

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 & II

Guidelines & Syllabus

DEPARTMENT OF COMPUTER SCIENCE



2023-2026

(With effect from the academic year 2023-2024)

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.

Programme Educational Objectives (PEOs)

PEO	Upon completion of M. Sc Computer Science Degree Programme, the graduates will be able to:	Mapping with Mission
PEO-1	apply scientific and computational technology to solve socio ecological issues and pursue research.	M1, M2
PEO-2	continue to learn and advance their career in industry both in private and public sectors	M4 & M5
PEO-3	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)

PO	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,	PEO1, PEO 2 & PEO3

	assess, and apply relevant information sources.	
PO7	learn independently for lifelong to execute professional, social and ethical responsibilities promoting sustainable development.	PEO3

Programme Specific Outcomes (PSOs)

PSO	Upon completion of M.Sc. Degree Programme, the graduates will be able to:	Mapping with POs
PSO 1	apply profound knowledge to analyze and design software and systems containing hardware and software components of varying complexity.	PO1
PSO 2	apply mathematical model, algorithmic principles, and computer science theory in the design of real-time applications	PO2
PSO 3	apply knowledge of computing to produce effective designs and solutions for specific problems.	PO4 & PO7
PSO 4	identify, analyze, design, optimize and implement system solutions using appropriate algorithms of varying complexity.	PO5 & PO6
PSO 5	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
PO 1	S	S	M	S	S
PO 2	S	M	S	S	S
PO 3	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	10	100	1000
Core Lab Courses	4	100	400
Project	1	100	100
Elective courses	5	100	500
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 Course – Theory	6(5) + 6(4) +	6(5)+ 6(5)+	6(5) + 6(5) + 6(5) +	6(5) + 6 (5)	74	58
Core Course -Lab	5(3)	6(4)	6 (4) 3 (3)			
Elective Course	5 (3) + 5 (3)	4 (3) + 4 (3)	-	4 (3) -	22	15
Elective Lab Course	3(2)				3	2
Core Project		-		10 (7)	10	7
Skill Enhancement Course		4 (2)	3 (2)	4 (2)	11	6
Internship/ Industrial Activity			(2)		-	2
Extension Activity				(1)	-	1
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: a) Advanced Operating Systems	3	4
SP232EC2	Elective Course III: b) Mobile Computing		
SP232EC3	Elective Course III: c) Block Chain Technology		
SP232EC4	Elective Course IV: a) Artificial Intelligence & 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
SP233CC3	Core Course VII: Network Security and Cryptography	5	6
SP233CC4	Core Course VIII: Data Science & Analytics	4	6
SP233CP1	Core Lab Course III: Digital Image Processing Lab using MATLAB	3	3
SP233SE1	Skill Enhancement Course II: Practical: Cloud Computing Lab	2	3
SU233SI1 /SU233IT1	Internship/ Industrial Activity	2	-
	Total	26	30

Semester IV

Course Code	Title of the Course	Credits	Hours / Week
SP234CC1	Core Course IX: Big Data Analytics	5	6
SP234CC2	Core Course X: Web Application development & hosting Practical	5	6
SP234EC1	Elective Course V: a) Dot Net Programming	3	4
SP234EC2	Elective Course V: b) Advanced Machine Learning Technologies		
SP234EC3	Elective Course V: c) Soft Computing		
SP234PW1	Core Project	7	10
SP234SE1	Skill Enhancement Course III: Professional Competency Skill	2	4
SP234EA1	Extension Activity	1	-
	Total	23	30
	TOTAL	91	120

Co-curricular Courses
Specific Value added Course

Semester	Code	Title of the Course	Credit
I & II	PG23LST1	Life Skill Training	1
II & IV	-	MOOC	1+1
II	PG232CE1	Community Engagement Course (CEC)	1
III & IV	PG23LST2	Life Skill Training	1
I	BP231FP1	Field Project	1
I & III	BP231V01 / BP233V01	Specific Value-added Course	1+1
II & IV	PG232V01- PG232V12/ PG234V01- PG234V12	Generic Value-added Course	1+1
Total			10
S. No.	Course code	Title of the course	Total hours
I	SP231V01	Website Creation	30

Examination Pattern

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 3 x 4 (Internal choice)	12	Part B 5 x 6 (Internal choice)	30
Part C 3 x 8 (Internal choice)	24	Part C 5 x 12 (Internal choice)	60
Total	40	Total	100

ii) 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) Skill Enhancement Course

Ratio of Internal and External = 25: 75

Internal Components and Distribution of Marks

Components	Marks
Internal test (2)	10
Quiz (2)	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 5 (Open choice any Five out of Eight)	25
Part C 1 x 9 (Open choice One out of Three)	9	Part C 5 x 8 (Open choice any Five out of Eight)	40
Total	25	Total	75

iv) Internship/ Industrial Activity

Components	Marks
Industry Contribution	50
Report & Viva-voce	50

v) Core 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

Co-Curricular Courses:

- (i) Life Skill Training
Internal Component

Components		Marks
Life Skill Training -I	Album (20 pages)	30
	Group Song, Mime, Skit (Group of 5students)	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
Report & Viva-voce	50

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

Components	Marks
Internal	25
External	75

(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

Outcome Based Education

(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	K1			K2			K3			K4, K5, K6			Total
		A	B	C	A	B	C	A	B	C	A	B	C	
Internal Test	Part													
	No. Of Questions	1	1			1		1		1	2	1	2	10
External Examination	Part													
	No. Of Questions	3	-	1	3	1	1	1	2	1	3	2	2	20

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.
- iv. 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:

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

For the entire programme:

Cumulative Grade Point Average (CGPA) $\frac{\sum_n \sum_i C_{ni} G_{ni}}{\sum_n \sum_i C_{ni}}$

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+	
6.0 and above but below 6.5	A	
5.5 and 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

Self Study	Stacks and Queues, Quick Sort, Traveling Salesperson
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Text book

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

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

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 Write a C++program to perform Single Inheritance
14. Write a C++program to perform Employee Details using files.

Text Books

1. Goodrich. *Data Structures & Algorithms in Java*. Wiley 3rd 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, Phillippe 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	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO1	PSO2	PSO3	PSO4	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

Text books

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 in 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

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

Text books

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

Reference Books

1. Judith Jeffloate, 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

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	

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 sensor, ultrasound sensor and infrared (IR) sensor with Arduino– Interfacing LE 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

Text books

1. Arshdeep Bahga, ,Vijay Madiseti, 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

Text books

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 Solving*, 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.

Text Books

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	Credits	Total Hours	Total Marks
SP231V01	1	30	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 & 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

Text Books

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%20Web%20Designing/WEB%20DESIGNING.pdf>
3. <https://dribbble.com/stories/2021/09/29/ethical-web-design-rules>

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 view –data modeling – multifact star schema or snow flake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.	18
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

Self Study	Decision Trees OLAP Tools
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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	18

	skeletons- Defining Remote objects- Remote Object Activation-Object Serialization-Java Spaces- Benefits and Limitations of Java Spaces	
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 Java Server Pages: JSP Overview- Installation- JSP tags-Components of a JSP page-Expressions- Script lets -Directives-Declarations-A complete example	18
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
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*, O'Reilly 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
	<p>Implement the following problems</p> <ol style="list-style-type: none"> 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

Self Study	Distributed File Systems Core OS Layer
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Textbooks

1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, (2004). *Operating System Concepts*, (7th edition), John Wiley & Sons.
2. Mukesh Singhal and Niranjana 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 system-Power Delivery-Processing Gain – Fourth Generation Mobile Communication systems.	12

Self Study	Satellites in Mobile Communication Bluetooth Technology
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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 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 & 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 healthcare data	12

Self Study	Types of Trust model Blockchain properties
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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: A Peer-to-Peer Electronic Cash System*”
2. Rodrigoda Rosa Righi, Antonio Marcos Alberti, Madhusudan Singh, 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 - AI 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

Self Study	Logic Programming The Machine Learning Cycle
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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 Approach*", 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	QUALITY OF SERVICE: 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

Self Study	Logic Programming The Machine Learning Cycle
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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, June 2003.

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: Role of a Business Manager in Automation initiatives - Skills required by a Business Manager for 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	AUTOMATION IMPLEMENTATION: 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	12
	causality by variable behavior - Understand the skill of drawing inference or establishing causality by tracking the behavior of a variable as it varies across time/referenced variable - Leveraging automation for this skill - Robot & new process creation.	
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

Self Study	Publishing and Running Workflows Multi source trend tracking
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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. Tom Taulli 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
	<p>Implement the following problems using Python Programming</p> <ol style="list-style-type: none"> 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--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	100

Prerequisites: 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	On completion of this course the student will be able to	
CO1	understand deeper insight of the meaning of their existence.	K1
CO2	recognize the philosophy of life and individual qualities	K2
CO3	acquire the skills required for a successful personal and professional life.	K3
CO4	develop as socially responsible citizens.	K4
CO5	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 Portion: 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>

Professional Ethics