definition, Conclusions and Decisions, Beliefs and Claims, Evidence –finding, evaluation, Inferences, Facts – opinion, probable truth, probably false, Venn diagram. Applied critical thinking: Inference, Explanation, Evidence, Credibility, Two Case Studies, critical thinking and science, critical evaluation, self assessment.	**15**
II	**Design Thinking**: Introduction, Need of Design Thinking, problem to question - design thinking process, Traditional Problem Solving versus Design Thinking, phases of Design Thinking, problem exploration, Stake holder assessment, design thinking for manufacturers, smart Idea to implementation.	**15**
III	**CASE STUDY:** Thinking to confidence, fear management, duty Vs passion, Team management, Tools for Thinking, prototype design, Relevance of Design and Design Thinking in engineering, human centered design, case study: apply design thinking in problem.	**15**
IV	**Problem solving:** problem definition, problem solving methods, selecting and using information, data processing, solution methods, solving problems by searching, recognizing patterns, spatial reasoning necessity and sufficiency, closing and using models, making choice and decisions	**15**
V	**Reasoning:** Deductive and hypothetical reasoning, computational problem solving; generating, implementing, and evaluating solutions, interpersonal problem solving. Advanced problem solving: Combining skills – using imagination, developing models, Carrying out investigations, Data analysis and inference. Graphical methods of solution, Probability, tree diagrams and decision trees	**15**

	Total	**75**

Textbooks

1. John Butterworth and Geoff Thwaites, 2013, *Thinking skills: Critical Thinking and Problem Solving*, Cambridge University Press.
2. H.S.Foglerand S.E.LeBlanc, 2008, *Strategies for Creative Problem Solv*ing, 2nd edition, Pearson, Upper Saddle River, NJ.

Reference Books

1 A. Whimbey and J. Lochhead, Lawrence Erlbaum, Mahwah, N. 1999, *Problem Solving & Comprehension*, 6th edition, Lawrence Erlbaum, Mahwah, N..
2 M. Levine,1994, *Effective Problem Solving*, 2nd edition, Prentice Hall, Upper Saddle River, NJ.
3 Michael Baker, 2015, *The Basic of Critical Thinking*, The Critical Thinking Co press.
4 David Kelley and Tom Kelley, 2013,Creative Confidence.

Web Resources

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO 7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	3	3	3	2	3	2	3
CO3	2	3	3	3	3	3	3	2	2	3	2	3
CO4	3	3	3	2	2	2	3	3	2	2	2	3
CO5	3	3	3	3	3	2	2	3	3	2	3	2
Total	**14**	**15**	**13**	**13**	**14**	**13**	**15**	**14**	**10**	**13**	**10**	**14**
Average	**2.8**	**3**	**2.6**	**2.6**	**2.8**	**2.6**	**3**	**2.8**	**2**	**2.6**	**2**	**2.8**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER I

ELECTIVE LAB COURSE I: PYTHON PROGRAMMING LAB

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP231EP1	-		3	-	2	3	45	25	75	100

Prerequisite:

Basics of any OO Programming Language.

Learning Objectives:

1. Presents an overview of elementary data items, lists, dictionaries, sets and tuples
2. To understand and write simple Python programs.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	write programs in Python using OOPS concepts	K1, K2
2	to understand the concepts of File operations and Modules in Python	K3, K4
3	implementation of lists, dictionaries, sets and tuples as programs	K4, K5
4	to develop web applications using Python	K5, K6
5	develop the programs using polymorphism	K6

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

Contents

1) Programs using elementary data items, lists, dictionaries and tuples
2) Programs using conditional branches,
3) Programs using loops.
4) Programs using functions
5) Programs using exception handling
6) Programs using inheritance
7) Programs using polymorphism
8) Programs to implement file operations.
9) Programs using modules.
10) Programs for creating dynamic and interactive web pages using forms.

Textbooks

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

Reference Books

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

Web Resources

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO 1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	2	3	2	3	3	2	2	2	3	2
CO2	3	3	2	2	3	3	3	3	2	3	2	3
CO3	2	2	3	3	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	2	3	2	3	3	3	1
CO5	3	3	2	3	2	2	2	3	1	2	3	2
Total	**14**	**14**	**11**	**14**	**11**	**13**	**15**	**11**	**9**	**13**	**14**	**9**
Average	**2.8**	**2.8**	**2.3**	**2.8**	**2.2**	**2.6**	**3**	**2.3**	**2.1**	**4.3**	**2.8**	**7.5**

S-Strong (3) M-Medium (2) L-Low (1)

SEMESTER I

SPECIFIC VALUE ADDED COURSE I: WEBSITE CREATION

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP231V01	**2**	**-**	**-**	**-**	**1**	**2**	**30**	**25**	**75**	**100**

Pre-requisite:

1. Basic knowledge in HTML tags & skill of creating web pages should be known
2. Knowledge of basic Computer hardware & software is also necessary.

Learning Objectives:

1. Define the principle of Web page design.
2. Visualize the basic concept of HTML.
3. Introduce basics concept of CSS.

Course Outcomes

	On the successful completion of the course, student will be able to:	
1	develop the skill and knowledge of Web page design.	**K1,K3**
2	understand and can function either as an entrepreneur or can take up jobs in the multimedia	**K2,K4**
3	create a Web site development studio.	**K5,K6**
4	develop the concept of web publishing	**K5,K6**
5	create attractive web pages	**K6**

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

Units	Contents	No. of Hours
I	**Web Design Principles**: Basic principles involved in developing a web site - Planning process -Five Golden rules of web designing -Designing navigation bar - Page design - Home Page Layout -Design Concept.	**6**
II	**Basics in Web Design:** Brief History of Internet -What is World Wide Web -Why create a web site- Web Standards	**6**
III	**Introduction to HTML:** What is HTML - HTML Documents -Basic structure of an HTML document - Creating an HTML document-Mark up Tags -Heading-Paragraphs- Line Breaks -HTML Tags.	**6**
IV	**Elements of HTML:** Introduction to elements of HTML-Working with Text - Working with Lists, Tables and Frames - Working with Hyperlinks, Images and Multimedia -Working with Forms and controls.	**6**
V	**Introduction to Cascading Style Sheets:** Concept of CSS -Creating Style Sheet - CSS Properties -CSS Styling (Background, Text Format, Controlling Fonts) Working with block elements and objects -Working with Lists and Tables -CSS Id and Class-Box Model (Introduction, Border properties, Padding Properties, Margin properties)	**6**
	Total	**30**

Textbooks

1. Kogent. *HTML 5 in simple steps* . published by Dreamtech Press, Learning Solutions Inc.
2. Murray, Tom/Lynchburg. 2002. *Creating a Web Page and Web Site.*

Reference Books

1. Steven M. Schafer. *HTML, XHTML, and CSS Bible* (Fifth Edition) published by Wiley India.

2. Ian Pouncey, Richard York. *Beginning CSS: Cascading Style Sheets for Web Design* published by Wiley India

Web Resources

1. https://egyankosh.ac.in/bitstream/123456789/72091/1/Unit-7.pdf
2. https://www.bdu.ac.in/cde/SLM/B.Com%20C.A%20III%20Year%20/Web%20Designing/WEB%20DESIGNING.pdf
3. https://dribbble.com/stories/2021/09/29/ethical-web-design-rules

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3	3	2	2	2	2
CO2	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3
Total	**15**	**14**	**15**	**15**	**15**	**15**	**14**	**10**	**14**	**14**
Average	**3**	**2.8**	**3**	**3**	**3**	**3**	**2.8**	**2**	**2.8**	**2.8**

3-Strong; 2-Medium; 1-Low

SEMESTER I

SPECIFIC VALUE ADDED COURSE: DIGITAL FORENSICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP231V02	2	-	-	-	**1**	**2**	**30**	**25**	**75**	**100**

Pre-requisite:

Analysis of digital evidence to investigate cybercrimes and security incidents.

Learning Objectives:

1. To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
2. To understand how to examine digital evidences such as the data acquisition, identification analysis.

Course Outcomes

On the Successful Completion of the Course, the Student will be able to:		
1	understand the origin of forensic science	**K2**
2	analyze the computer investigations	**K4**
3	validate data acquisitions	**K5**
4	practice and apply digital forensic tools.	**K3**
5	create a model Forensic Tool based on available tools.	**K6**

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

Units	Contents	No. of. Hours
I	**Introduction:** Digital Forensics, Definition and types of cybercrimes, electronic evidence and handling, electronic media, collection, searching and storage of electronic media, introduction to internet crimes, hacking and cracking, credit card and ATM frauds, web technology, cryptography, emerging digital crimes and modules.	**6**
II	**Definition and Cardinal Rules:** Data Acquisition and Authentication Process, Windows Systems-FAT12, FAT16, FAT32 and NTFS, UNIX file Systems, mac file systems, computer artifacts, Internet Artifacts, OS Artifacts and their forensic applications	**6**
III	**Introduction to Forensic Tools:** Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools, Anti Forensics and probable counters, retrieving information, process of computer forensics and digital investigations	**6**
IV	**Evidance:** Processing of digital evidence, digital images, damaged SIM and data recovery, multimedia evidence, retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.	**6**

V	**Evaluating Digital Forensics Tool Needs:** Types - Tasks Performed- Tool Comparisons Digital Forensics Software Tools- Command-Line Forensics Tools- Digital Forensics Hardware Tools- Forensic Workstations-Validating and Testing Forensics Software- Using National Institute of Standards and Technology Tools.	**6**
	Total	**30**

Textbooks:

1. Altheide & H. Carvey, 2018. "Digital Forensics with Open Source Tools", Syngress,
2. Nelson, Phillips Enfinger, Steuart, 2019. "Computer Forensics and Investigations", CENGAGE Learning.

Reference Books*:*

1. Vacca, J, 2015. "*Computer Forensics,Computer Crime Scene Investigation*", 2nd Ed, Charles River Media, ISBN: 1-58450-389.
2. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "*Guide to Computer Forensics and Investigations*", 2nd ed., Thomson Course Technology, 2016, ISBN: 0-619-21706-5.
3. Brian Carrier, 2005. "*File System Forensic Analysis*", Addison-Wesley Professional, 1st Edition
4. Marie-Helen Maras, 2020. "*Computer Forensics: Cybercriminals, Laws, and Evidence*", 3rd Edition, ISBN-13: 978-0134439549
5. Marjie T. Britz, 2019. "*Computer Forensics and Cyber Crime: An Introduction*", 4th Edition, Pearson

Web Resources*:*

1. https://www.interpol.int/en/How-we-work/Innovation/Digital-forensics
2. https://www.eccouncil.org/cybersecurity/what-is-digital-forensics
3. https://www.geeksforgeeks.org/digital-forensics-in-information-security
4. https://www.cemca.org/ckfinder/userfiles/files/Module%2002%20Computer%20Forensics%20Investigation%20Process.pdf
5. https://cenexp.com/biblioteca/librerias/FOR/Bforense/LF20.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	2	3	3	3	3	3	3
TOTAL	**13**	**15**	**13**	**15**	**14**	**14**	**14**	**15**	**14**	**15**	**13**	**15**
AVERAGE	**2.6**	**3**	**2.6**	**3**	**2.8**	**2.8**	**2.8**	**3**	**2.8**	**3**	**2.6**	**3**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER II

CORE COURSE III: DATA MINING AND WAREHOUSING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP232CC1	6	-	-	-	5	6	90	25	75	100

Pre-requisite:

Basics of RDBMS &Algorithms.

Learning Objectives:

1. To enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing.
2. To develop skills of using recent data mining software for solving practical problems.

Course Outcomes

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

On the successful completion of the course, student will be able to:		
1	understand the basic data mining techniques and algorithms	**K1,K2**
2	understand the Association rules, Clustering techniques and Data warehousing contents	**K2,K3**
3	compare and evaluate different data mining techniques like classification, prediction, Clustering and association rule mining	**K4,K5**
4	design data warehouse with dimensional modeling and apply OLAP operations	**K5,K6**
5	identify appropriate data mining algorithms to solve real world problems	**K6**

Units	Contents	No. of Hours
I	**BASICS AND TECHNIQUES:** Basic data mining tasks – data mining versus knowledge discovery in databases – data mining issues – data mining metrics – social implications of data mining – data mining from a database perspective. Data mining techniques: Introduction – a statistical perspective on data mining – similarity measures – decision trees – neural networks – genetic algorithms.	**18**
II	**ALGORITHMS:** Classification: Introduction –Statistical –based algorithms-Regression and Bayesian -distance–based algorithms-Hamming distance - Euclidean Distance- decision tree-based algorithms- Use of A Decision Tree-Decision Tree Induction- neural network–based algorithms - Neural Network Architecture-Neural Network Method in Data Mining – rule-based algorithms–Combining Techniques.	**18**
III	**CLUSTERING AND ASSOCIATION:** Clustering: Introduction– Similarity and Distance Measures–Outliers–Hierarchical Algorithms - Partitional Algorithms. Association rules: Introduction - large item sets - basic algorithms – parallel & distributed algorithms – comparing approaches- incremental rules.Advanced Association rules and Techniques -Measuring the quality of Rules.	**18**
IV	**DATA WAREHOUSING AND MODELING** Data warehousing: Introduction-characteristics of a data warehouse–data marts– other aspects of data mart. Online analytical processing: introduction –OLTP & OLAP systems Data modeling –star schema for multidimensional	**18**

	view –data modeling – multifact star schema or snow flake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.	
V	**APPLICATIONS OF DATA WAREHOUSE:** Developing a data Warehouse: why and how to build a data warehouse –data warehouse architectural strategies and organization issues - design consideration – data content – metadata distribution of data – tools for data warehousing – performance considerations – crucial decisions in designing a data warehouse. Applications of data warehousing and data mining in government: Introduction - national data warehouses – other areas for data warehousing and data mining	**18**
	Total	**90**

Self Study	**Decision Trees OLAP Tools**

Textbooks

1. Margaret H.Dunham, (2003). *Data Mining: Introductory and Advanced Topics* . Pearson education.

2. C.S.R. Prabhu. *Data Warehousing Concepts,Techniques, Products and Applications*. PHI, (2nd edition).

Reference Books

1. Arun K. Pujari.(2003). *Data Mining Techniques*. Universities Press (India)Pvt. Ltd.

2. Alex Berson, Stephen J.Smith, (2001). *Data Warehousing, Data Mining and OLAP*,TMCH, Jiawei Han & MichelineKamber, Academic press.

3. Jiawei Han, Micheline Kamber ,2011 "*Data Mining: Concepts and Techniques*"

4. David L. Olson, Dursun Delen , 2008, "*Advanced Data Mining Techniques"*

5. Parteek Bhatia, 2019. "*Data Mining and Data Warehousing Principles and Practical Techniques"*

Web Resources

1. https://www.javatpoint.com/data-warehouse
2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/
3. https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html
4. https://www.google.co.in/books/edition/Data_Mining_and_Data_Warehousing/bF6NDwAAQBAJ?hl=en&gbpv=0
5. https://www.google.co.in/books/edition/DATA_WAREHOUSING/rv-Xb6EgO6AC?hl=en&gbpv=1&dq=data+warehousing++techniques&printsec=frontcover

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3	3	2	2	2	2
CO2	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3
Total	**15**	**14**	**15**	**15**	**15**	**15**	**14**	**10**	**14**	**14**
Average	**3**	**2.8**	**3**	**3**	**3**	**3**	**2.8**	**2**	**2.8**	**2.8**

3-Strong; 2-Medium; 1-Low

SEMESTER II

CORE COURSE IV: ADVANCED JAVA PROGRAMMING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP232CC2	6	-	-	-	5	6	90	25	75	100

Pre-requisite:

Basics of Java and its usage.

Learning Objectives:

1. Enable the students to learn the basic functions, principles and concepts of advanced java programming.
2. Learn JDBC, Servlet packages, JQuery, Java Server Pages and JAR file format.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the advanced concepts of Java Programming	**K1,K2**
2	understand JDBC and RMI concepts	**K2,K3**
3	apply and analyze Java in Database	**K3,K4**
4	handle different event in java using the delegation event model, event listener and class	**K5**
5	design interactive applications using Java Servlet, JSP and JDBC	**K5,K6**

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

Units	Contents	No. of Hours
I	**BASICS OF JAVA:** Java Basics Review: Components and event handling-Types of Exceptions–Threading – Concurrency-Synchronization–Networking features- java.net Package, Client and Server Programs, Content and Protocol Handlers-Network Class Overview-Java Security and the Network classes-Java Socket Programming-Media Techniques-Applet-Java Graphics-Basic Animation	**18**
II	**REMOTE METHOD INVOCATION:** Remote Method Invocation-Working of RMI- Distributed Application Architecture- Creating stubs and skeletons-Defining Remote objects- Remote Object Activation-Object Serialization-Java Spaces- Benefits and Limitations of Java Spaces	**18**
III	**DATABASE:** Java in Databases- java. sql package -JDBC Driver- JDBC principles–JDBC API-database access-Interacting-database search–Meta Data Interfaces-Stored Procedures-Extending JDBC-Creating multimedia databases – Database support in web applications- Components of Web Based Database Applications	**18**
IV	**SERVLETS:** Java Servlets: Java Servlet and CGI programming- A simple java Servlet- Anatomy of a java Servlet - Reading data from a client-Reading http request header-sending data to a client and writing the http response header-working with cookies	**18**

	Java Server Pages: JSP Overview- Installation- JSP tags-Components of a JSP page-Expressions- Script lets -Directives-Declarations-A complete example	
V	**ADVANCED TECHNIQUES:** JAR file format creation– Internationalization–Locales-Resource Bundles-MVC Architecture-Swing Programming–Swing Components: Text Fields, Buttons, Toggle Buttons, Check Boxes and Radio Buttons-Advanced java Techniques	**18**
	Total	**90**
Self Study	**Java Spaces Internationalization**	

Textbooks

3. Jamie Jaworski, (1999). *Java Unleashed*. SAMS Techmedia Publications.
4. Campione, Walrath and Huml, (1999). *The Java Tutorial*, Addison Wesley.

Reference Books

3. Jim Keogh, (2010). *The Complete Reference J2EE*. Tata McGraw Hill Publishing Company Ltd.
4. David Sawyer McFarland, (2011). *JavaScript And JQuery- The Missing Manual*, Oreilly Publications, (3rd edition).
5. Deitel and Deitel, *Java How to Program* .(3rd edition) ,PHI/Pearson Education Asia.
6. Dr. R. Nageswara Rao, 2008,"*Core and Advanced Java (Black Book)*"
7. George Reese, 2000, "*Database Programming with JDBC & Java"*, Second Edition published by O'Reilly Media, Inc.

Web Resources

1. https://www.javatpoint.com/servlet-tutorial
2. https://www.tutorialspoint.com/java/index.htm
3. https://onlinecourses.nptel.ac.in/noc19_cs84/preview
4. https://www.javatpoint.com/multithreading-in-java
5. https://www.javatpoint.com/java-jdbc

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	2	2	2	3
CO2	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**14**	**10**	**14**	**15**
Average	**3**	**3**	**3**	**3**	**3**	**3**	**2.8**	**2**	**2.8**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER II

CORE COURSE LAB II: ADVANCED JAVA PROGRAMMING LAB

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP232CP1	-	-	6	-	4	6	90	25	75	100

Pre- requisite:

Basics in Java Programming.

Learning Objectives:

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

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the implement concepts of Java using HTML forms, JSP&JAR	**K1,K2**
2	must be capable of implementing JDBC and RMI concepts	**K3,K4**
3	able to write Applets with Event handling mechanism	**K4,K5**
4	create interactive web based applications using servlets and jsp	**K5,K6**
5	able to do Socket programming	**K2, K6**

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

Units	List of Exercises	No. of Hours
	Implement the following problems 1. Display a welcome message using Servlet. 2. Design a Purchase Order form using Html form and Servlet. 3. Develop a program for calculating the percentage of marks of a student using JSP. 4. Design a Purchase Order form using Html form and JSP. 5. Prepare a Employee payslip using JSP. 6. Write a program using JDBC for creating a table, Inserting, Deleting records and list out the records. 7. Write a program using Java servlet to handle form data. 8. Write a simple Servlet program to create a table of all the headers it receives along with their associated values. 9. Write a program in JSP by using session object. 10. Write a program to build a simple Client Server application using RMI. 11. Create an applet for a calculator application. 12. Program to send a text message to another system and receive the text message from the system (use socket programming).	**90**

Textbooks

1. Jamie Jaworski, (1999). *Java Unleashed*. SAMS Techmedia Publications.
2. Campione, Walrath and Huml, (1999). *The Java Tutorial*. Addison Wesley.

Reference Books

1. Jim Keogh, (2010). *The Complete Reference J2EE*, Tata McGraw Hill Publishing Company Ltd.
2. David Sawyer McFarland, (2011). *JavaScript And JQuery-The Missing Manual*. Oreilly Publications, (3rd edition).

Web Resources

1. https://www.javatpoint.com/servlet-tutorial
2. https://www.tutorialspoint.com/java/index.htm
3. https://onlinecourses.nptel.ac.in/noc19_cs84/preview

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	2	3
CO2	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**11**	**14**	**15**
Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2.2**	**2.8**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER II

ELECTIVE COURSE III: a) ADVANCED OPERATING SYSTEMS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP232EC1	4	-	-	-	3	4	60	25	75	100

Pre-requisite:

Basics of OS & its functioning.

Learning Objectives:

1. Enable the students to learn the different types of operating systems and their functioning.
2. Gain knowledge on Distributed Operating Systems

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the design issues associated with operating systems	**K1,K2**
2	master various process management concepts including scheduling, deadlocks and distributed file systems	**K3,K4**
3	prepare Real Time Task Scheduling	**K4,K5**
4	analyze Operating Systems for Handheld Systems	**K5**
5	analyze Operating Systems like LINUX and iOS	**K5,K6**

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

Units	Contents	No. of Hours
I	**BASICS OF OPERATING SYSTEMS:** Basics of Operating Systems: What is an Operating System? – Main frame Systems –Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems –Real-Time Systems – Handheld Systems –Process: Process Scheduling – Algorithms - Cooperating Processes – Inter Process Communication: Shared Memory-Message Passing System.	**12**
II	**DISTRIBUTED OPERATING SYSTEMS:** Distributed Operating Systems: Issues – Communication Primitives - Deadlock – Resource-Necessary conditions for a deadlock – Resource Allocation graph - Deadlock handling strategies - deadlock detection- Deadlock Avoidance - Deadlock Recovery - distributed file systems –design issues – Case studies – The Sun Network File System.	**12**
III	**REAL TIME OPERATING SYSTEM (RTOS):** Real time Operating Systems: Introduction – Types of Real time OS- Hard Real time - Firm Real Time- Soft Real Time Systems - Difference between Hard and Real - Advantages Disadvantages of RTOS - Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling	**12**
IV	**HANDHELD SYSTEMS:** Features of Handheld Operating System-Types of Handheld Operating Systems- Operating Systems for Handheld Systems: Requirements–Technology Overview–Handheld Operating Systems –Palm OS - Symbian Operating System-Android OS – Architecture of android - Applications of Android OS – Securing handheld systems -Advantages – Disadvantages	**12**

V	**CASE STUDIES:** Case Studies : Linux System: Introduction – Memory Management –Contiguous memory management -paging-Segmentation-Disk Scheduling- Algorithms- First Come First Serve - Shortest Seek Time First - SCAN- CSCAN Scheduling - Managing I/O devices – Accessing Files- iOS: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.	**12**
	Total	**60**

Self Study	Distributed File Systems Core OS Layer

Textbooks

1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, (2004). *Operating System Concepts*, (7th edition), John Wiley & Sons.
2. Mukesh Singhal and Niranjan G. Shivaratri, (2001). *Advanced Concepts in Operating Systems –Distributed, Database, and Multiprocessor Operating Systems*. Tata McGraw-Hill.

Reference Books

1. RajibMall, (2006). *Real-Time Systems: Theory and Practice*, Pearson Education India.
2. Pramod Chandra P. Bhatt, (2010). *An introduction to operating systems, concept and practice, PHI*, (3rd edition).
3. Daniel.P.Bovet & Marco Cesati, (2005). *Understanding the Linux kernel*. ,(3rdedition),O"Reilly.
4. NeilSmyth, (2011). *iPhone iOS 4 Development Essentials–Xcode*. (4th edition),Payload media.
5. Abraham Silberschatz .6th edition, "*operating system concepts*"

Web Resources

1. https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2. https://www.udacity.com/course/advanced-operating-systems--ud189
3. https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf
4. https://os.ecci.ucr.ac.cr/slides/Abraham-Silberschatz-Operating-System-Concepts-10th-2018.pdf
5. https://www.amazon.in/Operating-System-Concepts-Abraham-Silberschatz/dp/1118129385

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3	3	2	2	2	2
CO2	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3
Total	**15**	**14**	**15**	**15**	**15**	**15**	**14**	**11**	**14**	**14**
Average	**3**	**2.8**	**3**	**3**	**3**	**3**	**2.8**	**2.2**	**2.8**	**2.8**

3-Strong; 2-Medium; 1-Low

SEMESTER II

ELECTIVE COURSE III: b) MOBILE COMPUTING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP232EC2	4	-	-	-	3	4	60	25	75	100

Pre-requisite:

Basics of Mobile Communication

Learning Objectives:

1. Present the overview of Mobile computing, Applications and Architectures.
2. Enable to understand the futuristic computing challenges.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the need and requirements of mobile communication	**K1,K2**
2	focus on mobile computing applications and techniques	**K2,K3**
3	demonstrate satellite communication in mobile computing	**K4**
4	analyze about wireless local loop architecture	**K5,K6**
5	analyze various mobile communication technologies	**K6**

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

Units	Contents	No. of Hours
I	**INTRODUCTION:** Introduction: Advantages of Digital Information - Introduction to Telephone Systems –Mobile communication: Need for Mobile Communication –-Requirements of Mobile Communication – History of Mobile Communication- Properties of Wireless medium.	**12**
II	**MOBILE COMMUNICATION:** Introduction to Cellular Mobile Communication – Mobile Communication Standards –Mobility Management –Hand off- Radio link transfer-Roaming Management- Frequency Management – Cordless Mobile Communication Systems- Cordless-Multichannel-Wireless Communications.	**12**
III	**MOBILE COMPUTING:** Mobile Computing: History of data networks – Classification of Mobile data networks - CDPD System – Satellites in Mobile Communication: Satellite classification – Global Satellite Communication – Changeover from one satellite to other – Global Mobile Communication – Interferences in Cellular Mobile Communication.	**12**
IV	**MOBILE COMMUNICATION SYSTEM:** Important Parameters of Mobile Communication System – Mobile Internet: Working of Mobile IP – Wireless Network Security – Wireless Local Loop Architecture: Components in WLL – Problems in WLL – Modern Wireless Local Loop – Local Multipoint Distribution Service – Wireless Application Protocol.	**12**
V	**COMMUNICATION TECHNOLOGY:** WCDMA Technology and Fiber Optic Microcellular Mobile Communication – Ad hoc Network and Bluetooth technology – Intelligent Mobile Communication	**12**

	system-Power Delivery-Processing Gain – Fourth Generation Mobile Communication systems.	
	Total	**60**

Self Study	**Satellites in Mobile Communication** **Bluetooth Technology**

Textbooks

1. T.G.Palanivelu,R.Nakkeeran, (2009). "Wireless and Mobile Communication",PHI Limited.
2. Jochen Schiller, (2007). Mobile Communications.,(2nd edition),Pearson Education.

Reference Books

1. Asoke K Talukder, Hasan Ahmed,RoopaYavagal,(2010). *Mobile Computing*. TMH.

Web Resources

1. https://www.tutorialspoint.com/mobile_computing/index.htm
2. https://www.javatpoint.com/mobile-computing
3. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	2	3
CO2	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**10**	**14**	**15**
Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2.8**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER II

ELECTIVE COURSE III: c) BLOCKCHAIN TECHNOLOGY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP232EC3	4	-	-	-	3	4	60	25	75	100

Pre-requisite:

Basics of Blockchain and Crypto Currency

Learning Objectives:

1. Understand the fundamentals of blockchain and cryptocurrency.
2. Identify problems & challenges posed by Block Chain

Course Outcomes

On the successful completion of the course, student will be able to:		
1	demonstrate blockchain technology and crypto currency	**K1,K2**
2	understand the mining mechanism in blockchain	**K2**
3	apply and identify security measures, and various types of services that allow people to trade and transact with bitcoins	**K3,K4**
4	apply and analyze Blockchain in health care industry	**K4,K5**
5	analyze security, privacy, and efficiency of a given Blockchain system	**K5,K6**

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

Units	Contents	No. of Hours
I	**INTRODUCTION:** Introduction to Blockchain - The big picture of the industry – size, growth, structure, players. Bitcoin versus Cryptocurrencies versus Blockchain - Distributed Ledger Technology (DLT). Strategic analysis of the space – Blockchain platforms, regulators, application providers. The major application: currency, identity, chain of custody.	**12**
II	**NETWORKAND SECURITY:** Advantage over conventional distributed database, Blockchain Network- Certificate Authorities-Adding Network Administrators- Consortium-Mining Mechanism-Distributed Consensus-Blockchain 1.0, 2.0 and 3.0 – transition, advancements and features. Privacy-Security issues in Blockchain.	**12**
III	**CRYPTOCURRENCY:** Cryptocurrency - History, Distributed Ledger, Bitcoin protocols -Symmetric-key cryptography - Public-key cryptography - Digital Signatures -High and Low trust societies - Types of Trust model: Peer-to-Peer, Leviathan, and Intermediary. Application of Cryptography to Blockchain	**12**
IV	**CRYPTO CURRENCY REGULATION:** Cryptocurrency Regulation-Stakeholders, Roots of Bitcoin, Legal views- exchange of cryptocurrency-Foreign Exchange Market-Medium of exchange-Black Market-Global Economy. Cyrpto economics–assets, supply and demand-inflation and deflation – Regulation	**12**
V	**CHALLENGESINBLOCKCHAIN:** Opportunities and challenges in Block Chain – Application of block chain: Industry 4.0 – machine to machine communication –Datamanagementinindustry4.0–future prospects. Block chain in Health 4.0 - Blockchain properties - Healthcare Costs - Healthcare Quality - Healthcare Value - Challenges for using blockchain for	**12**

	healthcare data	
	Total	**60**

Self Study	Types of Trust model Blockchain properties

Textbooks

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

Reference Books

1. Satoshi Nakamoto,"*Bitcoin: APeer-to-PeerElectronicCashSystem*"
2. Rodrigoda Rosa Righi, AntonioMarcos Alberti, MadhusudanSingh,2020,"*Blockchain Technology for Industry 4.0*" Springer ..

Web Resources

1. https://www.javatpoint.com/blockchain-tutorial
2. https://www.tutorialspoint.com/blockchain/index.htm
3. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs01/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	2	3
CO2	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**10**	**14**	**15**
Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2.8**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER II

ELECTIVE COURSE IV: a) ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP232EC4	4	-	-	-	3	4	60	25	75	100

Pre-requisite:

Basics of AI & an Introduction about ML

Learning Objectives:

1. Enable the students to learn the basic functions of AI, Heuristic Search Techniques.
2. Provide knowledge on concepts of Representations and Mappings and Predicate Logic.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	demonstrate AI problems and techniques	**K1,K2**
2	understand machine learning concepts	**K2,K3**
3	apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning	**K3,K4**
4	analyze the impact of machine learning on applications	**K4,K5**
5	analyze and design a real world problem for implementation and understand the dynamic behavior of a system	**K5,K6**

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

Units	Contents	No. of Hours
I	**INTRODUCTION:** Introduction: History of AI - AI Problems - Al techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems - Problem Characteristics - Issues in design of Search - Building AI Systems – Intelligent Agents.	**12**
II	**SEARCH TECHNIQUES:** Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis. Knowledge representation issues: Representations and mappings -Approaches to Knowledge representations -Issues in Knowledge representations - Frame Problem.	**12**
III	**PREDICATE LOGIC:** Using Predicate logic: Representing simple facts in logic - Representing Instance and Is a relationships - Computable functions and predicates - Resolution - Natural deduction. Representing knowledge using rules: Procedural Vs Declarative knowledge- Logic programming Forward Vs Backward reasoning -Matching-Control knowledge.	**12**
IV	**MACHINE LEARNING:** Understanding Machine Learning: What Is Machine Learning?-Defining Big Data- Big Data in Context with Machine Learning-The Importance of the Hybrid Cloud-Leveraging the Power of Machine Learning-The Roles of Statistics and Data Mining with Machine Learning-Putting Machine Learning in Context-Approaches to Machine Learning.	**12**

V	**APPLICATIONS OF MACHINE LEARNING:** Applying Machine Learning: Getting Started with a Strategy – Understanding Machine Learning Techniques – Tying Machine Learning Methods to Outcomes – Applying Machine Learning to Business Needs. Looking Inside Machine Learning: The Impact of Machine Learning on Applications-Data Preparation-The Machine Learning Cycle.	**12**
	Total	**60**
Self Study	**Logic Programming The Machine Learning Cycle**	

Textbooks

1. Elaine Richand Kevin Knight, (1991). *Artificial Intelligence*. Tata McGraw Hill Publishers company Pvt Ltd, (2nd edition).
2. George FLuger, 2002,"*Artificial Intelligence*",4thEdition, Pearson Education Publ,

Reference Books

1. Judith Hurwitz,Daniel Kirsch. *Machine ,"Learning For Dummies*®", IBM Limited Edition
2. Dr. Dheeraj Mehrotra, "*Basics of Artificial Intelligence And Machine Learning"* Notion Press
3. Mariya Yao, Adelyn Zhou, 2018. Marlene Jia, "*Applied Artificial Intelligence: A Handbook for Business Leaders"*
4. Peter Norvig and Stuart J. Russell, "*Artificial Intelligence: A Modern Approac*h", Third Edition.
5. Glaé Bassens, Grant Beyleveld, and Jon Krohn, 2019. "*Deep Learning Illustrated is a visual, interactive introduction to artificial intelligence***"** published by Pearson's Addison-Wesley.

Web Resources

1. https://www.ibm.com/downloads/cas/GB8ZMQZ3
2. https://www.javatpoint.com/artificial-intelligence-tutorial
3. https://nptel.ac.in/courses/106/105/106105077/
4. https://books.google.co.in/books/about/Applied_Artificial_Intelligence.html?id=qZ5vuAEACAAJ&source=kp_cover&redir_esc=y
5. https://people.engr.tamu.edu/guni/csce421/files/AI_Russell_Norvig.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	2	3
CO2	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**10**	**14**	**15**
Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2.8**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER II

ELECTIVE COURSE IV: b) WEB SERVICES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP232EC5	4	-	-	-	3	4	60	25	75	100

Pre-requisite:

Basics of Distributed Computing

Learning Objectives:

1. Present the Web Services , Building real world Enterprise applications using Web Services with Technologies XML, SOAP , WSDL , UDDI
2. Get overview of Distributed Computing,XML,and its technologies

Course Outcomes

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

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

Units	Contents	No. of Hours
I	**INTRODUCTION:** Introduction to web services – Overview of Distributed Computing- Evolution and importance of web services-Industry standards, Technologies and concepts underlying web services-Web services and enterprises-web services standards organization-web services platforms.	**12**
II	**XML FUNDAMENTALS:** XML Fundamentals – XML documents: XML Syntax, XML Elements, XML Attributes, XML Namespaces – XML DOM - Validation of XML Documents - XML DTD - XML Schema – XML Server - Processing XML – XML XSLT – XML XQuery – XML XLink.	**12**
III	**SOAP MODEL:** SOAP: The SOAP model- SOAP messages-SOAP encoding- WSDL: WSDL structure- interface definitions-bindings-services-Using SOAP and WSDL- UDDI: About UDDI- UDDI registry Specification-Core data structures-Accessing UDDI	**12**
IV	**TECHNOLOGIES AND STANDARDS:** Advanced web services technologies and standards: Conversations overview-web services conversation language- WSCL interface components. Workflow: business process management- workflows and workflow management systems Security: Basics-data handling and forwarding- data storage-errors-Web services security issues.	**12**
V	**QUALITYOFSERVICE:** Quality of Service: Importance of QoS for web services- QoS metrics-holes-design patterns- QoS enabled web services- QoS enabled applications. Web services management-web services standards and future trends..	**12**
	Total	**60**

Self Study	**Logic Programming** **The Machine Learning Cycle**

Textbooks

1. Sandeep Chatterjee, James Webber, "*Developing Enterprise Web Services: An Architects Guide*", Prentice Hall, Nov 2003.

2. Keith Ballinger, "*NET Web services: Architecture and Implementation with .Net*", Pearson Education, First Edition, Feb 2003

Reference Books

1. Ramesh Nagappan,Feb 2003,"*Developing Java Web Services: Architecting and developing secure Web Services Using Java*", John Wiley and Sons, first Edition .

2. Eric A Marks and Mark J Werrell, March 2003, "*Executive Guide to Web services*", John Wileyand sons.

3. Anne Thomas Manes,"*Web Services: Amanagers Guide*",Addison Wesley,June2003.

Web Resources

1. https://www.tutorialspoint.com/webservices/index.htm
2. https://www.javatpoint.com/web-services-tutorial
3. https://www.btechguru.com/training--programming--xml--web-services--web-services-part-1-video-lecture--11801--24--147.html

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	2	3
CO2	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**10**	**14**	**15**
Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2.8**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER II

ELECTIVE COURSE IV: c) ROBOTIC PROCESS AUTOMATION FOR BUSINESS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP232EC6	4	-	-	-	3	4	60	25	75	100

Pre-requisite:

Basics of Robots & its Applications

Learning Objectives:

1. Learn the concepts of RPA ,its benefits ,types and models.
2. Gain the knowledge in application of RPA in Business Scenarios.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	demonstrate the benefits and ethics of RPA	**K1,K2**
2	understand the Automation cycle and its techniques	**K2**
3	draw inferences and information processing of RPA	**K3,K4**
4	implement& Apply RPA in Business Scenarios	**K5**
5	analyze on Robots& leveraging automation	**K5,K6**

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

Units	Contents	No. of Hours
I	**INTRODUCTION:** Introduction to RPA -Overview of RPA -Benefits of RPA in a business environment -Industries & domains fit for RPA - Identification of process for automation - Types of Robots - Ethics of RPA & Best Practices - Automation and RPA Concepts - Different business models for implementing RPA -Centre of Excellence –Types and their applications -Building an RPA team -Approach for implementing RPA initiatives.	12
II	**AUTOMATION:** RoleofaBusinessManagerinAutomationinitiatives-SkillsrequiredbyaBusinessManagerfor successful automation - The importance of a Business Manager in automation - Analyzing different business processes - Process Mapping frameworks - Role of a Business Manager in successful implementation – Part 1 - Understanding the Automation cycle – First 3 automation stages and activities performed by different people.	12
III	**AUTOMATIONIMPLEMENTATION:** Evaluating the Automation Implementation Detailed description of last 3 stages and activities performed by different people - Role of a Business Manager in successful completion – Part 2 - Activities to be performed post-implementation - Guidelines for tracking the implementation success - Metrics/Parameters to be considered for gauging success - Choosing the right licensing option - Sending emails - Publishing and Running Workflows.	12
IV	**ROBOT:** Ability to process information through scopes/systems - Understand the skill of information processing and its use in business - Leveraging automation - Creating a Robot - New Processes. Establish causality by variable behavior - Understand the skill of drawing inference or	12

	establishing causality by tracking the behavior of a variable as it varies across time/referenced variable - Leveraging automation for this skill - Robot & new process creation.	
V	**ROBOTSKILL:** Inference from snapshots of curated terms – Omni-source data curation - Multisource trend tracking - Understand the skill of drawing inference from the behavior of curated terms by taking snapshots across systems in reference to time/variable(s) - Leveraging automation for this skill – Robot creation and new process creation for this skill.	**12**
	Total	**60**

Self Study	Publishing and Running Workflows Multi source trend tracking

Textbooks

1. Alok Mani Tripathi, 2018." *Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool*" Packet Publishing Limited March
2. TomTaulli February 2020,"*The Robotic Process Automation Handbook*" A press,

Reference Books

1. Steve Kaelble 2018, "*Robotic Process Automation*" John Wiley &Sons,Ltd.,

Web Resources

1. https://www.tutorialspoint.com/uipath/uipath_robotic_process_automation_introduction.htm
2. https://www.javatpoint.com/rpa
3. https://onlinecourses.nptel.ac.in/noc19_me74/preview

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	2	3
CO2	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**10**	**14**	**15**
Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2.8**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER II

SKILL ENHANCEMENT COURSE I: PRACTICAL: DATA MINING LAB USING R

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP232SE1	-	-	4	-	2	4	60	25	75	100

Pre-requisite:

Basics of DM Algorithms & R Programming.

Learning Objectives:

1. To enable the students to learn the concepts of Data Mining algorithms namely classification, clustering, regression.
2. To understand & write programs using the DM algorithms.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	write programs using R for Association rules, Clustering techniques	**K1,K2**
2	implement data mining techniques like classification, prediction	**K2,K3**
3	use different visualizations techniques using R	**K4,K5**
4	apply different data mining algorithms to solve real world applications	**K5,K6**

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

Units	List of Exercises	No. of Hours
	Implement the following problems using Python Programming 1. Implement Apriori algorithm to extract association rule of data mining. 2. Implement k-means clustering technique. 3. Implement any one Hierarchical Clustering. 4. Implement Classification algorithm. 5. Implement Decision Tree. 6. Linear Regression. 7. Data Visualization.	**60**

Textbooks

1. Margaret H. Dunham, (2003). *Data Mining: Introductory and Advanced Topics*. Pearson education.
2. C.S.R. Prabhu, *Data Warehousing Concepts, Techniques, Products and Applications*, PHI, (2nd edition)

Reference Books

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

Web Resources

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	2	3
CO2	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**10**	**14**	**15**
Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2.8**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER I & II
LIFE SKILL TRAINING I: ETHICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PG23LST1	1	-	-	-	1	1	15	50	50	100

Pre-requisites: Value education-its purpose and significance in the present world

Learning Objectives

1. To familiarize students with values of the individual, society, culture, one's own health and life philosophy,
2. To impart knowledge of professional ethical standards, codes of ethics, obligations, safety, rights, and other worldwide challenges.

Course Outcomes

Cos	On completion of this course the student will be able to	
1	understand deeper insight of the meaning of their existence.	K1
2	recognize the philosophy of life and individual qualities	K2
3	acquire the skills required for a successful personal and professional life.	K3
4	develop as socially responsible citizens.	K4
5	create a peaceful, communal community and embrace unity.	K3

Unit	Contents	No. of Hours
I	**Goal Setting:** Definition - Brainstorming Session – Setting Goals – Few components of setting goals.	3
II	**Group Dynamics:** Definition - Nature of Groups – Types of Groups – Determinants of group behavior	3
III	**Conflict Resolution:** Definition – What is a conflict resolution – Why should conflicts be resolved? - Lessons for life	3
IV	**Decision Making:** Definition – 3C's of decision making – Seven Steps to effective decision making – Barriers in effective decision making	3
V	**Anger Management:** Effects of anger – Tips to reduce anger – Anger warning signs – Identify your triggers – Ways to cool down your anger.	3
TOTAL		15
Self-Study : Salient values for life, Human Rights, Social Evils and how to tackle them, Holistic living, Duties and responsibilities.		

Textbooks

Life Skill Training – I Ethics, Holy Cross College (Autonomous), Nagercoil

Reference Books

1. Holy Cross College (Autonomous), Nagercoil (2007). Foundation Course Life's Challenges. Sipca Computers.
2. Mathew, Sam (2010). Self Help Life Book. Opus Press Publisher.
3. Swati Mehrotra. (2016). Inspiring Souls Moral Values and Life Skills (1st ed.) [English]. Acevision Publisher Pvt. Ltd.
4. Irai Anbu, v. (2010, August). Random Thoughts (1st ed.) [English]. THG Publishing Private Limited, 2019.
5. Holy Cross College (Autonomous), Nagercoil (2007). Foundation Course Life's Challenges. Sipca Computers.

Web Resources

1. https://positivepsychology.com/goal-setting-exercises/
2. https://www.gov.nl.ca/iet/files/CCB_GroupDynamicsGuide.pdf
3. https://en.wikipedia.org/wiki/Conflict_resolution
4. https://asana.com/resources/decision-making-process
5. https://www.mayoclinic.org/healthy-lifestyle/adult-health/in-depth/anger-management/art-20045434

SEMESTER III

CORE COURSE V: DIGITAL IMAGE PROCESSING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP233CC1	6	-	-	-	5	6	90	25	75	100

Pre-requisite

Basics of Image Processing

Learning Objectives

1. To learn basic image processing techniques for solving real problems.
2. To learn image compression and Segmentation procedures.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	understand the fundamentals of Digital Image Processing	**K1,K2**
2.	understand the mathematical foundations for digital image representation, image acquisition, image transformation, and image enhancement	**K2,K3**
3.	apply, design and implement and get solutions for digital image processing problems	**K3,K4**
4.	apply the concepts of filtering and segmentation for digital image retrieval	**K3,K5**
5.	explore the concepts of Multi-resolution process and recognize the objects in an efficient manner	**K5,K6**

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

Units	Contents	No. of Hours
I	**Introduction:** What is Digital image processing – the origin of DIP Examples of fields that use DIP – Fundamentals steps in DIP – Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition – Image sampling and Quantization – Some Basic relationship between Pixels – Linear and Nonlinear operations.	**18**
II	**Image Enhancement:** Image Enhancement in the spatial domain: Background – some basic Gray level Transformations – Histogram Processing – Histogram Equalization - Enhancement using Arithmetic / Logic operations: Image Subtraction - Image Averaging – Basics of spatial filtering – Smoothing spatial filters: Smoothing Linear Filters – Sharpening spatial filters – Combining spatial enhancement methods.	**18**
III	**Image Restoration:** A model of the Image Degradation / Restoration Process – Noise models –Restoration is the process of noise only – Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear, Portion – Invariant Degradations – Estimating the degradation function – Inverse filtering – Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.	**18**
IV	**Image Compression:** Image Compression Fundamentals–Coding Redundancy - Interpixel Redundancy - Image compression models: The source encoder and decoder - Channel Encoder and Decoder - Elements	**18**

	of Information Theory - Measuring Information - The Information Channel - Fundamental Coding Theorems – Error Free compression – Visible length Coding - LZW Coding - Lossy compression- Lossy Predictive Coding – Image compression standards.	
V	**Image Segmentation:** Segmentation -Detection and Discontinuities – Point detection Line Detection - Edge Detection - Edge Linking and Boundary deduction – Local Processing- Global Processing – Region-Based segmentation – Basic Formulation - Region Growing, Splitting and Merging – Color fundamentals-color models-RGB color model-CMY and CMYK color models.	**18**
	Total	**90**

Self-study	Geometric Transformations,Threshholding

Textbooks

1. Rafael C. Gonzalez, Richard E. Woods, " *Digital Image Processing*", Second Edition, PHI/ Pearson Education.
2. B. Chanda, D. Dutta Majumder, 2003 , "*Digital Image Processing and Analysis*", PHI.

Reference Books

1. Nick Efford, 2004, "*Digital Image Processing a practical introducing using Java*", Pearson Education,
2. David A.Forsyth ,"*Computer Vision: A Modern Approach",* Second Edition, Pearson Education.
3. Annadurai, "*Fundamentals of Digital Image Processing*"
4. Ralph Gonzalez, Richard Woods , Steven Eddins ",*Digital Image Processing Using Matlab*, Second Edition
5. John D. Kelleher, 2019, "*DEEP LEARNING (The MIT Press Essential Knowledge series)".*

Web Resources

1. https://nptel.ac.in/courses/117/105/117105135/
2. https://www.tutorialspoint.com/dip/index.htm
3. https://www.javatpoint.com/digital-image-processing-tutorial
4. https://www.v7labs.com/blog/image-processing-guide
5. https://in.mathworks.com/discovery/image-segmentation.html

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	1	3	3	3	3
CO4	3	3	2	3	3	2	3	3	3	2	3	2
CO5	3	2	2	2	2	2	2	2	2	1	2	1
TOTAL	**15**	**14**	**13**	**15**	**15**	**13**	**15**	**12**	**14**	**12**	**14**	**12**
AVERAGE	**3**	**2.8**	**2.6**	**3**	**3**	**2.6**	**3**	**2.4**	**2.8**	**2.4**	**2.8**	**2.4**

3 – Strong, 2- Medium, 1- Low

SEMESTER III

CORE COURSE VI: CLOUD COMPUTING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP233CC2	6	-	-	-	5	6	90	25	75	100

Pre-requisite

Basics of Cloud and its applications

Learning Objectives

1. Gain knowledge on cloud computing, cloud services, architectures and applications.
2. Enable the students to learn the basics of cloud computing with real time usage.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	understand the concepts of cloud and its architecture	**K1, K2**
2.	use and analyse the architecture and services of cloud	**K3, K4**
3.	manage schedules, events and projects	**K2,K4**
4.	collaborate cloud for Event & Project Management	**K4, K5**
5.	apply and create the cloud simulator tools and virtual machines	**K3, K6**

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

Units	Contents	No. of Hours
I	**INTRODUCTION:** Beyond the Desktop: An Introduction to Cloud Computing- Working of cloud computing-Companies in the Cloud- Essential characteristics, Architectural Influences, Technological Influences, and Operational Influences. Cloud Computing Security challenges: Security Policy Implementation, Policy Types, and Computer Security Incident Response Team (CSIRT).	**18**
II	**CLOUD ARCHITECTURE**: Layers and Models Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers- Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds – Pros and Cons of Cloud computing.	**18**
III	**CLOUD COMPUTING FOR EVERYONE**: Cloud Computing for the Family-Centralizing email communications- Cloud computing for the community- Collaborating on schedules-Collaborating on group projects and events- Cloud Computing for corporation- Managing schedules- Managing Projects-Managing Contact Lists- Collaborations-Presenting and accessing on the road.	**18**
IV	**USING CLOUD SERVICES**: Collaborating on Calendars, Schedules and Task Management-Exploring online scheduling and planning- Collaborating on event management- Collaborating on contact management-Collaborating on project management-Collaborating on word processing, spreadsheets, and databases.	**18**
V	**CLOUD SIMULATORS**- CloudSim and GreenCloud Introduction to Simulator, understanding CloudSim simulator- CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim-Introduction to GreenCloud- Basics of VMWare-Advantages of VMware virtualization-using Vmware workstation- creating virtual machines-understanding virtual machines.	**18**
	Total	**90**

Self-study	Collaborating on project management

Textbooks

1. Michael Miller, 2009. *Cloud Computing*, Pearson Education, New Delhi.
2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security A comprehensive Guide to secure Cloud Computing" Wiley.
3. James E Smith, Ravi Nair, 2006. *Virtual Machines*, Morgan Kaufmann Publishers.

Reference Books

1. Anthony T Velte, Toby J Velte, Robert Elsenpeter, 2010. *Cloud Computing : A Practical Approach*, Tata McGraw-Hill.
2. David E.Y. Sarna, 2011. *Implementing and Developing Cloud Application*, CRC press.
3. V. K. Pachghare , 2016. *Cloud Computing*, PHI Learning Pvt Ltd.
4. Barrie Sosinsky, 2016. *Cloud Computing Bible*,Wiley Publishing, Inc.
5. Rajkumar Buyya, Christian Vechhiola, S. ThamaraiSelvi, 2016. *Mastering Cloud Computing*, McGraw Hill Education(India) Private Limited.

Web Resources

1. https://nptel.ac.in/courses/106/105/106105167/
2. https://www.tutorialspoint.com/cloud_computing/index.htm
3. https://www.javatpoint.com/cloud-computing-tutorial
4. https://www.geeksforgeeks.org/architecture-of-cloud-computing/
5. https://cloud.google.com/learn/what-is-cloud-architecture

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	2	3	3	3	2	3
CO3	3	3	3	2	3	3	3	2	3	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	2	1	3	3	3	3	3	3
TOTAL	**11**	**15**	**13**	**14**	**13**	**13**	**13**	**14**	**14**	**14**	**12**	**14**
AVERAGE	**2.2**	**3**	**2.6**	**2.8**	**2.6**	**2.6**	**2.6**	**2.8**	**2.8**	**2.8**	**2.4**	**2.8**

3 – Strong, 2- Medium, 1- Low

SEMESTER III

CORE LAB COURSE III: DIGITAL IMAGE PROCESSING LAB Using MATLAB

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP233CP1	-		6	-	5	6	90	25	75	100

Pre-requisite:

Basic Programming of Image Processing and introduction to MATLAB

Learning Objectives:

1. To understand the basics of Digital Image Processing fundamentals, image enhancement and image restoration techniques
2. To enable the students to learn the fundamentals of image compression and segmentation

Course Outcomes

On the successful completion of the course, student will be able to:		
1	write programs in MATLAB for image processing using the techniques	K1, K2
2	able to implement image enhancements and restoration techniques	K2, K3
3	capable of using compression techniques in an Image	K3, K4
4	able to manipulate the image and segment it	K4, K5
5	able to implement the image processing techniques using MATLAB	K5, K6

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

Contents	Total No. of Hours
1. Implement Image enhancement Technique. 2. Histogram Equalization 3. Image Restoration. 4. Implement Image Filtering. 5. Edge detection using Operators (Roberts, Prewitts and Sobel soperators) 6. Implement image compression. 7. Image Subtraction 8. Boundary Extraction using morphology. 9. Image Segmentation	90

Textbooks

1. Rafael C. Gonzalez, Richard E. Woods, " *Digital Image Processing*", Second Edition, PHI/Pearson Education.
2. B. Chanda, D. Dutta Majumder, 2003 , "*Digital Image Processing and Analysis*", PHI.

Reference Books

1. Nick Efford, 2004, "*Digital Image Processing a practical introducing using Java*",
2. Pearson Education,David A.Forsyth ,"*Computer Vision: A Modern Approach",* Second Edition, Pearson Education.
3. Annadurai, "*Fundamentals of Digital Image Processing*"
4. Ralph Gonzalez, Richard Woods , Steven Eddins, 2003. ",*Digital Image Processing Using Matlab,* Second Edition
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Web Resources

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2. https://www.tutorialspoint.com/dip/index.htm
3. https://www.javatpoint.com/digital-image-processing-tutorial
4. https://www.v7labs.com/blog/image-processing-guide
5. https://in.mathworks.com/discovery/image-segmentation.html

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO 2	PO3	PO4	PO5	PO 6	PO 7	PSO1	PSO 2	PSO 3	PSO 4	PSO5
CO1	3	3	2	3	2	3	3	2	2	2	3	2
CO2	3	3	2	2	3	3	3	3	2	3	2	3
CO3	2	2	3	3	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	2	2	2	3	3	3	1
CO5	3	3	2	3	2	2	2	3	1	2	3	2
Total	**14**	**14**	**11**	**14**	**11**	**13**	**13**	**11**	**9**	**13**	**14**	**9**
Average	**2.8**	**2.8**	**2.3**	**2.8**	**2.2**	**2.6**	**2.6**	**2.3**	**2.1**	**2.6**	**2.8**	**7.5**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER III

ELECTIVE COURSE V: a) INTRODUCTION TO RESEARCH METHODOLOGY IN COMPUTER SCIENCE

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP233EC1	4	-	-	-	3	4	60	25	75	100

Pre-requisite

To understand the importance of Research Methodology

Learning Objectives

1. To ensure the reliability and validity of experiments
2. To make use of computer aids to analyze the data, prepare reports and presentations

Course Outcomes

On the successful completion of the course, students will be able to:		
1	perform exploratory data analysis	**K1, K2**
2	select and apply different research approaches and methodologies	**K2, K3**
3	construct and document an appropriate research design	**K3, K4**
4	validate the reliability	**K5, K6**
5	apply the appropriate computer tools in each stage of research	**K6**

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

Units	Contents	No. of Hours
I	**Postgraduate Research:** Introduction- The Concept of Research - Research Types –Research Attributes-Qualities of Research- Research Cycle- Types of Research Applicable in Information Systems and Cybersecurity Research -Descriptive Research- Exploratory Research- Applied Research - Experimental Research - Theoretical Research	**12**
II	**Computer Science (CS), Information Systems (IS) and Cybersecurity (CY) Research:** Introduction - CS Research - IS Research - Cybersecurity (CY) Research- The Intersection of CS, IS and CY Research- Designing the Research Proposal- Research Proposal Visualization - Writing a Convincing Research Proposal	**12**
III	**Mind Mapping to Visualize the Research Design:** Introduction - Strategy Approach- Design Project Versus Research Project- Developing the Flow of Ideas - Mind Mapping Applied to Research Design-The Concept of Mind Mapping - Mind Map Use Cases and Benefits - Application of Mind Mapping to Setting Out the Research Tasks.	**12**
IV	**Foundational Research Writing:** Foundational Research Tools and Techniques - Writing the Annotated Bibliography - Reading and Writing with Purpose - Critical Thinking and Analysis - Background Discussion - Practice-Oriented Background and Review of Trends - Theoretical Background - Conceptual Background- Literature Review and Analytical Framework- Structuring and Organizing the Literature Review	**12**
V	**Design and Methodology:** Introduction- Research Design - Types of Research Design- Requirements Engineering - Research Methodology - Quantitative and Qualitative methodology - Overview of Data Collection	**12**

	Techniques and Processes -Types of Data Collection - Data Organization, Selection and Processing - Data Presentation and Data Visualization - Data Analysis	
	Total	**60**

Self-study	The Concept of Mind Mapping

Textbooks

1. Uche M. Mbanaso , Lucienne Abrahams, Kennedy Chinedu Okafor, 2023."*Research Techniques for Computer Science, Information Systems and Cybersecurity*" Springer.
2. C R Kothari, Paperback, 2014. "*Research Methodology: Methods and Techniques*"

Reference Books

1. John W Creswel, 2014. "*Research Design: Qualitative, Quantitative, and Mixed Methods Approaches"*, 3rd Edition.
2. S.C. Gupta & V.K. Kapoor, 2014. "*Fundamentals of Mathematical Statistics"*, Sultan Chand & Sons, New Delhi,
3. S.C. Gupta & V.K. Kapoor,2014. " *Fundamentals of Applied Statistics"*, Sultan Chand & Sons.
4. Sampath.K, Panneerselvam.A & Santhanam.S ,1984. "*Introduction to Educational Technology"* (2nd Revised Ed.) New Delhi: Sterling Publishers
5. R. Paneerselvam, 2014. "*Research Methodology*" 2nd Edition, PHI,

Web Resources

1. https://ccsuniversity.ac.in/bridge-library/pdf/Research-Methodology-CR-Kothari.pdf
2. https://books.google.co.in/books/about/Research_Methodology.html?id=hZ9wSHysQDYC&redir_esc=y
3. https://www.researchgate.net/publication/323867128_Research_Methods_in_Computer_Science
4. https://southcampus.uok.edu.in/files/link/downloadlink/rm%20u1%20p1.pdf
5. http://wiki.icmc.usp.br/images/c/cf/Mpc.01-Introduction_EN.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	2	3	3	3	2	3
CO3	3	3	3	2	3	3	3	2	3	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	2	1	3	3	3	3	3	3
TOTAL	**11**	**15**	**13**	**14**	**13**	**13**	**13**	**14**	**14**	**14**	**12**	**14**
AVERAGE	**2.2**	**3**	**2.6**	**2.8**	**2.6**	**2.6**	**2.6**	**2.8**	**2.8**	**2.8**	**2.4**	**2.8**

3 – Strong, 2- Medium, 1- Low

SEMESTER III
ELECTIVE COURSEV: b) DATA SCIENCE AND ANALYTICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP233EC2	4	-	-	-	3	4	60	25	75	100

Pre-requisite

Basics of Data Science and its Applications

Learning Objectives

1. Introduce the students to data science, big data and its ecosystem.
2. To explore the programming language R, with respect to the data mining algorithms

Course Outcomes

On the successful completion of the course, students will be able to:		
1	understand the concept to data science and its techniques	**K1, K2**
2	review data analytics	**K2, K3**
3	apply and determine appropriate Data Mining techniques using R to real time applications	**K3, K4**
4	analyze and evaluate clustering algorithms	**K5, K6**
5	create a machine learning environment using AI	**K6**

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

Units	Contents	No. of Hours
I	**INTRODUCTION:** Introduction of Data Science: Benefits and uses of data science and big data–facets of data-data science process-Big data ecosystem and data science. The Data Science process: Defining research goals and creating a project charter -retrieving data-cleansing, integrating and transforming data, exploratory data analysis-Build the models-Presenting findings and building applications on top of them- Machine Learning: Types of Machine learning	**12**
II	**BASICS OF DATA ANALYTICS**: Introducing to Big data analytics-Overview-Phases of life cycle-review of data analytics-Advanced data Analytics-technology and tools Database Analytics: SQL Essentials,In-Database Text Analytics - Advanced SQL	**12**
III	**DATA ANALYTICS USING R:** Basic Data Analytics using R: R Graphical User Interfaces – Data Import and Export – Attribute and Data Types – Descriptive Statistics – Exploratory Data Analysis –Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – Data Exploration Versus Presentation.	**12**
IV	**CLUSTERING:** Overview of Clustering: K-means – Use Cases – Overview of the Method – Perform a K-means Analysis using R –Classification – Decision Trees – Overview of a Decision Tree – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Tree in R – Bayes' Theorem – Naive Bayes Classifier – Smoothing – Naïve Bayes in R.	**12**
V	**ARTIFICIAL INTELLIGENCE:** Machine Learning and deep learning in data science-Clustering, association rules. Linear regression-logistic regression-Additional regression methods- K Nearest Neighbour algorithm	**12**
	Total	**60**

Self-study	K-means Analysis using R

Textbooks

1. Davy Cielen, Arno D.B. Meysman, Mohamed Ali, 2016. " *Introducing Data Science* ",Manning Publication
2. Baphana.R.M, Pankaj .B., 2015. "*Data science in big data analytics"* - John Wiley & Sons

Reference Books

1. Lars Nielson , 2015. "*A simple introduction to Data Science"*New street communications.
2. Introducing-Data-Science-Big-Data-Machine-Learning-and-more-using-Python-tools-2016. Pdf
3. Roger D. Peng, 2015, "*R Programming for Data Science*",LeanPublication.
4. Thomas P Glancy,2015. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data.
5. .Margaret H.Dunham, 2003. "*Data Mining: Introductory and Advanced Topics"* . Pearson Education.

Web Resources

1. https://www.tutorialspoint.com/python_data_science/index.htm
2. https://www.javatpoint.com/data-science
3. https://nptel.ac.in/courses/106/106/106106179/
4. https://cloud.google.com/learn/artificial-intelligence-vs-machine-learning
5. https://www.mygreatlearning.com/blog/difference-data-science-machine-learning-ai/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	2	3	3	3	2	3
CO3	3	3	3	2	3	3	3	2	3	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	2	1	3	3	3	3	3	3
TOTAL	**11**	**15**	**13**	**14**	**13**	**13**	**13**	**14**	**14**	**14**	**12**	**14**
AVERAGE	**2.2**	**3**	**2.6**	**2.8**	**2.6**	**2.6**	**2.6**	**2.8**	**2.8**	**2.8**	**2.4**	**2.8**

3 – Strong, 2- Medium, 1- Low

SEMESTER III
ELECTIVE COURSE V: c) SOFT COMPUTING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP233EC3	4	-	-	-	3	4	60	25	75	100

Pre-requisite

Basics of Neural Networks, Fuzzy Logic & its applications

Learning Objectives

1. To explore the benefits computing methodologies like neural networks, fuzzy logicand genetic algorithms.
2. To enable the students to develop hybrid systems for the industrial problems.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	implement machine learning through neural networks	**K1, K2**
2.	apply genetic algorithms to solve optimization problem	**K3, K4**
3.	understand fuzzy concepts and develop a fuzzy expert system to derive decisions	**K2, K6**
4.	learn and evaluate fuzzy logic and its applications.	**K3, K5**
5.	know the applications of soft computing to solve problems in varieties of application domains.	**K2, K6**

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

Units	Contents	No. of Hours
I	**NEURAL NETWORKS FUNDAMENTALS:** Artificial Neural Network: Basic Concepts of Neural networks - Evolution of Neural networks - Basic Models of Artificial neural network - Terminologies of ANN- McCulloch - Pitts Neuron - Linear separability - Hebb Network - Applications of Neural networks. Supervised learning Network: Introduction – Perceptron Networks – Adaptive Linear Neuron – Multiple Adaptive Linear Neurons – Back propagation Network.	**12**
II	**CATEGORIES OF NEURAL NETWORKS** Associative Memory Networks: Introduction – Training algorithms for pattern association – Auto associative Memory Network – Bidirectional Associative Memory – Hopfield Networks. Unsupervised Learning networks: Introduction – Fixed Weight Competitive Nets - Kohonen Self-Organizing Maps – Learning Vector Quantization – Adaptive Resonance Theory Network.	**12**
III	**BASIC CONCEPTS OF FUZZY SET** Introduction to Classical Sets and Fuzzy Sets: Introduction - Classical sets - Fuzzy Sets. Classical Relation and Fuzzy Relations: - Introduction - Cartesian product of a relation - Classical Relation - Fuzzy Relations. Membership Functions: Introduction - Features of Membership Functions – Fuzzification - Methods of Membership Value Assignments. Defuzzification: Introduction - Lambda-Cuts for Fuzzy Sets - Lambda-Cuts for Fuzzy Relations - Defuzzification Methods.	**12**
IV	**FUZZY ARITHMETIC AND DECISION MAKING** Fuzzy Arithmetic and Fuzzy Measures: Introduction - Fuzzy Arithmetic - Extension principles – Fuzzy measures. Fuzzy Rule Base and	**12**

	Approximate Reasoning: Introduction- Truth values and Tables in fuzzy logic - Fuzzy properties - Formation of rules- Decomposition of rules - Aggregation of Fuzzy rules - Fuzzy reasoning - Fuzzy Inference Systems. Fuzzy Decision Making-Fuzzy Logic Control Systems: Introduction - Control System Design - Architecture and Operation of FLC System.	
V	**GENETIC ALGORITHMS** Genetic Algorithms: Introduction - Basic Operators and Terminologies in GAs - Traditional Algorithm vs. Genetic Algorithm - Simple GA - General Genetic algorithm - The Schema Theorem - Classification of Genetic Algorithm - Applications of Genetic Algorithm. Applications of Soft Computing: Introduction - A Fusion approach of Multispectral Images with SAR Image for Flood area Analysis - Optimization of TSP using Genetic Algorithm Approach.	**12**
	Total	**60**

Self-study	Architecture and Operation of FLC System, Optimization of TSP using Genetic Algorithm Approach

Textbooks

1. S.N Sivanandam and S.N Deepa, 2007. *Principles of Soft Computing*, Wiley –India.
2. Samir Roy and Udit, 2013. *Introduction to Soft Computing*, Pearson India.

Reference Books

1. S. Rajasekaran and G.A.V. Pai, 2004. *Neural Networks, Fuzzy Logic and Genetic Algorithms*,PHI.
2. J. S. R. Jang, C. T. Sun and E. Mizutani, 2004. *Neuro-Fuzzy and Soft Computing*, PHI, Pearson Education.
3. S.N. Sivanandam, S. N. Deepa, 2007. *Introduction to Genetic Algorithms*, Springer.
4. Timothy J. Ross, 2000. *Fuzzy Logic with Engineering Application*, McGraw Hill.
5. Davis E. Goldberg, 2003. *Genetic Algorithms: Search, Optimization and Machine Learning*, Addison Wesley, N.Y.

Web Resources

1. https://en.wikipedia.org/wiki/Fuzzy_Sets_and_Systems
2. https://www.tutorialspoint.com/genetic_algorithms/genetic_algorithms_quick_guide.hm
3. https://www.techtarget.com/searchenterpriseai/definition/neural-network
4. https://www.analyticsvidhya.com/blog/2022/01/introduction-to-neural-networks/
5. https://fuzzy.cs.ovgu.de/ci/fs/fs_ch04_arithmetic.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	3	3	3	3	3	3	2	3	3	3	3	3
CO3	2	3	3	2	3	3	3	2	3	3	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	3	3	3	3	3	3	3
TOTAL	**13**	**15**	**14**	**14**	**15**	**15**	**13**	**14**	**14**	**15**	**13**	**14**
AVERAGE	**2.6**	**3**	**2.8**	**2.8**	**3**	**3**	**2.6**	**2.8**	**2.8**	**3**	**2.6**	**2.8**

3 – Strong, 2- Medium, 1- Low

SEMESTER - III

SKILL ENHANCEMENT COURSE II: CLOUD COMPUTING LAB

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP233SE1	-	-	3	-	2	3	45	25	75	100

Pre-requisite

Basic Programming using Cloud.

Learning Objectives:

1. Be familiar with developing web services/Applications in grid framework
2. Learn to run virtual machines of different configuration.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	configure various virtualization tools such as Virtual Box, VMware workstation.	**K1, K3**
2	design and deploy a web application in a PaaS environment.	**K2, K6**
3	learn how to simulate a cloud environment to implement new schedulers.	**K4**
4	install and use a generic cloud environment that can be used as a private cloud.	**K5, K6**
5	manipulate large data sets in a parallel environment.	**K3, K6**

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

	List of Exercises	No. of Hours
	Implement the following exercises: 1. Working with Google Drive to make spreadsheet and notes. 2. Install a C compiler in the virtual machine and execute a sample program. 3. Install Virtual box/VMware Workstation with different flavours of Linux or Windows OS on top of windows7 or 8. 4. Launch the web applications by using the GAE launcher. 5. Transfer files/folders from the host machine to the virtual machine. 6. Install Google App Engine. Create hello world app and other simple web applications using Python/Java. 7. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim. 8. To Connect Amazon Redshift with S3 bucket.	**45**

Textbooks

1. Michael Miller, 2009. "*Cloud Computing"*, Pearson Education, New Delhi.
2. John Rittinghouse & James Ransome, 2010. *"Cloud Computing, Implementation, Management and Strategy"*, CRC Press,
3. James E Smith, Ravi Nair, 2006. "*Virtual Machines"*, Morgan Kaufmann Publishers,

Reference Books

1. Anthony T Velte, Toby J Velte, Robert Elsenpeter, 2010. "*Cloud Computing : A Practical Approach"*, Tata McGraw-Hill.
2. David E.Y. Sarna, 2011. "*Implementing and Developing Cloud Application"*, CRC press.
3. V. K. Pachghare , 2016. "*Cloud Computing"*, PHI Learning Pvt Ltd.

4. Barrie Sosinsky, 2016. "*Cloud Computing Bible"*, Wiley Publishing, Inc.
5. Rajkumar Buyya, Christian Vechhiola, S. ThamaraiSelvi, 2016. "*Mastering Cloud Computing"*, McGraw Hill Education(India) Private Limited.

Web Resources

1. https://nptel.ac.in/courses/106/105/106105167/
2. https://www.tutorialspoint.com/cloud_computing/index.htm
3. https://www.javatpoint.com/cloud-computing-tutorial
4. https://www.geeksforgeeks.org/architecture-of-cloud-computing/
5. https://cloud.google.com/learn/what-is-cloud-architecture

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	3	2	3	2	3	3	3
CO2	2	3	3	3	3	3	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	2	3	3	3	3	3	3	3
TOTAL	**13**	**15**	**14**	**14**	**13**	**15**	**13**	**14**	**14**	**14**	**14**	**14**
AVERAGE	**2.6**	**3**	**2.8**	**2.8**	**2.6**	**3**	**2.6**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**

3 – Strong, 2- Medium, 1- Low

SEMESTER III
CORE RESEARCH PROJECT

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP233RP1	**-**	**-**	**-**	**5**	**4**	**5**	**75**	**25**	**75**	**100**

Pre-requisite:

Basic knowledge of algorithms, data structures, and software development.

Learning Objectives:

1. Acquire skills in data analysis using algorithms, programming languages, and software tools relevant to the data type.
2. Develop the ability to interpret computational results accurately, drawing conclusions based on evidence and relating them to the problem statement.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	learn to manage software projects, adhering to timelines and adapting to challenges.	**K1**
2.	understand ethical considerations in computing and collaborate effectively with peers and advisors	**K2**
3.	conduct independent software development, from formulating problems to implementing solutions	**K2**
4.	communicate their project outcomes through written reports and oral presentations	**K3, K5**
5.	develop critical thinking skills, analyzing software performance and drawing informed conclusions	**K4, K6**

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

Course Requirements:

1. All students are mandated to undertake a dissertation in their final year (III semester).
2. Students may pursue their project in another institution with consent from the Supervisor, HoD, and Principal, especially with MoU/Collaboration for project completion.

Evaluation Structure:

Evaluation	Marks	Month/ Date	Evaluator
Proposed title, review of literature and objectives.	-	3rd Week of III Semester	-
I Review	5	July	Supervisor
II Review	5	August	Supervisor
Report	15	September/ October	Supervisor
External – Dissertation *Viva-voce (individual & open)	40 35	October /November	Ext. examiner
Total marks	100		

- The presentation mode is by PowerPoint.

Dissertation Format:

1. Dissertation format specifications include:
   - Font: Times New Roman
   - Heading: Font size 14 (Bold, Uppercase)
   - Subheadings: Font size 12 (Bold, Lowercase), numbered (e.g., Introduction 1; Subheading 1.1; 1.2)

- Text content: Font size 12 (Normal)
- Citation: Follow specified citation formats for referencing other researchers' work.
- Line spacing: 1.5
- Margin: 2" left, 1" right, Gutter: 0.5
- Page numbering: Bottom middle alignment, excluding initial pages and references.
- Total pages: Minimum 30, Maximum 50 (excluding initial pages and references).
- Tables and Figures should be included subsequently after referring to them in the text.
- Chapters should be printed on both sides.

2. Project reports must be completed within the stipulated time.
3. Submission requirements include one soft copy (PDF format on CD) and three hard copies (soft binding) duly signed and endorsed by the Supervisor and the Head.

Structure of Project Report:

1. Initial Pages:
   - Title Page
   - Supervisor's Certificate
   - Candidate's Declaration (endorsed by Supervisor and HoD)
   - Acknowledgment (one-page, signed by the candidate)
   - Table of Contents
   - List of Abbreviations
   - List of Tables
   - List of Figures
   - Abstract
2. Main Body:
   - Introduction with **Background** and Objectives
   - Methodology
   - **System Design and Architecture**
   - Module Description
   - **Implementation**
   - Output
   - Conclusion and Future Work
   - References
3. Reference guidelines for various sources are provided for proper citation.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMEs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	2	3	3	3	3	3	3
TOTAL	**13**	**15**	**13**	**15**	**14**	**14**	**14**	**15**	**14**	**14**	**13**	**15**
AVERAGE	**2.6**	**3**	**2.6**	**3**	**2.8**	**2.8**	**2.8**	**3**	**2.8**	**2.8**	**2.6**	**3**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER III

SPECIFIC VALUE-ADDED COURSE: SET/NET COACHING FOR COMPUTER SCIENCE

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP233V01	2	-	-	-	1	2	30	25	75	100

Pre-requisite

Fundamental knowledge in problem solving skills.

Learning Objectives

1. To crack UGC NET and SET examinations.
2. To develop research and teaching attitude among the students.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	recall mathematical knowledge for reasoning, logical thinking and data interpretation and understand concept of internet	**K1, K2**
2	understand the sustainable goals and apply skills for higher education systems	**K2, K3**
3	analyze technical concepts in digital Systems, DBMS,operating systems etc.	**K4**
4	able to evaluate the estimation problems in software engineering	**K5**
5	learn skills to solve problems in computer science and can create new technology based on IoT	**K5, K6**

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

Units	Contents	No. of Hours
I	Teaching Aptitude-Research Aptitude-Comprehension-Quantitative and Qualitative Data- Logical Reasoning- ICT- Digital Initiatives in Higher Education- ICT: General Abbreviations and Terminology-Basics of the Internet, Intranet, E-Mail, Audio, And Video-conferencing.	**6**
II	People, Development, and Environment - Development and Environment – Higher Education System- Policies, Governance, and Administration-Professional, Technical, and Skill-Based Education-Institutions of Higher Learning in Ancient India.	**6**
III	Digital Logic Circuits and Components- Data Representation-Computer Graphics-2-D -Database Management Systems- Data Modeling-SQL-Data Warehousing-Data Mining-System Software-Operating Systems.	**6**
IV	Software Engineering- Software Quality- Estimation and Scheduling of Software Projects-Data Structures-Theory of Computation and Compilers-Regular Language Models.	**6**
V	Data Communication and Computer Networks- Functions of OSI and TCP/IP Layers-WWW-Mobile Technology-Cloud Computing-Platforms-Basics of IoT- ANN.	**6**
	Total	**30**

Textbooks

1. Kailash Chandra Gururani Surabhi Sharma, 2023. *UGC NET/SET/JRF Paper 2 Computer Science and Applications,* Arihant Publications.

2. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, 2004. *Operating System Concepts*, (7th

edition), John Wiley & Sons.

Reference Books

1. Anthony T Velte, Toby J Velte, Robert Elsenpeter, 2010. *Cloud Computing : A Practical Approach*, Tata McGraw-Hill.
2. Atul Kahate, 2017. *Cryptography and Network Security*, TMH.
3. Abraham Silberchatz, Henry F. Korth, S. Sudarshan, 2014. *Database Systems Concepts*, Sixth Edition, Tata McGraw Hill.
4. KVS Madaan, 2024. *NTA UGC NET Teaching and Research Aptitude*, Pearson.
5. Ramez Elmasri, Shamkant B. Navathe, 2014. "*Database Systems"*, Sixth edition, Pearson Education, New Delhi.

Web Resources

1. https://testbook.com/ugc-net-paper-1
2. https://careerendeavour.com/net-computer-science-study-material/
3. https://ugc-net.com/ugc-net-computer_science-notes.php
4. https://careerendeavour.com/wp-content/uploads/2022/07/ARTIFICIAL-INTELLIGENCE.pdf
5. https://careerendeavour.com/wp-content/uploads/2022/04/dbms.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMEs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	3	3	3	3	2	3
CO3	3	2	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	2	3	3	3	3	3	3
TOTAL	**13**	**14**	**13**	**15**	**14**	**14**	**14**	**15**	**14**	**14**	**13**	**15**
AVERAGE	**2.6**	**2.9**	**2.6**	**3**	**2.8**	**2.8**	**2.8**	**3**	**2.8**	**2.8**	**2.6**	**3**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER – III

SPECIFIC VALUE-ADDED COURSE: SCRIPT USING JAVASCRIPT

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP233V02	2	-	-	-	1	2	30	25	75	100

Pre-requisite:

Basics of JavaScript and its Concepts

Learning Objectives:

1. Students should grasp fundamental concepts such as variables, data types, operators, and control structures, enabling them to write basic JavaScript code.
2. Students should be able to understand and implement event-handling mechanisms in JavaScript, allowing them to respond to various user actions.

Course Outcomes

On the Successful Completion of the Course, the Student will be able to:		
1	recall fundamentals concepts of programming language and apply theoretical concepts to practical scenarios with confidence.	**K1,K3**
2	gain a deeper understanding of web development concepts such as DOM	**K2**
3	analyze a solid foundation for exploring other technologies such as front-end frameworks	**K4**
4	enhances and evaluate students' employability and opens up opportunities in the tech industry	**K5**
5	build a wide range of applications, from interactive websites to server-side applications..	**K6**

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

Units	Contents	No. of. Hours
I	**Basics of JavaScript:** JavaScript 101 – Setting Expectations and Prerequisites – Tools you Need – JavaScript Syntax – Two Types of Comments. **Variables, Identifiers, and Statements:** Writing Code – Variables – Identifiers – Statements – Keywords. **Practical Program:** Print Your Name and Class Using the Basic Syntax of JavaScript.	6
II	**Operators:** Types of Operators – Arithmetic – Assignment – String Concatenation Operators – Logical and Comparison Operators. **Datatype:** Number – Strings. **Arrays:** Arrays Index – Array Values Data Types.	6
III	**Inserting JavaScript Code:** Within the Page – Within your Server as a Separate File. **Conditional Statement:** if Statement – if-else Statement – Switch Statement. **Loops:** For – While – do-While. **Practical Program:** Print Car names Using "for" Loop	6
IV	**HTML DOM:** The Document Object – Document Properties and Methods – Navigating Through the Document Object Model – Parent and Child Concept. **HTML and CSS Editing Using JavaScript and DOM:** The getElementById method and innerHTML Property – innerHTML versus innerText versus textContent – JavaScript and CSS.	6

V	**Errors and Debugging:** Try, Catch, and Finally – Console.log - Debugging a Script - Add Debugging Code to the Programs - JavaScript Validator. **JavaScript in Bootstrap:** Data Bootstrap Attributes – Events. **Practical Program:** Interactive Color Changer Using JavaScript	**6**
	Total	**30**

Textbooks:

1. James Patterson, JamesPatrick, 2021." *A Beginner's Guide to Learning the Basics of JavaScript Programming"*, 3rd Edition.
2. Danny Goodman , Michael Morrison, Paul Novitski, Tia Gustaff Rayl,2019. **"***Javascript Bible Reference Book",* Wiley Publication.

Reference Books:

1. OREILLY, 2017. *Modular JavaScript Series Practical Modern JavaScript*, NicolasBevacqua.
2. Baptiste Pesquet, 2018. *The JavaScript Way A Modern Introduction to an Essential Language*,
3. Amin, 2016. *,JavaScript Functions, Closures, and Prototype in JavaScript,* AminMeyghani.
4. Elisabeth Robson,2014, *Head First JavaScript Programming: A Brain-Friendly Guide*, 3 rd ed.
5. Eric Elliott, 2014.*Programming JavaScript Applications*, published by O'Reilly Media, Inc.

Web Resources:

1. https://pdfroom.com/books/javascript-a-beginners-guide-to-learning-the-basics
2. of- javascript-programming/EjndOYp32Rq
3. https://nicholasjohnson.com/learn-to-code-with-javascript/book/
4. https://www.w3schools.com/js/default.asp
5. https://www.geeksforgeeks.org/javascript/
6. https://en.wikipedia.org/wiki/JavaScript

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMEs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	2	3	3	3	3	3	3
TOTAL	**13**	**15**	**15**	**15**	**14**	**14**	**15**	**15**	**14**	**14**	**13**	**15**
AVERAGE	**2.6**	**3**	**3**	**3**	**2.8**	**2.8**	**2.9**	**3**	**2.8**	**2.8**	**2.6**	**3**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER – III

SELF LEARNING COURSE: 3D ANIMATION AND MODELLING USING BLENDER

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP233SL1	-	-	-	-	1	-	-	25	75	100

Pre-requisite:

Basics of 3D Animation and Modelling using Blender

Learning Objectives:

1. To learn the foundational principles of animation, such as timing, spacing, squash and stretch, anticipation, follow-through, and exaggeration.
2. To know how to navigate the viewport, access tools, manage objects, and customize the workspace to your workflow.
3. To gain an understanding of basic rigging concepts, such as bones, joints, and skinning.

Course Outcomes

On the Successful Completion of the Course, the Student will be able to:		
1	understand foundational animation principles and apply these principles such as timing, spacing, squash and stretch, anticipation, and follow-through to create believable motion	**K2,K3**
2	analyze to proficient in navigating the interface of industry-standard 3D animation software	**K4**
3	create keyframe animations for object properties such as position, rotation, and scale to produce basic animated sequences with smooth transitions and controlled timing.	**K6**
4	configure render settings and output animations to various formats suitable for different platforms and purposes, demonstrating proficiency in the rendering process	**K5**
5	prepare to pursue further studies in 3D animation or related fields or enter the industry as entry-level animators or 3D artists.	**K4,K5**

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

Units	Contents
I	**History and Installation:** Sample Artwork - Blender History Timeline - About Open Source: Do I Owe Royalties If I Use Blender for Commercial Work or Otherwise - Does the GPL Apply to All the Work I Do with Blender - If I Download Blender for Free, Can I Give It Away? Can I Sell It- Installing Blender: Hardware - Operating Systems
II	**The Interface:** The Blender Interface - Changing the View - Blender Window Conventions - Multiple-View Setup - Built-In Screen Layouts - Adding New Objects: The Cursor - Choosing a New Object. Moving Things Around Moving Objects - Rotating Objects - Scaling Objects - Using Numbers - Layers - Undoing Things - Saving Your Work.
III	**Modeling:** Mesh - Origin Point – Vertices – Edges – Faces. Edit Mode: Some Mesh-Editing Tools - Background Images – Topology. Example Modeling Through Mesh Editing: Smoothing a Mesh. Sculpt Mode: Getting into Position - Adding a Multiresolution Modifier
	Basic Rigging and Animation: Keyframing with the Timeline - The Dopesheet –

IV	Parenting - Rigging with Bones: Types of Bones - Making Bones Work with a Mesh - Using Bone Envelopes - Weight Painting - Dividing the Two Techniques. Rigging a Simple Character: Applying the Bone Envelopes - Adding Weight Painting
V	**Advanced Rigging**: Forward Kinematics vs. Inverse Kinetics - Making an IK Arm - Setting a Custom Bone Shape - Exercise: Creating an IK Leg - Blender 2.5 Rigs - Walk Cycles - Shape Keys - Lip Syncing: The Basis Shape Key - Smile and Frown - Sneer_L and Sneer_R - Preparing the Sound for Lip Syncing - Moving the Lips.
	Total

Textbooks:

1. James Chronister, 2017. *Blender 2.7X Series. Blender Basics Classroom Tutorial,* Fifth Edition,
2. Apress. 2019. *A Beginner's Blender: Open-Source 3D Modeling, Animation and Game Design,* Lance Flavell

Reference Books:

1. Gordon Fisher, 2014. *Blender 3D Basics* - Second Edition, Published by Packt Pub Ltd
2. John M. Blain, Blender 2021.*The Complete Guide to Blender Graphic*s, Fourth Edition.
3. Mark Lutz , 2008. Ray Technology. *The Complete Graphic Designer*, Fourth Edition
4. Jonathan Williams, 2013. *Blender Master Class A Hands-On Guide to Modeling, Sculpting, Materials, and Rendering,*
5. Jonathan Williams,Blender Mastery, 2019. *The Complete Guide to 3D Modeling, Sculpting, Texturing, and Rendering,*

Web Resources:

1. https://docs.blender.org/manual/en/latest/index.html
2. https://archive.org/details/2017BlenderBasics
3. https://medium.com/swlh/3d-game-programming-with-java-and-libgdx-setting-up-a-model-with-blender-1eadab56d45d
4. https://www.javatpoint.com/blender
5. https://blendershq.com/home/about-blenders/history-of-the-blenders/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMEs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	2	3	3	3	3	3	3
TOTAL	**13**	**15**	**13**	**15**	**14**	**14**	**14**	**15**	**14**	**14**	**13**	**15**
AVERAGE	**2.6**	**3**	**2.6**	**3**	**2.8**	**2.8**	**2.8**	**3**	**2.8**	**2.8**	**2.6**	**3**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER IV

CORE COURSE VII: BIG DATA ANALYTICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP234CC1	6	-	-	-	5	6	90	25	75	100

Pre-requisite

Basic knowledge data bases and its analysis

Learning Objectives

1. To make the students understand Big Data Analytics
2. To understand the various algorithms in Big Data Analytics

Course Outcomes

On the successful completion of the course, students will be able to:		
1	learn and explore the fundamental concepts of big data analytics	**K1, K2**
2	understand the various search methods and apply visualization techniques.	**K2, K3**
3	apply and analyze the big data using intelligent techniques	**K3, K4**
4	use and evaluate various techniques for mining data stream.	**K3, K5**
5	understand the analytics process in simple terms and supporting useful methods in its application.	**K6**

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

Units	Contents	No. of Hours
I	**From Data to Big Data:** Introduction - No analytics without data - Databases - Raw data - Text - Images, audios and videos - The Internet of Things - From bytes to yottabytes: the data revolution - Big data: definition - The 3Vs model - **Big Data:** Introduction - Beyond the 3Vs - From understanding data to knowledge - Improving decision-making - Things to take into account - Data complexity - Data quality: Data security - Big data and businesses - Opportunities - Challenges – Conclusions	**18**
II	**Building an Understanding of Big Data Analytics:** Introduction - Before breaking down the process. What is data analytics? - Before and after big data analytics - Traditional versus advanced analytics: What is the difference? - Advanced analytics: new paradigm - New statistical and computational paradigm within the big data context **Why Data Analytics and When Can We Use It?** Introduction - Understanding the changes in context - When real time makes the difference - - Analytics culture within companies - Big data analytics application: examples	**18**
III	**Data Analytics Process:** Introduction - Understanding data analytics is good but knowing how to use it is better! (What skills do you need?) - First phase: find the data - Second phase: construct the data - Third phase: go to exploration and modelling - Fourth phase: evaluate and interpret the results - Fifth phase: transform data into actionable knowledge - Disciplines that support the big data analytics process	**18**
IV	**Supervised versus Unsupervised Algorithms:** Introduction - Supervised and unsupervised learning - Supervised learning: predict, predict and predict! - Unsupervised learning: go to profiles search! - Regression versus classification - Regression - Classification - Clustering	**18**

	gathers data - What good could it serve? - Principle of clustering algorithms - Partitioning your data by using the K-means algorithm	
V	**Applications and Examples:** Introduction - Which algorithm to use? - Supervised or unsupervised algorithm: in which case do we use each one? - What about other Machine Learning algorithms? -Applications - The duo big data/Machine Learning : examples of use	**18**
	Total	**90**

Self-study	Supervised learning

Textbooks

1. Soraya Sedkaoui, 2018. *Data Analytics and Big Data* - Wiley, ISTE .
2. John Wiley &nSons,2015. *Data science in big data analytics*-Wiley

Reference Books

1. Michael Minelli, Michele Chamboss, Ambiga Dhiraj ,2014. "*Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for today's businesses*" John Wiley.
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services.
3. Zikopoulos, Paul, Chris Eaton, 2011.*Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data*, Tata McGraw Hill Publications.
4. Bill Franks,2012. "*Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics*", JohnWiley & sons, .
5. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos,2012 "*Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data*", McGrawHill Publishing.

Web Resources

1. https://www.techtarget.com/searchbusinessanalytics/definition/big-data-analytics
2. https://www.coursera.org/in/articles/big-data-analytics
3. https://nptel.ac.in/courses/106104189
4. https://www.slideshare.net/nasrinhussain1/big-data-ppt-31616290
5. https://www.dacc.edu.in/wp-content/uploads/2020/08/sybca-bigdata-ppt.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	2	3	3	3	2	3
CO3	3	3	3	2	3	3	3	2	3	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	2	1	3	3	3	3	3	3
TOTAL	**11**	**15**	**13**	**14**	**13**	**13**	**13**	**14**	**14**	**14**	**12**	**14**
AVERAGE	**2.2**	**3**	**2.6**	**2.8**	**2.6**	**2.6**	**2.6**	**2.8**	**2.8**	**2.8**	**2.4**	**2.8**

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

CORE COURSE VIII: SOFTWARE PROJECT MANAGEMENT

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP234CC2	6	-	-	-	5	6	90	25	75	100

Pre-requisite

To Study about the Software Project Management.

Learning Objectives

1. To gain knowledge in software development.
2. To study software project planning and control.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	explain project management in terms of the software development process	**K1, K2**
2	describe the responsibilities of IT project managers	**K2, K3**
3	implement communication, modeling, construction & deployment practices in software development	**K3, K4**
4	apply project management concepts and techniques to an IT project	**K5, K6**
5	integrate project frameworks into the operations of their organisation.	**K6**

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

Units	Contents	No. of Hours
I	**INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT:** Project Definition – Contract Management – Activities Covered By Software Project Management - Plans, methods and methodologies– Stakeholders-Project success and failure−What is management-Management control- Overview of Project Planning – Stepwise Project Planning.	**18**
II	**PROJECT EVALUATION :** Strategic Assessment – Technical Assessment-Project portfolio management- Evaluation of individual projects – Cost Benefit Analysis – Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation-Program management-Managing the allocation of resources within programmes	**18**
III	**ACTIVITY PLANNING :** Objectives – Project Schedule – Sequencing and Scheduling Activities –Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature of Risk – Types of Risk – Framework for dealing with risk- Risk identification Risk assessment – Risk Planning And Control.-Evaluating risks to the schedule -Applying the PERT technique	**18**
IV	**MONITORING AND CONTROL :** Creating Framework – Collecting the Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types of Contract – Stages in Contract Placement – Typical Terms of a Contract – Contract Management – Acceptance.	**18**
V	**MANAGING PEOPLE AND ORGANIZING TEAM** : Introduction – Understanding Behavior – Organizational Behavior Background –	**18**

	Selecting the Right Person for the Job – Instruction in the Best Methods – Motivation – The Old man – Hack man Job Characteristics Model – Working In Groups – Becoming a Team –Decision Making – Leadership –Organizational Structures – Stress –Health and Safety – Case Studies.	
	Total	**90**

Self-study	Cost Monitoring

Textbooks

1. Bob Hughes, Mikecotterell, 2004. "*Software Project Management*", Third Edition, Tata McGraw Hill.
2. Ramesh, Gopalaswamy, ,2001. "*Managing Global Projects*", Tata McGraw Hill.

Reference Books

1. Royce, 1999. "*Software Project Management*", Pearson Education,
2. Jalote, 2002. "*Software Project Manangement in Practive*", Pearson Education,
3. Lewis, James, 2006. "*The Project Manager's Desk Reference*", Third edition. New York: McGraw-Hill.
4. Lewis, James,2005. *Project Planning, Scheduling, and Control*, Fourth edition. New York: McGraw-Hill
5. Lewis, James, 2003. " T*eam-Based Project Management*", Beard Books.

Web Resources

1. https://www.javatpoint.com/software-project-management
2. https://www.smartsheet.com/content/software-project-management
3. https://www.javatpoint.com/software-project-planning
4. https://www.srividyaengg.ac.in/coursematerial/CSE/104831.pdf
5. https://www.msajce-edu.in/academics/cse/LectureNote/IT8075-LN.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	2	3	3	3	2	3
CO3	3	3	3	2	3	3	3	2	3	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	2	1	3	3	3	3	3	3
TOTAL	**11**	**15**	**13**	**14**	**13**	**13**	**13**	**14**	**14**	**14**	**12**	**14**
AVERAGE	**2.2**	**3**	**2.6**	**2.8**	**2.6**	**2.6**	**2.6**	**2.8**	**2.8**	**2.8**	**2.4**	**2.8**

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

CORE LAB COURSE IV: WEB APPLICATION DEVELOPMENT LAB

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP234CP1	-		6	-	5	6	90	25	75	100

Pre-requisite:

Basic Programming using HTML tags

Learning Objectives:

1. Able to design a webpage using HTML tags
2. Enable the students to use Forms and other controls in a web page

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand and implement the basic HTML tags to create static webpages	K1, K2
2	capable of using hyperlinks, frames, images, tables, in a webpage	K2, K3
3	able to write dynamic web applications using HTML forms and analyse them	K3, K4
4	must be able to write dynamic web applications in PHP and HTML tags using XAMPP.	K5
5	develop an interactive web applications.	K6

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

Contents	Total No.of Hours
1. Develop a website for your college using advanced tags of HTML. 2. Write names of several countries in a paragraph and store it as an HTML document, world.html. Each country name must be a hot text. When you click India (for example), it must open india.html and it should provide a brief introduction about India. 3. Develop a HTML document to i)display Text with Bullets / Numbers - Using Lists ii) to display the Table Format Data 4. Develop a Complete Web Page using Frames and Framesets which gives the Information about a Hospital using HTML. 5. Write a HTML document to print your Bio-Data in a neat format using several components. 6. Develop a HTML document to display a Registration Form for an inter-collegiate function. 7. Using HTML form accept Customer details like Name, City, Pin code, Phone number and Email address and validate the data and display appropriate messages for violations using PHP (Eg.NameisMandatoryfield;Pin codemust be 6 digits, etc.). 8. Write a program to accept two numbers n1and n2 using HTML form and display the Prime numbers between n1 and n2 using PHP. 9. Create a Login form webpage using HTML5 and Bootstrap in Visual Studio. Utilize Bootstrap's pre-made form components and grid system for layout. Incorporate	90

HTML5 attributes for form validation, ensuring username and password fields are correctly filled before submission. 10.Develop a language learning website in Eclipse using Java EE, with JSP and Servlets for frontend, interactive lessons, quizzes, progress tracking, and social features. Ensure MySQL integration for data storage, robust security, and comprehensive documentation	

Textbooks

1. Ivan Bayross, 2010. "*Web Enabled Commercial Applications Development Using HTML, JavaScript, DHTML and PHP*", BPB Publications, 4th Revised Edition,
2. Thomas Michaud, 2013. *Foundations of Web Design: Introduction to HTML & CSS*,Pearson Education.
3. Larry Ullman, 2017. "*PHP and MySQL for Dynamic Web Sites: Visual QuickPro Guide*", Peachpit Press, 5th Edition.

Reference Books

1. A.K. Sainiand Sumint Tuli, 2002 "*MasteringXML*", FirstEdition, NewDelhi,
2. James George, 2020. "*The Principles of Beautiful Web Design*", SitePoint, 4th Edition.
3. Jennifer Niederst Robbins, 2013. *HTML5 Pocket Reference*, (5th Edition), O'Reilly Media.
4. Mark Pilgrim, 2010. *HTML5: Up and Running*, (1st Edition), O'Reilly Media.
5. Jon Duckett, 2010. *Beginning HTML, XHTML, CSS and Java Scrip*t, (2nd Edition),Wiley Publishing.

Web Resources

1. https://www.tutorialspoint.com/xml/index.htm
2. https://www.tutorialspoint.com/internet_technologies/websites_development.htm
3. https://www.youtube.com/watch?v=PlxWf493en4
4. https://www.geeksforgeeks.org/design-a-web-page-using-html-and-css/
5. https://www.Learn-HTML.org

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO 1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO1	PSO 2	PSO 3	PSO 4	PSO5
CO1	3	3	2	3	2	3	3	2	2	2	3	2
CO2	3	3	2	2	3	3	3	3	2	3	2	3
CO3	2	2	3	3	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	2	2	2	3	3	3	1
CO5	3	3	2	3	2	2	2	3	1	2	3	2
Total	**14**	**14**	**11**	**14**	**11**	**13**	**13**	**11**	**9**	**13**	**14**	**9**
Average	**2.8**	**2.8**	**2.3**	**2.8**	**2.2**	**2.6**	**2.6**	**2.3**	**2.1**	**2.6**	**2.8**	**7.5**

S-Strong (3) M-Medium (2) L-Low(1)

SEMESTER IV

ELECTIVE COURSE VI: a) WIRELESS SENSOR NETWORKS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP234EC1	4	-	-	-	3	4	60	25	75	100

Pre-requisite

Basic concepts in Wireless sensor networks

Learning Objectives

1. To understand the Medium Access control and its protocols
2. To understand the routing metrics and network layer protocols

Course Outcomes

On the successful completion of the course, students will be able to:		
1	learn and understand the channel encoding and modulation mechanism	**K1, K2**
2	use the contention free and contention based MAC protocols	**K3**
3	analyse the QoS based routing protocols	**K4**
4	evaluate the challenges, design goals and architecture of wireless sensor networks	**K5, K6**
5	develop protocols for sensor networks and network layer.	**K6**

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

Units	Contents	No. of Hours
I	**Introduction:** Components of a wireless sensor node- Motivation for a Network of Wireless Sensor Nodes, Classification of sensor networks, Characteristics of wireless sensor networks, Challenges of wireless sensor networks, Comparison between wireless sensor networks and wireless mesh networks, Limitations in wireless sensor networks, Design challenges, Hardware architecture	12
II	**Basic Architectural Framework :** Physical Layer, Basic Components, Source Encoding, Channel Encoding, Modulation. Types of Modulation: Amplitude modulation- Frequency Modulation -phase shift keying - pulse amplitude modulation- Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.	12
III	**Medium Access Control:** Wireless MAC Protocols- Issues in designing a MAC protocol for AdHoc Wireless Netwoks- Characteristics of MAC Protocols in Sensor Networks- Classifications of MAC protocol- Contention - Free MAC Protocols, Contention -Based MAC Protocols, and Hybrid MAC Protocols. Location discovery, quality, other issues, S-MAC, IEEE 802.15.4.	12
IV	**Network Layer:** Routing Metrics - Objectives-, Flooding and Gossiping, Data Centric Routing, Proactive Routing, Classification of Routing Protocols - On-Demand Routing, Hierarchical Routing, Location-Based Routing- QoS-Based Routing Protocols	12

V	**Wireless LANS:** IEEE 802.11-Blue tooth. Connecting LANs - Connecting devices. Wireless WANs: Cellular Telephony, Satellite Networks. Network LayerIPv4 Address-IPv6 Address -Inter networking. Transport Layer-Process to Process delivery –UDP - TCP. Application Layer- Name space - DNS.	**12**
	Total	**60**

Self-study	Satellite Networks.

Textbooks

1. Waltenegus Dargie, Christian Poellabauer, 2010 ,"F*undamentals of Wireless Sensor Networks: Theory and Practice",*Wiley

2. Mohammad S. Obaidat, Sudip Misra, 2010. "*Principles of Wireless Sensor Networks"*, Cambridge,

3. Behrouz A Forouzan , 2013."*Data Communication and Networking"* The McGraw- Hill- 4th edition.

Reference Books

1. Ian F. Akyildiz, Mehmet Can Vuran , 2010 , " *Wireless Sensor Networks*", Wiley

2. C S Raghavendra, K M Sivalingam, TaiebZnati, 2010, "*Wireless Sensor Networks*", Springer,

3. Sivarmmurthy & B.S. Manoj, 2004, "*Adhoc Wireless Networks*", PHI

4. FEI HU., XIAOJUN CAO, 2013 , "*Wireless Sensor Networks*", CRC Press,

5. Feng ZHAO, Leonidas GUIBAS, 2004, " *Wireless Sensor Networks*", ELSEVIER .

Web Resources

1. https://www.accessengineeringlibrary.com/content/book/9780073250328/chapter/chapter2
2. https://www.google.co.in/books/edition/Fundamentals_of_Wireless_Sensor_Networks/8c6k0EVr6rMC?hl=en&gbpv=1&printsec=frontcover
3. https://mrcet.com/downloads/digital_notes/CSEIOT/WIRELESS%20SENSOR%20NETWORKS.pdf
4. https://www.csd.uoc.gr/~hy541/Lectures_files/Lectures_pdfs/CS541_Lecture1.pdf
5. https://www.uvm.edu/~muse/MUSE-Coursepack-InstructorManual.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	1	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	2	3	3	3	2	3
CO3	3	3	3	2	3	3	3	2	3	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	2	1	3	3	3	3	3	3
TOTAL	**11**	**15**	**13**	**14**	**13**	**13**	**13**	**14**	**14**	**14**	**12**	**14**
AVERAGE	**2.2**	**3**	**2.6**	**2.8**	**2.6**	**2.6**	**2.6**	**2.8**	**2.8**	**2.8**	**2.4**	**2.8**

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

ELECTIVE COURSE VI: b) BIO INFORMATICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP234EC2	4	-	-	-	3	4	60	25	75	100

Pre-requisite:

Molecular biology, genetics and their application in Computer Science

Learning Objectives

1. To learn the concepts of computer science that relate to problems in biological sciences
2. To learn and use computer as a tool for biomedical research

Course Outcomes

On the successful completion of the course, students will be able to:		
1	learn and recall different biological databases, tools and modeling networks	**K1**
2	understand and apply algorithms for searching the biological databases.	**K2, K3**
3	predict and analyse gene and protein secondary structure.	**K3, K4**
4	categorize sequence alignment methods.	**K5**
5	create molecular models.	**K6**

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

UNITS	CONTENTS	NO. OF HOURS
I	**INTRODUCTION :** Need for Bio informatics technologies – Overview of Bio informatics technologies- Structural bio informatics – Data format and processing – Secondary resources and applications- Structural Classification- Structure Prediction- Functional Assignments in Structural Genomics - Protein-Protein Interactions. Protein - Ligand Interactions– Role of Structural bio informatics - Biological Data Integration System.	**12**
II	**DATA WAREHOUSING AND DATAMINING IN BIOINFORMATICS :** Bio informatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bio informatics	**12**
III	**MODELING FOR BIOINFORMATICS :** 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.	**12**
IV	**PATTERN MATCHING AND VISUALIZATION :** 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.	**12**
V	**MICROARRAY ANALYSIS :** Micro array technology for genome expression study – image analysis for data extraction – preprocessing – segmentation – gridding – spot extraction – normalization, filtering – cluster analysis-Temporal Expression Profile Analysis and Gene	**12**

	Regulation – gene network analysis – Compared Evaluation of Scientific Data Management Systems – Cost Matrix – Evaluation model - Benchmark – Tradeoffs..	
	Total	**60**

Self-study	Protein modeling

Textbooks

1. Yi-Ping Phoebe Chen (Ed),2007, "*BioInformatics Technologies*", First Indian Reprint, Springer Verlag.

2. Zoe lacroix and Terence Critchlow, 2004, "*BioInformatics – Managing Scientific data*", First Indian Reprint, Elsevier.

Reference Books

1. Bryan Bergeron, 2003,"*Bio Informatics Computing*", Second Edition, Pearson Education.

2. CynthiaGibas, PerJambeck, 2001."*Developing Bioinformatics Computer Skills",* O'Reilly MediaInc

3. David Edwards, Jason Eric Stajich, David Hansen, 2009. " *Bioinformatics Tools and Applications*", Springer,

4. S C Rastogi, N Mendiratta and P Rastogi, 2015." *Bioinformatics: Methods and Applications*" , ISBN : 978-81-203-4785-4, PHI Learning Private Limited,

5. David W Mount, 2004. "*Bioinformatics: Sequence and genome analysis*", Cold spring harbor laboratory press, 2 nd Edition.

Web Resources

1. https://www.niuniv.com/files/file_1581067133_computer-applications.pdf
2. https://www.slideshare.net/biinoida/bioinformatics
3. https://archive.nptel.ac.in/courses/102/106/102106065/
4. https://www.youtube.com/watch?v=lhU3CzslFqw
5. https://mgcub.ac.in/pdf/material/20200406015739416c3962e5.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	2	3	3	3	2	3
CO3	3	3	3	2	3	3	3	2	3	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	2	1	3	3	3	3	3	3
TOTAL	**11**	**15**	**13**	**14**	**13**	**13**	**13**	**14**	**14**	**14**	**12**	**14**
AVERAGE	**2.2**	**3**	**2.6**	**2.8**	**2.6**	**2.6**	**2.6**	**2.8**	**2.8**	**2.8**	**2.4**	**2.8**

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

ELECTIVE COURSE VI: c) NETWORK SECURITY AND CRYPTOGRAPHY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP234EC3	4	-	-	-	3	4	60	25	75	100

Pre-requisite

Basics of Networks and its Security.

Learning Objectives

1. Explore the working principles and utilities of various cryptographic algorithms.
2. Gain knowledge on classical encryption techniques and concepts of modular arithmetic and number theory.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	recognize and understand the process of the cryptographic algorithms	**K1, K2**
2	compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication	**K3,K4**
3	apply and analyze appropriate security techniques to solve network security problem	**K3, K4**
4	explore suitable cryptography algorithms	**K5**
5	evaluate different digital signature algorithms to achieve authentication and design secure applications	**K5, K6**

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

Units	Contents	No. of Hours
I	**INTRODUCTION:** Introduction to Cryptography – Computer Security Concepts-Security Attacks – Security Services –Security Mechanisms-Classical Encryption Techniques-Symmetric-Asymmetric- Substitution-Transposition Techniques- Block Ciphers- Design Principles- Stream Ciphers- DES – Triple DES – AES – IDEA – Blowfish – RC5.	**12**
II	**CRYPTOSYSTEM:** Public-key Cryptosystem: Introduction to Number Theory-Prime Numbers-Euler's Theorems -RSA Algorithms–Diffie-Hellman Key Exchange -Elliptic Curve Cryptography - Cryptographic Hash functions – Message Authentication Codes- Hash and Mac Algorithm – Digital Signatures - Key Management and Distributions-Symmetric Encryption-Asymmetric Encryption-Distribution of Public Keys.	**12**
III	**NETWORK SECURITY:** Network Security Practice: User Authentication Protocols. Authentication Applications–Kerberos–X.509Authentication services and Encryption Techniques. E-mail Security – PGP – S / MIME – IP Security-Overview-Policy-Encapsulating Security Payload-Internet Key Exchange - Cryptographic Suites.	**12**
IV	**WEB SECURITY:** Web Security-Secure Socket Layer– Transport Layer Security- HTTPS- Secure Shell- Secure Electronic Transaction-System Security-Intruders and Viruses – Firewalls– Password Security-Wireless LAN Security-Wireless Application Protocol-Wireless	**12**

	Transport Layer Security- WAP End-to-End Security.	
V	**CASE STUDY:** Case Study: Implementation of Cryptographic Algorithms–RSA–DSA–ECC (C/JAVA Programming). Network Forensic – Security Audit - Other Security Mechanism: Introduction to: Steganography –Quantum Cryptography – Water Marking - DNA Cryptography-Intrusion Detection-Password Management.	**12**
	Total	**60**

Self-study	Water Marking, DNA Cryptography

Textbooks

1. William Stallings, 2017. "*Cryptography and Network Security"*, PHI/Pearson Education, 7th Edition.
2. Bruce Schneir, 2012. "*Applied Cryptography"*, CRC Press.

Reference Books

1. A. Menezes, P Van Oorschot and S. Vanstone, 2010." *Hand Book of Applied Cryptography"*, CRC Press.
3. Ankit Fadia, 2006. "*Network Security"*, MacMillan.
4. Behrouz A. Frouzan, 2013. "*Cryptography and Network Security"*, TMH.
5. Atul Kahate, 2017. "*Cryptography and Network Security"*, TMH.
6. Bruce Schiener, 2012. "*Applied Cryptography"*. John Wiley & Sons

Web Resources

1. https://nptel.ac.in/courses/106/105/106105031/
2. http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html
3. https://www.tutorialspoint.com/cryptography/index.htm
4. https://www.vssut.ac.in/lecture_notes/lecture1428550736.pdf
5. https://www.myprivatetutor.ae/prime/documents/ppts/details/15/cryptography-and-network-security

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	2	3	3	3	2	3
CO3	3	3	3	2	3	3	3	2	3	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	2	1	3	3	3	2	3	3
TOTAL	**12**	**15**	**13**	**14**	**13**	**13**	**13**	**14**	**14**	**13**	**12**	**14**
AVERAGE	**2.4**	**3**	**2.6**	**2.8**	**2.6**	**2.6**	**2.6**	**2.8**	**2.8**	**2.6**	**2.4**	**2.8**

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

ELECTIVE COURSE VII: a) PRINCIPLES OF PROGRAMMING LANGUAGES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP234EC4	4	-	-	-	3	4	60	25	75	100

Pre-requisite

Adequate knowledge in programming and Logical Thinking

Learning Objectives

1. To describe the basics of computer and understand the problem-solving aspect.
2. To demonstrate the algorithm and flow chart for the given problem.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	remember and recall technical project reports and present them orally among the user.	**K1**
2	understand and design program to evaluate simple expressions and logical operations.	**K2, K5**
3	communicate computer science concepts, designs, and solutions effectively and professionally.	**K2, K3**
4	demonstrate and analyse the concept of pointer and perform I/O operations.	**K4, K5**
5	develop and implement programs with suitable modules to solve the given problem.	**K6**

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

Units	Contents	No. of Hours
I	**Preliminary Concepts:** Reasons for studying concepts of programming languages-programming domains-language evaluation criteria- influences on language design- language categories-language design trade-offs-implementation methods-programming environments-Evolution of Major Programming Languages. **Syntax and Semantics:** General problem of describing syntax-formal methods of describing syntax- attribute grammars- describing the meanings of programs.	**12**
II	**Names- Bindings- and Scopes:** Introduction- names- variables- concept of binding- scope and lifetime- referencing environments- named constants Data types: Introduction- primitive- character- string types- user defined ordinal types- array- associative arrays- record- tuple types- list types- union types- pointer and reference types- type checking- Expressions and Statements: Arithmetic expressions- overloaded operators- type conversions- relational and boolean expressions- short-circuit evaluation- Control Structures –Guarded commands.	**12**
III	**Subprograms:** Fundamentals of subprograms- design issues for subprograms- local referencing environments- parameter passing methods- parameters that are subprograms- calling subprograms indirectly- overloaded subprograms- generic subprograms- design issues for functions- user defined overloaded operators- closures- co routines Implementing subprograms Abstract Data types: The concept of abstraction- introductions to data abstraction- design issues- language examples- parameterized ADT-	**12**

	encapsulation constructs- naming encapsulations	
IV	**Object Oriented Programming:** Design issues for OOP- OOP in Smalltalk- C++- Java- Ada 95- Ruby- Implementation of Object-Oriented constructs. Concurrency: Introduction- introduction to subprogram level concurrency- semaphores- monitors- message passing- Ada support for concurrency- Java threads- concurrency in functional languages- statement level concurrency. Exception Handling and Event Handling: Introduction- exception handling in Ada- C++- Java- introduction to event handling- event handling with Java and C#.	**12**
V	**Functional Programming Languages:** Introduction- mathematical functions- fundamentals of functional programming language- LISP- support for functional programming in primarily imperative languages- comparison of functional and imperative languages Logic Programming Language: Introduction- an overview of logic programming- basic elements of prolog- deficiencies of prolog- applications of logic programming. Scripting Language: Pragmatics- Key Concepts.	**12**
	Total	**60**

Self-study	Java- introduction to event handling

Textbooks

1. Robert W Sebesta , 2012. *Concepts of Programming Languages*, 10th Edition.
2. David. A. Watt, 2004. *Programming Language Design Concepts*, Wiley India Edition.

Reference Books:

1. A.B. Tucker- R.E. Noonan, 2001. *Programming Languages*, TMH.
2. K. C. Louden and K A Lambert, 2011. *Programming Languages*, 3rd edition, Cengage Learning.
3. C Ghezzi and M Jazayeri, 2008. *Programming Language Concepts*, Wiley India.
4. Ravi Sethi, 2007. *Programming Languages*, 2nd Edition, Pearson Education.
5. Arvind Kumar Bansal, 2014. *Introduction to Programming Languages*, CRC Press.

Web Resources

1. https://onlinecourses.nptel.ac.in/noc20_cs81/preview
2. https://nptel.ac.in/courses/106/101/106101208/
3. https://www.w3resource.com/c-programming-exercises/
4. https://www.hackerearth.com/challenges/
5. https://www.codechef.com/ide

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	2	3	2	3	2	3
CO2	3	3	2	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	2	3	3	2	3	3	3	3	3	3
TOTAL	**14**	**15**	**13**	**15**	**14**	**14**	**14**	**15**	**14**	**13**	**14**	**14**
AVERAGE	**2.8**	**3**	**2.6**	**3**	**2.8**	**2.8**	**2.8**	**3**	**2.8**	**2.6**	**2.8**	**2.8**

3 – Strong- 2- Medium- 1- Low

SEMESTER IV

ELECTIVE COURSE VII: b)ADVANCED DATABASE SYSTEMS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP234EC5	4	-	-	-	3	4	60	25	75	100

Pre-requisite

Fundamental computer knowledge that includes the hardware and memory storage.

Learning Objectives

1. To understand the basic DBMS models, architecture, query and to normalize the database.
2. To learn Transaction Processing, Recovery and Distributed Database.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	learn and recall the relational databases and uses of PL/SQL	**K1**
2	understand and apply Schema, ER- Model, normalization, transaction, concurrency, and recovery on tables using SQL and PL/SQL.	**K2, K3**
3	analyze and manage relational & distributed, database, transaction, concurrency control and query languages	**K4**
4	assess and evaluate databases based on models and Normal Forms.	**K4, K5**
5	design and construct tables and manipulate it effectively using PL/SQL database objects	**K5, K6**

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

Units	Contents	No. of Hours
I	**Introduction**: Database System Applications-Purpose of Database Systems-View of Data- Database Users and Administrators. **Relational Database**: Structure of Relational Databases- Databases Schema- Keys-Schema Diagrams- **Formal Relational Query Languages**: Relational Algebra-Tuple Relational Calculus	**12**
II	**Database Design:** Overview of Design Process-The Entity Relationship Model-Constraints- Removing Redundant Attributes in Entity Sets-Entity-Relationship Diagrams-Reduction to Relational Schemas-Extended E-R features -Alternative Notations for Modeling Data. Relational Database Design: Features of Good Relational Design-Functional Dependency- Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF- Functional Dependency Theory	**12**
III	**Transaction Management:** Transaction Concept-Simple Transaction Model-Storage Structure- Transaction Atomicity and Durability-Transaction Isolation-Serializability. Concurrency Control: Lock Based Protocols-Locks-Granting of Locks-Two Phase Locking Protocol-Time Stamp Based Protocol - Recovery System: Failure Classification-Recovery and Atomicity: Log Records-Database Modification-Concurrency Control and Recovery-Recovery Algorithm	**12**
IV	**Distributed Database:** Homogeneous and Heterogeneous Databases-Distributed Data storage- Distributed Transactions-Commit Protocols-Concurrency Control in Distributed Databases- Distributed Query Processing. Case study: MongoDB	**12**
V	**SQL** - Table Fundamentals - Viewing Data - Inserting - Deleting - Updating - Modifying - Constraints - Functions - Grouping - Subqueries - Joins -	**12**

	Views.PL/SQL: Introduction - PL/SQL Block - Data Types and Variables - Control Structure -Cursors - PL/SQL Security - Locks. PL/SQL Database Objects: Exception Handling- Packages - Procedures and Functions - Database Triggers	
	Total	**60**

Self-study	Procedures and Functions

Textbooks

1. Abraham Silberchatz, Henry F. Korth, S. Sudarshan, 2014. "*Database Systems Concepts"*, Sixth Edition, Tata McGraw Hill.
2. Ivan Bayross, "*SQL, PL/SQL The Programming Language of ORACLE"*, Fourth edition, BPB Publications.

Reference Books

1. Atul Kahate, 2004."*Introduction to Database Management Systems"*, Pearson Education.
2. Carlo Zaniolo, Stefano Ceri, Christos Faloustsos, R.T. Snodgrass, V.S. Subramanian,
3. 1997. "*Advanced Database Systems"*, Morgan Kaufman.
4. George Koch, Kelvin Loney, 2002. "*Oracle 9i: The Complete Reference"*, Oracle Press, Tata
5. McGraw Hill Publication.
6. Ramez Elmasri, Shamkant B. Navathe, 2014. "*Database Systems"*, Sixth edition, Pearson
7. Education, New Delhi.

Web Resources

1. http://awtrey.com/tutorials/dbeweb/database.php
2. http://www.tutorialspoint.com/dbms/index.htm
3. http://www.tutorialspoint.com/plsql/index.htm
4. https://www.javatpoint.com/dbms-functional-dependency
5. https://onlinecourses.nptel.ac.in/noc22_cs91/preview

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	2	3	3	3	3	3	3
TOTAL	**13**	**15**	**13**	**15**	**14**	**14**	**14**	**15**	**14**	**14**	**13**	**15**
AVERAGE	**2.6**	**3**	**2.6**	**3**	**2.8**	**2.8**	**2.8**	**3**	**2.8**	**2.8**	**2.6**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

ELECTIVE COURSE VII: c) PRINCIPLES OF COMPILER DESIGN

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP234EC6	4	-	-	-	3	4	60	25	75	100

Pre-requisite

Knowledge about compiler design.

Learning Objectives

1. To gain knowledge in programming components.
2. To study about components of compilation process.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	acquire knowledge about compiler tools to meet the requirements of the realistic constraints of compilers	**K1, K2**
2	understand the parser and its types i.e. Top-Down and Bottom-up parsers and construction of LL, SLR, CLR, and LALR parsing table	**K2, K3**
3	implement the compiler using syntax-directed translation method	**K3, K4**
4	able to analyse and design symbol table organization and different techniques used in that.	**K4, K5**
5	evaluate the target machine's run time environment, its instruction set for code generation and techniques used for code optimization	**K5, K6**

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

Units	Contents	No. of Hours
I	**INTRODUCTION** : Basic concepts of Compiler- Analysis of source program- Phases of a compiler – Cousins of Compiler- Grouping of Phases- Compiler Construction Tools-Syntax Definition	**12**
II	**LEXICAL ANALYSIS** : Role of Lexical Analyzer-Input Buffering- Specification of tokens- language for specifying lexical analyzers- regular expressions- NFA - DFA -reduced DFA - Design of lexical analyzer	**12**
III	**SYNTAX ANALYSIS :** Role of Parser- Context free grammars –Writing a Grammar- derivation and parse trees – - top-down parsing Bottom Up Parsing – operator precedence parsing —LR parsers.	**12**
IV	I**NTERMEDIATE CODE GENERATION :** Intermediate languages-– translation of Declaration - assignment statements, Boolean Expressions, Case Statements - Back Patching – Procedure calls	**12**
V	**CODE OPTIMIZATION AND CODE GENERATION :**Introduction – Sources of optimization –Peephole Optimization - optimization of basic blocks – loop optimization – Design issues of code generation - runtime storage Management - - Basic blocks _ flow graph-Next use information – A simple code Generator.	**12**
	Total	**60**

Self-study	Boolean Expressions

Textbooks

1. Alferd V.Aho, Jeffery D.Ullman,2008. "*Principles of Compiler Design*", Pearson Education, New Delhi.
2. Steven S. Muchnick,"*Advanced Compiler Design and Implementation*" ,

Reference Books

1. D. Chithra, 2011 , "*Principles of Compiler Design*, CBS Publishers,
2. Dr. O. G. Kakde., 2008, "*Compiler Design Fourth Edition*".
3. Allen I. Holub, " *Compiler design in C* **"**
3. Andrew W. Appel, **"***Modern Compiler Implementation in C "*
4. Dr Rajeshs Prasad,2019. "*Compiler Design",*Kindle Edition
5. Rajkumar Y Sudha Rani S, Karthi M, 2019."*Compiler Design/e"*

Web Resources

1. http://awtrey.com/tutorials/dbeweb/database.php
2. https://www.vssut.ac.in/lecture_notes/lecture1422914957.pdf
3. https://www.sircrrengg.ac.in/images/CSEMATERIALS/3_1_COMPILER_DESIGN.pdf
4. https://www.jbiet.edu.in/pdffls/csecoursefile2020/CD_III_I.pdf
5. https://www3.nd.edu/~dthain/compilerbook/compilerbook.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	2	3	3	3	3	3	3
TOTAL	**13**	**15**	**13**	**15**	**14**	**14**	**14**	**15**	**14**	**14**	**13**	**15**
AVERAGE	**2.6**	**3**	**2.6**	**3**	**2.8**	**2.8**	**2.8**	**3**	**2.8**	**2.8**	**2.6**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

SKILL ENHANCEMENT COURSE III: SOFT SKILL DEVELOPMENT LAB

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP234SE1	-		4	-	2	4	60	25	75	100

Pre-requisite:

Basic communication skills in professional and social contexts effectively.

Learning Objectives:

1. To acquire useful words and apply them in situational context.
2. To enrich the leadership qualities and interpersonal communication

Course Outcomes

On the successful completion of the course, student will be able to:		
1	effectively communicate through verbal/oral communication and improve the listening skills	**K1 &K2**
2	write precise briefs or reports and technical documents.	**K2**
3	actively participate in group discussion / meetings / interviews and prepare & deliver presentations.	**K3&K6**
4	become more effective individual through goal/target setting, self-motivation and practicing creative thinking.	**K4**
5	function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality	**K5&K6**

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

Units	Contents	No. of Hours
	1. Technical Writing Enhancement Using AI (Gravity Write, ChatGPT) 2. AI-Powered Vocabulary Building (Quizlet, WordTune) 3. Error Detection with AI Tools (Grammarly, Hemingway App) 4. AI for Conceptual Reading Comprehension (Natural Reader) 5. AI-Assisted Writing for Emails, Blogs, and Forums (Grammarly, MailMentor) 6. AI-Enhanced PPT Creation & Presentation (Canva, Beautiful.ai, Gamma AI) 7. Resume Building with AI Tools (Zety, ChatGPT, Resume.io) 8. AI-Powered Job Interview Preparation (InterviewBuddy) 9. AI Tools for Enhancing Listening Skills (Otter.ai, Speechify) 10. AI-Based Practice for Speeches & Conversations (SpeechTexter) 11. Learning English Through AI-Enhanced Mass Media (Newsela) 12. Grammar Mastery Using AI (Grammarly, ProWritingAid)	**60**

Textbooks

1. Uma Narula, (2019). *Development Communication: Theory and Practice*. (Revised edition). Har-Aanad Publication.
2. Annette Capel and Wendy Sharp, (2013). *Cambridge English: Objective First*. (4th edition). Cambridge University Press.

Reference Books

1. Michael McCarthy and Felicity O'Dell. (1996). *English Vocabulary in Use:100 Units of Vocabulary Reference and Practice*. Cambridge University Press.

2. Murphy, Raymond. *Intermediate English Grammar*. (2nd edition).
3. Guy Brook-Hart, (2014). *Cambridge English: Business Benchmark.* (2nd edition), Cambridge University Press.
4. Norman Lewis, (1978). *How to Read Better & Faster*. New Delhi: Binny Publishing House.
5. Emma Sue-Prince, (2013). *The Advantage: The 7 Soft Skills You Need to Stay One Step Ahead.* (1st edition). FT Press

Web Resources

1. https://soaneemrana.org/onewebmedia/SOFT%20SKILL%20DEVELOPMENT%20LAB%20SEM%206.pdf
2. https://amolshakadwipi.wordpress.com/wp-content/uploads/2018/09/soft-skills-lab-manual_snjb.pdf
3. https://mu.ac.in/wp-content/uploads/2021/07/Soft-Skills-Development.pdf
4. https://tkmit.ac.in/facilities/soft-skill-training/
5. https://www.studocu.com/in/document/the-universal-school/italian-ab-initio-sl/mca-sem2-soft-skills-development-lab-3/84263492

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	2	3	3	3	3	3	3
TOTAL	**13**	**15**	**13**	**15**	**14**	**14**	**14**	**15**	**14**	**14**	**13**	**15**
AVERAGE	**2.6**	**3**	**2.6**	**3**	**2.8**	**2.8**	**2.8**	**3**	**2.8**	**2.8**	**2.6**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

SELF LEARNING COURSE: WEB DESIGNING WITH BOOTSTRAP AND JQUERY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
SP234SL1	-	-	-	-	1	-	-	**25**	**75**	**100**

Pre-requisite:

To start learning web designing with Bootstrap and jQuery

Learning Objectives:

1. To understand how to integrate Bootstrap into web projects for rapid development
2. To learn how to customize Bootstrap components to suit the design requirements of different projects.

Course Outcomes

On the Successful Completion of the Course, the Student will be able to:		
1	understand the basics of Bootstrap Environment for web projects	**K2**
2	analyze the usage of Bootstrap Layout Components	**K4**
3	apply Bootstrap Navigation Elements	**K3**
4	illustrate and evaluate the usage of jQuery	**K5**
5	summarize the concept of JSON and create an application using jQuery	**K6**

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

Units	Contents
I	**Bootstrap:** Introduction – Overview – Environment Setup – Bootstrap With CSS: Grid System – CSS – Typography – Tables - Forms – Buttons – Images – Helper Classes – Responsive Utilities
II	**Bootstrap Layout Components:** Glypicons – Dropdowns – Button Groups – Button Dropdown – Input groups – Breadcrumb - Clearfix – Star Rating – Tooltip – Picker
III	**Bootstrap Navigation:** Navbar – Navigation Elements – Pagination – Labels – Badges – Jumbotron – Page Header – Thumbnails – Alerts – Progress Bars – Media Object – List Group – Panels – Wells – Carousel - Tabs/Pills – Modals – Popover – Scrollspy
IV	**Jquery:** Introduction – Overview – Basics – Selectors – Effects – hide – show – toggle – slideToggle – animate – delay – text() – val – css – before – prepand – append – after – insertAfter – remove – clone – serialize – serializeArray – Jquery Events
V	**JSON :** Introduction - Basic Example - Object - Array - Comments - Parse JSON Data - XML: Introduction - Features - Basic Example - Attributes - Comments - Validation - DTD - XML Parsers
	Total

Textbooks:

1. Paul Deital, Harvey Deitel& Abbey Deitel, 2012 ."*Internet and World Wide Web - How to Program*", Pearson, Fifth Edition.
2. Matt Lambert, 2016. "*Learning Bootstrap 4*", Packt Publishing, Second Edition.

Reference Books:

1. Silvio Moreto, Marcos Roriz, 2018. “Bootstrap 4 in Action”, Manning Publications
2. Jacob Lett ,2018. “Bootstrap 4 Quick Start: Responsive Web Design and Development Basics for Beginners" published by Jacob Lett.

3. Ralph Steyer, 2013. "Learning jQuery: A Hands-on Guide to Building Rich Interactive Web Front Ends" Addison-Wesley Professional.
4. Ajdin Imsirovic, 2017. "Bootstrap 4 Cookbook" Packt Publishing.
5. Jake Spurlock, 2013."*Bootstrap",3rd Edition*,Published by O'Reilly Media, Inc.

Web Resources:

1. https://wiki.lib.sun.ac.za/images/0/07/Bootstrap-tutorial.pdf
2. https://www.cs.toronto.edu/~mashiyat/csc309/Tutorial/6/Bootstrap.pdf
3. http://didawiki.cli.di.unipi.it/lib/exe/fetch.php/magistraleinformaticaeconomia/va/2016/va_lesson4.pdf
4. https://www.webstepbook.com/supplements-2ed/slides/ppt/22-jQuery1.pdf
5. https://ecs.syr.edu/faculty/fawcett/handouts/CSE686/Presentations/jQuery.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMEs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	2	3	3	3	3	3	3
TOTAL	**13**	**15**	**13**	**15**	**14**	**14**	**14**	**15**	**14**	**14**	**13**	**15**
AVERAGE	**2.6**	**3**	**2.6**	**3**	**2.8**	**2.8**	**2.8**	**3**	**2.8**	**2.8**	**2.6**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER III & IV
LIFE SKILL TRAINING II: VALUES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PG23LST2	1	-	-	-	1	1	15	50	50	100

Pre-requisites: Value education-its purpose and significance in the present world

Learning Objectives

1. To guide students in making wise choices and decisions, and to help them discover the true purpose of their lives.
2. To ensure students not only grasp the concept of values but also incorporate them into their actions and attitudes.

Course Outcomes

On completion of this course the student will be able to		
1	recognize the perception of life and lead a positive life	**K1**
2	understand relationship with family, friends and the society	**K2**
3	develop as socially responsible citizens.	**K3**
4	assess goals, fix targets and value life	**K4**
5	create a peaceful, communal community and embrace unity.	**K6**

K1-Remember; **K2**-Understand; **K3**-Apply; **K4 – Analyse; K6**- Create

Units	Contents	No. of Hours
I	**Positive Thinking -** Why you should change your thinking? – How to became a better thinker- Putting yourself in the right place to think- Portrait of the good thinker. **Habits-** Habits vs. Addiction- Why are life styles changes so difficult to hold on to? - Habit Swapping.	3
II	**Art of Listening-** Many faces of speech- To be truly present- Valuing the other- Activating the subconscious. **Leadership-** Introduction- Who is a better leader? - Qualities of a Leader- You too can be a leader.	3
III	**Interpersonal Relationship-** Introduction - Factors that build trust- Steps to build a positive personality. **Managing Emotions-** 7 'Root' emotions- Importance of managing emotions- Why is it important to manage emotions?	3
IV	**Stress Management –** Highly effective tips for relieving stress- Fast-Acting Self Relief Strategies. **Anger Management:** Effects of anger – Tips to reduce anger – Anger warning signs – Identify your triggers – Ways to cool down your anger.	3
V	**Forgiveness-** What is forgiveness- Value of forgiveness- Benefits of forgiving- Self-forgiveness. **Gratitude –** What is gratitude? – How gratitude arises? –Features of gratitude – Gratitude is recognizing and acknowledging.	3

TOTAL	15
Self-Study Salient values for life, Human Rights, Social Evils and how to tackle them, Holistic living, Duties and responsibilities.	

Textbooks

Life Skill Training – II, Holy Cross College (Autonomous), Nagercoil

Reference Books

1. Holy Cross College (Autonomous), Nagercoil (2007). Foundation Course Life's Challenges. Sipca Computers.
2. Mathew, Sam (2010). Self Help Life Book. Opus Press Publisher.
3. Romuald Andrade. (2015). *Habit Triggers: How To Create Better Routines And Success Rituals To Make Lasting Changes In Your Life*. Kindle Edition.
4. William Fergus Martin. (2014). *Four Steps to Forgiveness:* A *Powerful Way To Freedom, Happiness And Success*. Findhorn Press.
5. Robert A. Emmons and Joanna Hill (2001). *Words Of Gratitude for Mind, Body, and Soul*. USA: Templeton Foundation Press.

Web Resources

1. https://www.mayoclinic.org/healthy-lifestyle/stress-management/in-depth/positive-thinking/art-20043950
2. https://jamesclear.com/habits
3. https://www.skillsyouneed.com/ps/managing-emotions.html
4. https://emeritus.org/in/learn/what-is-leadership/
5. https://www.verywellmind.com/how-to-maintain-interpersonal-relationships-5204856