MANONMANIAM SUNDARANAR UNIVERSITY

TIRUNELVELI – 12

MODIFIED AND CORRECTED SYLLABUS
(RECEIVED FROM CHAIRPERSON ON 27.10.2023.)

M.C.A.

TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION,
CHENNAI – 600 005

FROM THE ACADEMIC YEAR 2023 – 2024

1. Preamble

The Department of Computer Science was established with the objective of imparting quality education in the domain of Computer Science and Applications. With rapidly evolving technology and the continuous need for innovation, the department has always produced quality professionals, holding important positions in Information Technology industries in India and abroad. The Department updates its syllabi frequently to attract young talents from all over the country. The academic activities of the department, during the last four years, were centered on teaching and research programmes in computer science with a view to train post-graduates and researchers who can contribute significantly to the requirements of professional organizations in the field.

2. General Graduate Attributes (MCA)

G.A.1.Core Knowledge Enrichment

Train the students with Deep Core subject knowledge(including the fundamental concepts, computational models, advanced core techniques, appropriate Domain expertise).

Apply the knowledge of deep core concepts to conceptualize the computational models.

Accredited or validated against national or international standards.

G.A.2. Critical Analysis and Decision Making

Skilled with strategic thinking, problem solving, making better use of intuition, learning to evaluate better, and recognizing the essence of things

Analyze the complex problems and to evaluate and assess information in a practical and technical way and ends up with the specialized computational models to provide valid decisions.

G.A.3. Real–Time Project Design and development

Investigating the real world problems to design and develop the computational framework to cope with real world expectations; to fit that model to the complex real-time data and to apply appropriate research methods to synthesis the information to make appropriate decisions

G.A.4. Project Management Capabilities

Trained to apply effective management skills to produce specific project outcomes

G.A.5. Tools usage

Capable to learn and apply recent domain specific knowledge in the computer science and applications industry

G.A.6. Leadership and Teamwork

Skilled to work effectively as a member and also as a leader in multi-disciplinary teams.

G.A.7. Communication Skills

Trained to communicate the technical aspects with computing professionals and with society at large. Such ability includes listening, reading, speaking and writing, and the ability to comprehend and effective technical report writing and document preparation.

G.A.8. Professionalism

Trained to think and act professionally to adapt themselves in their work places and society to showcase their talents and skills smartly for their self up liftmen.

Aware about the cyber regulations and professional ethics, responsibilities and norms of professional computing practice

G.A.9.Advanced Technology Awareness

Trained to update themselves periodically with the current/modern technologies and enrich their knowledge through various online MOOC Courses to cope with the current industrial requirements.

G.A.10. Life Long Learning

To inculcate the passion for continuum learning for a successful professional career

G.A.11. Social Welfare with Ethical Values

Adapt at operating in other cultures, comfortable with different nationalities and social contexts, able to determine and contribute to desirable social outcomes.

Avoiding unethical behavior such as fabrication, falsification of data, committing plagiarism.

G.A.12. Entrepreneurship

Identify the timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and the society at large.

3. Programme Specific Qualification Attributes

PSQA-GA Mapping

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
K1(Knowledge)	✓								✓	✓		✓
K2 (Understanding)	✓	✓								✓		✓
K3 (Application level)	✓		✓	✓	✓					✓	✓	✓
K4 (Analytical level)		✓	✓	✓	✓	✓	✓		✓	✓		✓
K5 (Evaluation capability level)		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
K6 (Scientific or Synthesis level)	✓	✓	✓	✓				✓	✓	✓	✓	✓

4. Vision

Achieving excellence in Information Technology Enabled Services through Teaching, Research, Extension and Consultancy.

Mission

- To offer accredited post graduate and research programmes with the state-of-art technology throughout the Nation
- To maintain high academic standards and teaching quality

- To be a center of excellence for research and innovation in frontier areas of Computer Science and technology relevant to the country.

5. Programme Objectives and Outcomes Programme Educational Objectives

P.E.O.1. Sound background in fundamental core concepts and Computational principles, which are applied for complex problems Solving

P.E.O.2. Developing the professional skills and entrepreneur skills with Team work, leadership and communication qualities

P.E.O.3. Practicing lifelong learning for successful professional career with Ethical values

Programme Outcomes (POs) for Master of Computer Applications

P.O.1. Train the students with Deep Core subject knowledge (including the fundamental concepts, computational models, advanced core techniques, appropriate Domain expertise). Apply the knowledge of deep core concepts to conceptualize the computational models. Accredited or validated against national or international standards.

P.O.2. Skilled with strategic thinking, problem solving, making better use of in tuition, learning to evaluate better, and recognizing the essence of things. Analyze the complex problems and to evaluate and assess information in a practical and technical way and ends up with the specialized computational models to provide valid decisions.

P.O.3. Investigating the real world problems to design and develop the computational framework to cope with real world expectations; to fit that model to the complex real-time data and to apply appropriate research methods to synthesis the information to make appropriate decisions

P.O.4. Trained to apply effective management skills to produce specific project outcomes

P.O.5. Capable to learn and apply recent domain specific knowledge in the computer science and applications industry

P.O.6. Skilled to work effectively as a member and also as a leader in multi-disciplinary teams.

P.O.7. Trained to communicate the technical aspects with computing professionals and with society at large. Such ability includes listening reading, speaking and writing, and the ability to comprehend and effective technical report writing and document preparation.

P.O.8. Trained to think and act professionally to adapt themselves in their work places and society to show case their talents and skills smartly for their self up liftmen. Aware about the cyber regulations

and professional ethics, responsibilities and norms of professional computing practice.

P.O.9. Trained to update themselves periodically with the current/modern technologies and enrich their knowledge through various online MOOC Courses to cope with the current industrial requirements.

P.O.10. To inculcate the passion for continuum learning for a successful Professional career

P.O.11. Adapt at operating in other cultures, comfortable with different Nationalities and social contexts, able to determine and contribute to desirable social outcomes. Avoiding unethical behavior such as Fabrication, falsification of Data, committing plagiarism

P.O.12. Identify the timely opportunity and using innovation to pursue that opportunity to create value and wealth for the better men to the individual and the society at large.

PEO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO 1	✔	✔	✔	✔	✔					✔	✔	
PEO 2		✔	✔	✔		✔	✔	✔	✔	✔		✔
PEO 3	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

PO-GA Mapping

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
PO1	■											
PO2		■										
PO3			■									
PO4				■								
PO5					■							
PO6						■						
PO7							■					
PO8								■				
PO9									■			
PO10										■		
PO11											■	
PO12												■

Programme Specific Outcomes

P.S.O.1. To develop the abilities to acquire deep knowledge of fundamental and core theoretical and programming concepts for holistic development

P.S.O.2. Design, develop and test the software systems for real-time socio- economic problems

P.S.O.3. Analyze and recommend appropriate IT Solutions

6. Candidate Eligibility for M.C.A. Programme Admission

Candidates who have passed in any one of the following or equivalent are eligible to apply:

(i)   BCA/Bachelor Degree in Computer Science or equivalent Degree.

OR

(ii) B.Sc., /B.Com. / B.A. with Mathematics at 10th, +2 level or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).

Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination.

Bridge Course on Basics in Computer Science

Course duration: 30 Hours

Course Modules:

Module1: Computer Organization and Architecture

Module2: Data Structures and Algorithms

Module3: Problem Solving Techniques

Module4: Operating Systems

Module5: Object oriented programming

Module6: Database Management System

Module 7: Software Engineering

Module 8: Computer Networks

7. Duration of the Programme, Medium and training

The programme shall be of two years duration spread over four semesters under choice based credit system. The medium of instruction/study is English. Industrial training will bring knowledge in the software industry. Industrial visit may also be permitted to interact the students with the people in the software industry.

8.CBCS- Structure

Component wise Credit Distribution

Credits	Sem I	Sem II	Sem III	Sem IV	Total
Core/Core LAB	16	16	15	12	59
Electives (i)Discipline– Centric	6	6	3	3	18
(ii Skill Enhancement	1	1	2	2	
(iii)Summer Internship / IndustrialTraining/ Project			2	3	11
Ability Enhancement / Extension	1	1	2	2+1	7
Total Credits	24	24	24	23	95

9. Credit Calculation

Method of teaching	Hours	Credits
Lecture	1	1
Tutorial / Demonstration	1	1
Practical / Internship/self-Learning	2/1	1

10. Examinations

Examinations are conducted in semester pattern. The examination for the Semester I & III will be held in November/December and that for the Semester II and IV will be in the month of April/May.

11. Scheme for Evaluation and Attainment Rubrics

Evaluation will be done on a continuous basis and will be evaluated four times during the course work. The first evaluation will be in the 7th week, the second in the 11thweek, third in the 16thweek and the end– semester examination in the 19thweek. Evaluation maybe by objective type questions, short answers, essay so recombination of these, but the end semester examination is a University theory examination with prescribed question paper pattern.

Attainment of Rubrics for Theory Courses

THEORY EXAMINATION Evaluation of

Internal Assessment

Test	:15 Marks	(Best one out of Three Tests)
Seminar	:5 Marks	
Assignment	:5 Marks	

Total: 25Marks

*** No Internal Minimum

Evaluation of End Semester Examinations

Question Paper Pattern (Theory)

Section	Approaches	Mark Pattern	K Level	CO Coverage
A	One word (Answer all questions)	10X1 = 10 (Multiple	K1-K2	CO1-CO5
B	100 to 200 words (Answer any three out of five	5X5 = 25 (Analytical type questions)	K4-K6	CO1-CO5
C	500 to 1000 words	5X8 = 40 (Essay type questions)	K2-K3	CO1-CO5

Attainment Rubrics for Lab Courses

PRACTICAL \ MINI PROJECTEXAMINATION

Evaluation of Internal Assessment

  Test 1 : 20Marks

  Test 2 : 20 Marks   (Best one out of Two Tests)

  Test 3 : 20Marks

  Total : 40 Marks

  *** No Internal Minimum

QUESTION PAPER PATTERN

  Time duration: 3 Hours

  Max. Marks: 60

Two Questions may be taken from the list of practical problems: 60 Marks

Distribution of the Marks

(i) Practical/Mini project
 - Record Note Book- 10
 - Problem Understanding- 10
 - Implementation- 20
 - Debugging and Modification- 10
 - For correct output and viva - 10

(ii) Industrial Training
 - Internal Assessment- 40
 - Joint Viva-voce - 60

(Internal Examiner 30 and External Examiner 30)

PASSING MINIMUM

The candidate shall be declared to have passed in the theory/practical/Dissertation examination if the candidate secures:

    (i)   50% marks in the ESE and
    (ii)   50% in ESE and IA put together

M.C.A - Revised Course Structure

Changes in Internal & External Practical Marks

Semester I

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
Core – I	Discrete Mathematics	4	4		25	75	100
Core – II	Linux and shell programming	4	4		25	75	100
Core – III	Python Programming	4	4		25	75	100
Elective – I	Advanced Operating Systems	3	3		25	75	100
Elective – II	Advanced ComputerNetworks	3	3		25	75	100
Lab I	Linux and shell programming Lab	2		4	50	50	100
Lab II	Python Programming Lab	2		4	50	50	100
Ability Enhancement Course AEC-I	Effective Communication inEnglish	1		2	50	50	100
Skill Enhancement Course– SEC I	Basics of Web Design	1	2		25	75	100
	Total	24	22	10			

Semester II

Type of the Course	Title of the Course	Credits	Hours Theory	PRACTICAL	INT	EXT	TOT
Core – IV	Data Structures and Algorithms	4	4		25	75	100
Core – V	Advanced Software Engineering	4	4		25	75	100
Core – VI	Advanced Java Programming	4	4		25	75	100
Elective – III	Artificial Intelligence and Machine Learning	3	3		25	75	100
Elective –IV	Internet of Things	3	3		25	75	100
Lab– III	Data Structures and Algorithms lab	2		4	*50*	*50*	100
Lab – IV	Advanced Java Programming Lab	2		4	*50*	*50*	100
Ability Enhancement Course AEC-II	English for Competitive Exams	1		2	*50*	*50*	100
Skill Enhancement Course – SEC II	Web Development using PHP	1	2		25	75	100
	Total	24	22	10			

Discrete Mathematics

Course Objective

- To know the concepts of relations and functions
- To distinguish among different normal forms and quantifiers
- To solve recurrence relations and permutations & combinations
- To know and solve matrices , rank of matrix & characteristic equations
- To study the graphs and its types

Unit-I

Relations- Binary relations-Operations on relations- properties of binary relations in a set – Equivalence relations–– Representation of a relation by a matrix - Representation of a relation by a digraph – **Functions**-Definition and examples-Classification of functions-Composition of functions-Inverse function

Unit-II

Mathematical Logic-Logical connectives-**Well formed formulas** – Truth table of well formed formula –Algebra of proposition –Quine's method- **Normal forms of well formed formulas**- Disjunctive normal form-Principal Disjunctive normal form-Conjunctive normal form-Principal conjunctive normal form-**Rules of Inference for propositional calculus** – **Quantifiers**- Universal Quantifiers- Existential Quantifiers

Unit-III

Recurrence Relations- Formulation -solving recurrence Relation by Iteration-solving Recurrence Relations- Solving Linear Homogeneous Recurrence Relations of Order Two- Solving Linear Non homogeneous Recurrence Relations. **Permutations**-Cyclic permutation- Permutations with repetitions- permutations of sets with indistinguishable objects- **Combinations**- Combinations with repetition

Unit-IV

Matrices- special types of matrices-Determinants-Inverse of a square matrix-Cramer's rule for solving linear equations-Elementary operations-Rank of a matrix-solving a system of linear equations-characteristic roots and characteristic vectors-Cayley-Hamilton Theorem-problems

Unit-V
Graphs -Connected Graphs -Euler Graphs- Euler line-Hamiltonian circuits and paths –planar graphs – Complete graph-Bipartite graph-Hyper cube graph-Matrix representation of graphs

Text book

1. N.Chandrasekaran and M.Umaparvathi, Discrete mathematics, PHI Learning Private Limited, New Delhi, 2010.

Reference Book

1. Kimmo Eriksson & Hillevi Gavel, Discrete Mathematics & Discrete Models, Studentlitteratur AB, 2015.
2. Kenneth H. Rosen Discrete Mathematics and applications, Mc Graw Hill, 2012.

Course Outcomes

On the successful completion of the course, students will be able

CO1:	To understand the concepts of relations and functions distinguish among normal forms	K2	IO
CO2:	To analyze and evaluate the recurrence relations	K4,K5	HO
CO3:	To distinguish among various normal forms and predicate calculus	K5	HO
CO4:	To solve and know various types of matrices	K1	LO
CO5:	To evaluate and solve various types of graphs	K5	HO

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

Linux and Shell Programming

Course Objective

- To teach principles of operating system including File handling utilities, Basic Linux commands, Scripts and filters.
- To familiarize fundamentals of shell (bash), shell programming, pipes, Control structures, arithmetic in shell interrupt processing, functions, debugging shell scripts.
- To impart fundamentals of file concepts kernel support for file, File structure related system calls (file API's).
- To facilitate students in understanding Inter process communication, semaphore and shared memory.
- To explore real-time problem solution skills in Shell programming.

Unit-I

Basic bash Shell Commands: Interacting with the shell-Traversing the file system-Listing files and directories-Managing files and directories-Viewing file contents. **Basic Script Building:**Using multiple commands-Creating a script file-Displaying messages-Using variables-Redirecting input and output-Pipes-Performing math-Exiting the script. **Using Structured Commands:**Working with the if-then statement-Nesting ifs-Understanding the test command-Testing compound conditions-Using double brackets and parentheses-Looking at case.

(Book-1, Chapters: 3, 11, and 12)

Unit-II

More Structured Commands: Looping with for statement-Iterating with the until statement-Using the while statement-Combining loops-Redirecting loop output. **Handling User Input:** Passing parameters-Tracking parameters-Being shifty-Working with options-Standardizing options-Getting user input. **Script Control:** Handling signals-Running scripts in the background-Forbidding hang-ups -Controlling a Job-Modifying script priority-Automating script execution.

(Book-1, Chapters: 13, 14, and 16)

Unit-III

Creating Functions: Basic script functions-Returning a value-Using variables in functions-Array and variable functions-Function recursion-Creating a library-Using functions on the command line. **Writing Scripts for Graphical Desktops:** Creating text menus-Building text window widgets-Adding X Window graphics. **Introducing sed and gawk:** Learning about the sed Editor-Getting introduced to the gawk Editor-Exploring sed Editor basics.

(Book-1, Chapters: 17, 18, and 19)

Unit-IV

Regular Expressions: Defining regular expressions-Looking at the basics-Extending our patterns-Creating expressions. **Advanced sed:** Using multiline commands-Understanding the hold space-Negating a command-Changing the flow-Replacing via a pattern-Using sed in scripts-Creating sed utilities. **Advanced gawk:** Reexamining gawk-Using variables in gawk-Using structured commands-Formatting the printing-Working with functions.

 (Book-1, Chapters: 20, 21, and 22)

Unit-V

Working with Alternative Shells: Understanding the dash shell-Programming in the dash shell-Introducing the zsh shell-Writing scripts for zsh.**Writing Simple Script Utilities:** Automating backups-Managing user accounts-Watching disk space. **Producing Scripts for Database, Web, and E-Mail:** Writing database shell scripts-Using the Internet from your scripts-Emailing reports from scripts. **Using Python as a Bash Scripting Alternative:** Technical requirements-Python Language-Hello World the Python way-Pythonic arguments-Supplying arguments-Counting arguments-Significant whitespace-Reading user input-Using Python to write to files-String manipulation.

 (Book-1, Chapters: 23, 24, 25, and Book-2, Chapter: 14)

 Text book:

1. Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting BIBLE", Wiley Publishing, 3rd Edition, 2015.**Chapters:** 3, 11 to 14, 16 to 25.
2. Mokhtar Ebrahim, Andrew Mallett, "Mastering Linux Shell Scripting", Packt Publishing, 2nd Edition, 2018. **Chapter:** 14.

Reference Books:

1. ClifFlynt, SarathLakshman, ShantanuTushar, "Linux Shell Scripting Cookbook ", Packt Publishing, 3rd Edition, 2017.
2. Stephen G.Kochan, Patrick Wood, "Shell Programming in Unix, Linux, and OS X", Addison Wesley Professional, 4th Edition, 2016.
3. Robert Love, "Linux System Programming", O'Reilly Media, Inc, 2013
4. W.R. Stevens, "Advanced Programming in the UNIX environment", 2nd Edition, Pearson Education, 2013
5. Graham Glass, King Ables, " UNIX for Programmers and Users", 3rd Edition, Pearson Education, 2003

Course Outcomes

On the successful completion of the course, students will be able

CO1:	To understand, apply and analyze the concepts and methodology of Linux shell programming	K1-K6
CO2:	To comprehend, impart and apply fundamentals of control structure and script controls	K1-K6
CO3:	To understand, analyses and evaluate the functions, graphical desktop interface and editors	K1-K6
CO4:	To collaborate, apply and review the concepts and methodology of regular expression and advanced gawk	K1-K6
CO5:	To comprehend, use and illustrate the advance concepts such as alternate shell script, data connectivity and bash scripting using python	K1-K6

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

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	-	S	L	-	M	M	M	M	S
CO2	S	S	M	-	S	L	-	M	M	M	M	S
CO3	S	S	M	-	S	L	-	M	M	S	S	S
CO4	S	S	M	-	S	L	-	M	M	M	M	S
CO5	S	S	M	-	S	L	-	M	M	M	M	S

S- Strong; M-Medium; L-Low

Python Programming

Course Objectives:

- To acquire programming skills in core Python
- To learn Strings and function
- To develop object oriented skills in Python
- To comprehend various Python Packages
- To develop web applications using Django

Unit I

Introduction : Fundamental ideas of Computer Science **-** Strings, Assignment, and Comments - Numeric Data types and Character sets – Expressions – Loops and Selection Statements: Definite iteration: the for Loop - **selection**: if and if-else statements - Conditional iteration: the while Loop

Unit II

Strings and Text Files: Accessing Characters and substrings in strings - Data encryption-Strings and Number systems- String methods – Text - Lists and Dictionaries: Lists – Dictionaries – Design with Functions: A Quick review - Problem Solving with top-Down Design - Design with recursive Functions - Managing a Program's namespace - Higher-Order Functions

Unit III

Design with Classes: Getting inside Objects and Classes – Data-Modeling Examples – Building a New Data Structure – The Two – Dimensional Grid - Structuring Classes with Inheritance and Polymorphism - Graphical User Interfaces - The Behavior of terminal-Based programs and GUI-Based programs - Coding Simple GUI-Based programs - Windows and Window Components - Command Buttons and responding to events

Unit IV

Working with Python Packages: NumPy Library-Ndarray – Basic Operations – Indexing, Slicing and Iteration – Array manipulation - Pandas –The Series – The DataFrame - The Index Objects – Data Vizualization with Matplotlib – The Matplotlib Architecture – pyplot – The Plotting Window – Adding Elements to the Chart – Line Charts – Bar Charts – Pie charts

Unit V

Django: Installing Django – Building an Application – Project Creation – Designing the Data Schema - Creating an administration site for models - Working with QuerySets and Managers – Retrieving Objects – Building List and Detail Views

Text Book:

1. K.A. Lambert, " Fundamentals of Python: first programs", Second Edition, Cengage Learning, 2018 **(Unit - I, II and III)**
2. Fabio Nelli, "Python Data Analytics: With Pandas, NumPy, and Matplotlib", Second Edition, Kindle Edition, 2018 **(Unit - IV)**
3. Antonio Mele, "Django 3 By Example", Third Edition, 2020 **(Unit - V)**

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Comprehend the programming skills in python and develop applications using conditional branches and loop	K1- K6
CO2	Create python applications with strings and functions	
CO3	Understand and implement the Object Oriented Programming paradigm with the concept of objects and classes, Inheritance and polymorphism	
CO4	Evaluate the use of Python packages to perform numerical computations and data vizualization	
CO5	Design interactive web applications using Django	

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

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	M	S	S	S	S	M	S	S
CO2	S	S	S	M	S	S	S	S	S	S	M	S
CO3	S	M	S	S	M	S	M	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S	M	S
CO5	S	S	S	S	S	S	S	S	S	M	M	S

S- Strong; M-Medium; L-Low

Linux and Shell Programming - Lab

Course Objectives

- To enable the students to study and understand the efficiency of Linux shell script.
- To demonstrate the File Backup process.
- To develop and implement the shell script for GUI processing.
- To develop and implement the shell script for IPC and Networking.
- To demonstrate PostgreSQL.

List of Programs

1. Write a Shell Script program to calculate the number of days between two dates.
2. Write a Shell Script program to check systems on local network using control structures with user input.
3. Write a Shell Script program to check systems on local network using control structures with file input.
4. Write a Shell Script program to demonstrate the script control commands.
5. Write a Shell Script program to demonstrate the Shell script function.
6. Write a Shell Script program to demonstrate the Regular Expressions.
7. Write a Shell Script program to demonstrate the sed and awk Commands.
8. Write a Shell Script program to demonstrate the File Backup process through creating a daily archive location.
9. Write a Shell Script program to create a following GUI tools.

   a) Creating text menus
   b) Building text window widgets
10. Write a Shell Script program to demonstrate to connect a PostgreSQL database and performing CRUD operations.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	To understand, apply and analyze the concepts and methodology of Linux shell programming	K1-K6
CO2:	To comprehend, impart and apply fundamentals of control structure and script controls	K1-K6
CO3:	To understand, analyses and evaluate the functions, graphical desktop interface and editors	K1-K6
CO4:	To collaborate, apply and review the concepts and methodology of regular expression and advanced gawk	K1-K6
CO5:	To comprehend, use and analyze the advance concepts such as alternate shell script, dy and bash scripting using PostgreSQL	K1-K6

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

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	-	S	-	-	-	M	-	-	-
CO2	S	S	S	-	S	-	-	-	M	-	-	-
CO3	S	S	S	-	S	-	-	-	M	S	S	S
CO4	S	S	S	-	S	-	-	-	M	-	-	-
CO5	S	S	S	-	S	-	-	-	M	S	S	S

S- Strong; M-Medium; L-Low

Python Programming Lab

Course Objectives:

This course enables the students:

- To master the fundamentals of writing python scripts
- To create program using elementary data items
- To implement Python programs with conditionals and loops
- To use functions for structuring Python programs
- To develop web programming with Django

Implement the following in Python:

1. Program using elementary data items, lists, dictionaries and tuples
2. Program using conditional branches, loops
3. Program using functions
4. Program using classes and objects
5. Program using inheritance
6. Program using polymorphism
7. Program to implement file operations
8. Program using Pandas
9. Program using Modules
10. Program for creating dynamic and interactive web pages using forms

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Comprehend the programming skills in python and write scripts	K1- K6
CO2	Create python applications with elementary data items, lists, dictionaries and tuples	
CO3	Implement the Object Oriented Programming programming concepts such as objects and classes, Inheritance and polymorphism	
CO4	Assess the use of Python packages to perform numerical computations and perform data vizualization	
CO5	Create interactive web applications using Django	

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

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	S	S	S	M	S
CO3	S	S	S	S	S	S	M	S	S	M	L	S
CO4	S	S	S	S	S	S	S	M	S	S	S	S
CO5	S	S	S	S	L	S	M	S	S	M	M	S

S- Strong; M-Medium; L-Low

AEC-I :   Ability Enhancement Course   1

L	T	P	C
2			1

EFFECTIVE COMMUNICATION IN ENGLISH

Course code:

Course Objectives:

• To help the students develop communication skills and self confidence
• To motivate the students to acquire employability skills
• To introduce various interview techniques to the students
• To motivate the students to becomes good public speakers
• To develop leadership qualities in the students
• To guide the students how to tackle interviews
• To help the students to enhance their writing skills
• To teach the students how to write a good CV
• To introduce various articles in writing to the students

Course Contents

Public Speaking
The power of Public Speaking, • Developing confidence, • Planning • Preparation • Successful and effective delivery of speech

Group Discussion
What is group discussion? • Why are group discussions held? • Preparation for a group discussion • Skills for effective participation • Traits tested in a group discussion • Initiating a group discussion • Non-verbal communication in group discussion • Typesof group discussions

Interviews
Interviewing in the 21st century • Developing an Interview Strategy • Taking Care of the Details • Practicing for the Interview • During the Interview • Stress Interviews • Traditional Interviews

Writing Skills • Basics of writing • Writing paragraphs • Writing research articles •Report writing • Writing a CV

L	T	P	C
2			1

Skill Enhancement Course (SEC 2)

Basics of Web Design

UNIT I

Introduction to Web Design Introduction of Internet, WWW, Website, Working of Websites, Webpages, Front End, Back End, Client and Server Scripting Languages, Responsive Web Designing, Types of Websites (Static and Dynamic Websites).

UNIT II

HTML Basics HTML: Introduction, Basic Structure of HTML, Head Section and Elements of Head Section, HTML 5 Introduction, HTML5 New Elements: Section, Nav, Article, Aside, Audio Tag, Video Tag, HTML5 Form Validations: Require Attribute. Autofocus Attribute, email, number type, date type , Range type, HTML embed multimedia, HTML Layout, HTML Iframe

Unit III

CSS Introduction to CSS, Types of CSS, CSS Selectors: Universal Selector, ID selector, Tag Selector, Class Selector, Sub Selector, Attribute Selector, Group Selector, CSS Properties: Back Ground properties, Block Properties, Box properties, List properties, Border Properties, Positioning Properties, CSS Lists CSS Tables, CSS Menu Design CSS Image Gallery

Unit IV

JavaScript and Angular JS Introduction to Client Side Scripting Language, Variables in Java Script, Operators in JS, Conditions Statements, JS Popup Boxes.

Unit V

JS Events, Basic Form Validations in JavaScript. Introduction to Angular JS: Expressions, Modules and Directives.

Books for Reference:

1. HTML5, Black Book, Kagent Learning Solution Inc, 2014
2. Mastering HTML, CSS &JavaScript Web Publishing by Lemay Laura, BPB publications
3. HTML & CSS: The Complete Reference by Thomas Powell

Revised Course Structure

Changes in Internal & External Practical Marks

SEMESTER II

Type of the Course	Title of the Course	Credits	Hours Theory	PRACTICAL	INT	EXT	TOT
Core – IV	Data Structures and Algorithms	4	4		25	75	100
Core – V	Advanced Software Engineering	4	4		25	75	100
Core – VI	Advanced Java Programming	4	4		25	75	100
Elective – III	Artificial Intelligence and Machine Learning	3	3		25	75	100
Elective –IV	Internet of Things	3	3		25	75	100
Lab– III	Data Structures and Algorithms lab	2		4	*50*	*50*	100
Lab – IV	Advanced Java Programming Lab	2		4	*50*	*50*	100
Ability Enhancement Course AEC-II	English for Competitive Exams	1		2	*50*	*50*	100
Skill Enhancement Course – SEC II	Web Development using PHP	1	2		25	75	100
	Total	24	22	10			

Data Structures and Algorithms

Course Objectives:
- To get a clear understanding of various ADT structures.
- To understand how to implement different ADT structures with real-time scenarios.
- To analyze the various data structures with their different implementations.
- To get an idea of applying right models based on the problem domain.
- To realize, and understand how and where to implement modern data structures with Python language.

Unit-I

Abstract Data Types: Introduction-Date Abstract Data Type-Bags-Iterators. **Arrays**: Array Structure-Python List-Two Dimensional Arrays-Matrix Abstract Data Type. **Sets, Maps:** Sets-Maps- Multi-Dimensional Arrays.

Unit-II

Algorithm Analysis: Experimental Studies-Seven Functions-Asymptotic Analysis. **Recursion:** Illustrative Examples-Analyzing Recursive Algorithms-Linear Recursion-Binary Recursion-Multiple Recursion.

Unit-III

Stacks, Queues, and Deques: Stacks- Queues- Double-Ended Queues Linked. **Lists:** Singly Linked Lists-Circularly Linked Lists-Doubly Linked Lists. **Trees:** General Trees-Binary Trees-Implementing Trees-Tree Traversal Algorithms.

Unit-IV

Priority Queues: Priority Queue Abstract Data Type- Implementing a Priority Queue- Heaps-Sorting with a Priority Queue. **Maps, Hash Tables, and Skip Lists:** Maps and Dictionaries-Hash Tables- Sorted Maps-Skip Lists-Sets, Multisets, and Multimaps.

Unit-V

Search Trees: Binary Search Trees-Balanced Search Trees-AVL Trees-Splay Trees. **Sorting and Selection:** Merge sort-Quick sort-Sorting through an Algorithmic Lens-Comparing Sorting Algorithms-Selection. **Graph Algorithms:** Graphs-Data Structures for Graphs-Graph Traversals-Shortest Paths-Minimum Spanning Trees.

Text book:
1. Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011. (Unit – 1) **Chapters:** 1, 2, 3.

2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", John Wiley & Sons, 2013. (Unit – 2, 3, 4, and 5) **Chapters:** 3 to 12, and 14.

Reference books:
1. Dr. Basant Agarwal; Benjamin Baka, "Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7", Packt Publishing, 2018.

2. Magnus Lie Hetland, "Python Algorithms: Mastering Basic Algorithms in the Python Language", Apress, 2014.

Course Outcome:
On the successful completion of the course, students will be able to,

CO1	Understand various ADT concepts	
CO2	Familiar with implementation of ADT models with Python language and understand how to develop ADT for the various real-time problems	K1-K6
CO3	Apply with proper ADT models with problem understanding	
CO4	Apply and Analyze right models based on the problem domain	
CO5	Evaluate modern data structures with Python language	

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

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	L	S	S	S	L	M	M
CO2	S	M	S	M	M	L	L	L	L	L	M	M
CO3	S	S	S	L	L	L	M	M	M	M	M	L
CO4	S	S	S	L	L	L	M	M	M	L	L	L
CO5	S	S	S	L	M	M	S	S	S	S	M	L

L - Low, M- Medium, S - Strong

Course code		ADVANCED SOFTWARE ENGINEERING	L	T	P	C
Core			4			4
Pre-requisite		Basics of Software Engineering & SPM				

Course Objectives:
The main objectives of this course are to:
1. Introduce to Software Engineering, Design, Testing and Maintenance.
2. Enable the students to learn the concepts of Software Engineering.
3. Learn about Software Project Management, Software Design & Testing.

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

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

Unit:1	**INTRODUCTION**	**15hours**

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

Unit:2	**SOFTWARE REQUIREMENTS**	**15hours**

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.

Unit:3	**PROJECT MANAGEMENT**	**15hours**

Software Project Management: Responsibilities of a software project manager – Project planning – Metrics for Project size estimation – Project Estimation Techniques – Empirical Estimation Techniques – COCOMO – Halstead's software science – Staffing level estimation – Scheduling– Organization and Team Structures – Staffing – Risk management – Software Configuration Management – Miscellaneous Plan.		
Unit:4	**SOFTWARE DESIGN**	**15hours**
Software Design: Outcome of a Design process – Characteristics of a good software design – Cohesion and coupling - Strategy of Design – Function Oriented Design – Object Oriented Design - Detailed Design - IEEE Recommended Practice for Software Design Descriptions.		
Unit:5	**SOFTWARE TESTING**	**13hours**
Software Testing: A Strategic approach to software testing – Terminologies – Functional testing– Structural testing – Levels of testing – Validation testing - Regression testing – Art of Debugging–Testingtools-Metrics-ReliabilityEstimation.SoftwareMaintenance -Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars –webinars		
	Total Lecture hours	**75 hours**

	Text Books
1	An Integrated Approach to Software Engineering – Pankaj Jalote, Narosa Publishing House,Delhi, 3rd Edition.
2	Fundamentals of Software Engineering –Rajib Mall, PHI Publication,3rdEdition.
	Reference Books
1	Software Engineering– K.K. Aggarwal and Yogesh Singh, New Age International Publishers,3 rd edition.
2	A Practitioners Approach-Software Engineering,- R.S. Pressman, McGraw Hill.
3	Fundamentals of Software Manodrioli, PHI Publication. Engineerin g - Carlo Ghezzi, M. Jarayeri, D.

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

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

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

Course code		ADVANCED JAVA PROGRAMMING	L	T	P	C
Core			4			4
Pre-requisite		Basics of Java & its Usage				

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the basic functions, principles and concepts of advanced javaprogramming.
2. Provide knowledge on concepts needed for distributed Application Architecture.
3. Learn JDBC, Servlet packages, JQuery, Java Server Pages and JAR file format

Expected Course Outcomes:

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

1	Understand the advanced concepts of Java Programming	K1,K2
2	Understand JDBC and RMI concepts	K2,K3
3	Apply and analyze Java in Database	K3,K4
4	Handle different event in java using the delegation event model, event listener and class	K5
5	Design interactive applications using Java Servlet, JSP and JDBC	K5,K6

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

Unit:1	BASICSOFJAVA	12hours

Java Basics Review: Components and event handling–Threading concepts–
Networking features –Media techniques

Unit:2	REMOTEMETHOD INVOCATION	12hours

Remote Method Invocation-Distributed Application Architecture- Creating
stubs and skeletons-Defining Remote objects- Remote Object Activation-
Object Serialization-Java Spaces

Unit:3	DATABASE	10hours

Java in Databases-JDBC principles–database access-Interacting-
database search–Creatingmultimedia databases – Database support in
web applications

Unit:4	SERVLETS	12hours

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

Unit:5	ADVANCEDTECHNIQUES	12hours

JAR file format creation–Internationalization–Swing Programming–Advanced java Techniques

Unit:6	Contemporary Issues	2 hours
	Expert lectures ,online seminars –webinars	

	Total Lecture hours	60 hours

Text Books	
1	Jamie Jaworski, "Java Unleashed", SAMS Tech media Publications,1999.
2	Campione, Walrath and Huml, "The Java Tutorial", Addison Wesley,1999.

Reference Books	
1	JimKeogh,"TheCompleteReferenceJ2EE",TataMcGrawHillPublishingCompany Ltd,2010.
2	DavidSawyerMcFarland,"JavaScriptAndJQuery-TheMissingManual",Oreilly Publications,3rd Edition,2011.
3	Deitel and Deitel, "Java How to Program", Third Edition, PHI/Pearson Education Asia.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.javatpoint.com/servlet-tutorial
2	https://www.tutorialspoint.com/java/index.htm
3	https://onlinecourses.nptel.ac.in/noc19_cs84/preview

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

page-Expressions- Scriptlets-Directives-Declarations-A complete example

Data Structures and Algorithms Lab

Course Objectives:
- To understand Stack , Queue and Doubly Linked ADT structures.
- To implement different ADT structures with real-time scenarios.
- To analyze the recursion concepts.
- To apply different sorting and tree techniques.
- To implement modern data structures with Python language.

Implement the following problems using Python 3.4 and above

1. Recursion concepts.
    i) Linear recursion
    ii) Binary recursion.

2. Stack ADT.
3. Queue ADT.
4. Doubly Linked List ADT.
5. Heaps using Priority Queues.
6. Merge sort.
7. Quick sort.
8. Binary Search Tree.
9. Minimum Spanning Tree.
10. Depth First Search Tree traversal.

Course Outcome:

On the successful completion of the course, students will be able to,

CO1	Strong understanding in various ADT concepts	
CO2	To become a familiar with implementation of ADT models	
CO3	Apply sort and tree search algorithms	K1-K6
CO4	Evaluate the different data structure models	
CO5	Learn how to develop ADT for the various real-time problems	

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

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	L	S	S	M	M	S	S
CO2	S	M	S	M	M	L	S	M	S	L	M	M
CO3	S	S	S	L	L	L	M	M	M	M	S	L
CO4	S	S	S	M	M	S	M	M	S	S	S	L
CO5	S	S	S	S	L	M	S	M	M	M	M	L

L - Low, M- Medium, S - Strong

de		PRACTICAL IV:ADVANCED JAVA LAB	L	T	P	C
Core/Elective/Supportive					4	2
Pre-requisite		Basics in Java Programming				

Course Objectives:
The main objectives of this course are to:

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

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

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

LISTOF PROGRAMS	**75hours**

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 pay slip using JSP.
6. Write a program using JDBC for creating a table, Inserting, Deleting records andlist 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 withtheir 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 apple for a calculator application.
12. Program to send a text message to another system and receive the text message fromthe system (use socket programming).

Expert lectures, online seminars –webinars	
Total Lecture hours	**75hours**

	Text Books
1	JamieJaworski,"JavaUnleashed",SAMSTechmediaPublications,1999.
2	Campione, Walrath and Huml,"TheJavaTutorial",AddisonWesley,1999.
	Reference Books
1	JimKeogh,"TheCompleteReferenceJ2EE",Tata Mc Graw Hill Publishing Company Ltd,2010.
2	DavidSawyerMcFarland,"JavaScriptAndJQuery-TheMissingManual",Oreilly Publications, 3rd Edition,2011.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.javatpoint.com/servlet-tutorial
2	https://www.tutorialspoint.com/java/index.htm
3	https://onlinecourses.nptel.ac.in/noc19_cs84/preview

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

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

L	T	P	C
2			1

ENGLISH FOR COMPETITIVE EXAMS

Objectives:

- To help the students prepare for competitive exams
- To enable the students to learn the techniques to ace the tests
- To enable the students to learn English grammar
- To enhance the students' reading skills
- To teach the students how to answer comprehension questions
- To focus on vocabulary and its importance
- To guide the students about IELT exams
- To discuss various components of vocabulary
- To introduce a variety of reading passages to the students

Course Contents Reading

Comprehension

- Introduction to a variety of reading passages - Key to comprehension - Tackling questions - Techniques for answering comprehension questions

Reading Skills

- Skimming - Scanning - Intensive reading - Extensive reading

Vocabulary

Synonyms - Antonyms - Analogy - Sentence completion

Grammar

Basics of grammar (Parts of speech, tense form, articles, etc.) - Identifying errors

Writing

- Importance of writing - Responding to the task - Coherence and cohesion - Lexical resource - Grammatical range and accuracy - Planning and preparation - Using examples
- Writing general essays - Descriptive writing.

L	T	P	C
2			1

Web Development using PHP

UNIT I

Introduction to PHP as a programming Language: - Advantages of PHP, the server side architecture Decomposed, overview of PHP, history, object oriented support, benefits in running PHP as a server side script.

UNIT II

The basics of PHP: - data types, variables, constants, operators, Arrays, Conditional statements (if statement, Executing Multiple Statements, else if clause and switch statement), Iterations (for loop, while loop, controlling an array using a while loop, do while statement.

UNIT III

Functions, user defined functions, functions with arguments, built in functions (print(), includer(), header(), phpinfo()), Working with Strings.

UNIT IV

Working with forms, form elements (Text Box, Text Area, Password, Radio Button, Checkbox, The Combo Box, Hidden Field and image), adding elements to a form

UNIT V

Data base connectivity using PHP (MySQL, ODBC, ORACLE, SQL) Performing, executing Commands, different types of Data Base Operations like Insertion, deletion, update and query on dat

Books for Reference:

1. Mastering PHP, WebTech Solutions, Khanna Publishing House
2. Learning PHP, Ramesh Bangia, Khanna Publishing House

Course code		ADVANCED OPERATING SYSTEMS	L	T	P	C
Elective - 1			3			3
Pre-requisite		Basics of OS& its functioning				

Course Objectives:
The main objectives of this course are to:
1. Enable the students to learn the different types of operating systems and their functioning.
2. Gain knowledge on Distributed Operating Systems
3. Gain insight into the components and management aspects of real time and mobile operatingsystems.
4. Learn case studies in Linux Operating Systems

Expected Course Outcomes:	
On the successful completion of the course student will be able to:	
1 Understand the design issues associated with operating systems	K1,K2
2 Master various process management concepts including scheduling, deadlocks and distributed file systems	K3,K4
3 Prepare Real Time Task Scheduling	K4,K5
4 Analyze Operating Systems for Handheld Systems	K5
5 Analyze Operating Systems like LINUX and IOS	K5,K6

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

Unit:1	BASICSOFOPERATINGSYSTEMS	12hours

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

Unit:2	DISTRIBUTEDOPERATINGSYSTEMS	12hours

Distributed Operating Systems: Issues – Communication Primitives – Lamports Logical Clocks –Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues

Unit:3	REALTIMEOPERATINGSYSTEM	10hours

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

Unit:4	HANDHELDSYSTEM	12hours

	Operating Systems for Handheld Systems: Requirements–Technology Overview–Handheld Operating Systems–Palm OS-Symbian Operating System-Android–Architecture of android–	
	Securing handheld systems	
Unit:5	**CASE STUDIES**	**12hours**

Case Studies : Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS : Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

Unit:6	**Contemporary Issues**	**2 hours**
	Expert lectures, online seminars–webinars	
	Total Lecture hours	**60hours**

	Text Books
1	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts",Seventh Edition, John Wiley & Sons, 2004.
2	Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems –Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.
	Reference Books
1	Rajib Mall, "Real-Time Systems: Theory and Practice ",Pearson Education India,2006.
2	Pramod Chandra P. Bhatt, An introduction to operating systems, concept and practice, PHI,Third edition, 2010.
3	Daniel.P.Bovet&MarcoCesati,"UnderstandingtheLinuxkernel",3ʳᵈedition,O" Reilly,2005
4	Neil Smyth, "iPhone iOS 4Development Essentials–Xcode", Fourth Edition, Payload media,2011.
	Related Online Contents [MOOC, SWAYAM,NPTEL, Websites etc.]
1	https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2	https://www.udacity.com/course/advanced-operating-systems--ud189
3	https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf

Mapping with Programming Outcomes										
Cos	**PO 1**	**PO 2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO 8**	**PO9**	**PO1 0**
CO1	S	M	S	S	S	S	M	M	M	M
CO2	S	M	S	S	S	S	S	M	S	M
CO3	S	M	S	S	S	S	S	M	S	M
CO4	S	M	S	S	S	S	S	M	S	M
CO5	S	M	S	S	S	S	S	M	S	M

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

Course code		ADVANCED COMPUTER NETWORKS	L	T	P	C
Elective - 2		Elective	3			3
Pre-requisite		Basic Knowledge on mathematics and networking				
Course Objectives:						
The main objectives of this course are to: 1. Have a detailed knowledge on the concept of networks 2. Know the idea on protocols, OSI layers and its functions. 3. Get knowledge on protocols used in different layers. 4. Know about the function of Internet						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand fundamental underlying principles of computer networking					K1,K2
2	Understand details and functionality of layered network architecture.					K2,K3
3	Apply mathematical foundations to solve computational problems in computer Networking					K3,K4
4	Analyze and evaluate performance of various communication protocols.					K4,K5,K6
5	Compare and create new routing algorithms.					K6
K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create						
Unit:1		**INTRODUCTION**				**12hours**
Introduction- data communications – networks – The internet – Protocols and standards – OSI model – layers in OSI model – TCP/IP protocol suite – addressing – guided media – Unguided media						
Unit:2		**DATA LINK LAYER**				**12hours**
Switching – Circuit switched networks – datagram networks – virtual circuit networks – Framing –Flow and error control Multiple access – random access – wired Lan – wireless Lan – Cellular telephony – satellite networks						
Unit:3		**NETWORK LAYER**				**12hours**
Network layer – IP V4 addressing – IPV6 addressing – ICMP – IGMP –Network layer delivery –forwarding – unicast and multicast routing protocols						
Unit:4		**TRANSPORT LAYER**				**12hours**

Transport layer – Process to process delivery – UDP -TCP -Congestion – congestion control – QOS – Techniques to improve QOS			
Unit:5		**APPLICATION LAYER**	**12hours**
Domain name system – name space – domain name space – distribution of name space – DNS in theinternet – remote logging - email – file transfer -Network management system – SNMP Protocol			

Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures ,online seminars– webinars		
	Total Lecture hours	**60hours**

Text Books	
1	Data communications and networking – Behrouz A Forouzan McGraw Hill 4th Edition 2015 Reprint
Reference Books	
1	Computer Networks – Tenenbaum -Pearson -2022
2	Computer networking –Kurose James F, Ross Keith W -Pearson – 2017
3	Data and computer communications – William Stallings – Pearson 2017
4	Computer networks and Internet – Douglas E Comer – Pearson - 2018
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106105080
2	https://www.tutorialspoint.com/computer-networks/index.asp
3	https://www.javatpoint.com/computer-network-tutorial

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

Semester - II

Course code		ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	L	T	P	C
Elective - III		**Elective**	3			3
Pre-requisite		Basics of AI & An Introduction about ML				

Course Objectives:

The main objectives of this course are to:

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

Expected Course Outcomes:	

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

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

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

Unit:1	INTRODUCTION	12hours

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

Unit:2	SEARCH TECHNIQUES	12hours

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

Unit:3	PREDICATE LOGIC	12hours

Using Predicate logic: Representing simple facts in logic - Representing Instance and Isa 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.

Unit:4	MACHINE LEARNING	12hours

Understanding Machine Learning: What Is Machine Learning? - Defining Big Data - Big Data inContext with Machine Learning - The Importance of the Hybrid Cloud - Leveraging the Power ofMachine Learning - The Roles of Statistics and Data Mining with Machine Learning-Putting Machine Learning in Context-Approaches to Machine Learning.

Unit:5	APPLICATIONS OF MACHINE LEARNING	10 hours

Looking Inside Machine Learning: The Impact of Machine Learning on Applications - DataPreparation -The Machine Learning Cycle.

Unit:6	Contemporary Issues	2 hours
	Expert lectures, online seminars –webinars	

	Total Lecture hours	60hours

Text Books

1	Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Publisherscompany Pvt Ltd, Second Edition, 1991.
2	George F Luger, "Artificial Intelligence", 4thEdition, Pearson Education Publ,2002.

Reference Books

1	Machine Learning For Dummies ®, IBM Limited Edition by Judith Hurwitz, DanielKirsch.

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

1	https://www.ibm.com/downloads/cas/GB8ZMQZ3
2	https://www.javatpoint.com/artificial-intelligence-tutorial
3	https://nptel.ac.in/courses/106/105/106105077/

Mapping with Programming Outcomes

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

Semester - II

Course code		INTERNET OF THINGS	L	T	P	C
Elective - IV		**Elective**	3			3
Pre-requisite		Basics of Sensors & its Applications				

Course Objectives:

The main objectives of this course are to:

- To get familiar with the evolution of IOT with its design principles.
- To outline the functionalities and protocols of internet communication.
- To analyze the hardware and software components needed to construct IOT applications.
- To identify the appropriate protocol for API construction and writing embedded code.
- To realize various business models and ethics in Internet of Things.

Expected Course Outcomes:

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

1	Understand about IoT, its Architecture and its Applications	K1,K2
2	Comprehend the IoT evolution with its architecture and sensors	K2,K3
3	Assess the embedded technologies and develop prototypes for the IoT products	K4
4	Evaluate the use of Application Programming Interface and design an API for IoTin real-time	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

Unit:1	INTRODUCTION	12hours

Internet of Things: An Overview : IoT Conceptual Framework - IoT Architectural View - Technology Behind IoT - Sources of IoT - M2M Communication - Examples of IoT - Design Principles for Connected Devices : IoT/M2M Systems Layers and Designs Standardization - Communication Technologies - Data Enrichment, Data Consolidation and Device Management at
Gateway

Unit:2	Design Principles for Web Connectivity :	12hours

Communication Protocols for Connected Devices – Message Communication Protocols for Connected Devices – Web Connectivity for Connected Devices – Network Using Gateway , SOAP, REST, HTTP, RESTful and WebSockets - Internet
Connectivity Principles : Internet Connectivity - Internet Based Communication – IP Addressing in the IoT – Media Access Control – Application Layer Protocols: HTTP, HTTPS, FTP, Telnet and
Others

Unit:3	Data Acquiring, Organizing, Processing and	12hours

		Analytics :	

Data Acquiring and Storage – Organising the Data – Transactions, Business Processes, Integration and Enterprise Systems – Analytics – Knowledge Acquiring, Managing and Storing Processes - DataCollection, Storage and Computing Using a Cloud Platform: Cloud Computing Paradigm for Data Collection, Storage and Computing – Everything as a Service and Cloud Service Models.

Unit:4	SENSORS AND ACTUATORS	10hours

Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks :
Sensor Technology – Wireless Sensor Networks Technology - Prototyping the Embedded Devices for loT and M2M :
Embedded Computing Basics – Embedded Platforms for Prototyping.

Unit:5	Prototyping and Designing the Software for IoT Applications	12hours

Prototyping Embedded Device Software - Devices, Gateways, Internet and Web/Cloud Services Software Development – Prototyping online Component APIs and Web APIs – Security for IoT : Vulnerabilities, Security Requirements and Threat Analysis – IoT Security Tomography and LayeredAttacker Model – Security Models, Profiles and Protocols for IoT – IoT Application Case Study : Design Layers, Design Complexity and Designing using Cloud PaaS – IoT / IIoT Applications in the
premises, Supply – Chain and Customer Monitoring – Connected Car and its Applications andServices.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars –webinars

	Total Lecture hours	60 hours

Text Book	
1	Raj Kamal , " Internet of Things Architecture and Design Principles", McGraw Hill, 2017

Reference Books	
1	Ovidiu Vermesan and Peter Friess, "Internet of Things – From Research and Innovation to MarkDeployement" , River Publishers, 2014.
2	Peter Waher, "Learning Internet of Things" ,Packt Publishing, 2015.
3	Donald Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino,Raspberry Pi and Beagle Bone Black", Mc Graw Hill, 2015

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.nptel.ac.in/noc20_cs66/preview
2	https://www.javatpoint.com/iot-internet-of-things
3	https://www.tutorialspoint.com/internet_of_things/index.htm

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