

JP COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

(Run by DMI Sisters)

(Affiliated to Manonmaniam Sundaranar University – Tirunelveli)

Accredited by NAAC with “B++” Grade

2(f) status of UGC Act, 1956 | ISO 9001:2015 Certified Institution

Ayikudy, Tenkasi District - 627852.

SYLLABUS



Bachelor of Artificial Intelligence and Data Science

Choice Based Credit System (CBCS)

(w.e.f. June 2026-2027)



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Preamble:

- The B.Sc. Artificial Intelligence and Data Science programme has been designed to meet the growing demand for professionals capable of extracting meaningful insights from data and building intelligent solutions for real-world applications. In an era where data has become a strategic asset and Artificial Intelligence is transforming every sector, the programme equips learners with the knowledge and skills needed to thrive in a technology-driven environment.

Vision

- To be a center of excellence in Artificial Intelligence and Data Science education by nurturing competent, innovative, and ethical professionals equipped with strong analytical, computational, and research skills to address real-world challenges and contribute to the advancement of society through intelligent technologies.

Mission

- To provide quality education in Artificial Intelligence, Data Science, Machine Learning, Programming, and emerging technologies through a comprehensive and industry-oriented curriculum.
- To develop analytical, problem-solving, and computational skills that enable students to design intelligent solutions for real-world challenges.
- To promote innovation, research, and entrepreneurship by encouraging students to participate in projects, internships, hackathons, and collaborative learning.
- To strengthen industry readiness through skill development, certification programs, industry interactions, and experiential learning opportunities.



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PROGRAMME OUTCOMES (PO) FOR UG PROGRAMME

The successful completion of the B. Sc., Artificial Intelligence and Data Science programme shall enable the students to:

PO1	Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study.
PO2	Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share ones views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.
PO3	Critical thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.
PO4	Problem solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.
PO5	Analytical reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

PROGRAMME SPECIFIC OUTCOMES (PSOs) FOR UG

PSO1	To enable students to apply basic microeconomic, macroeconomic and monetary concepts and theories in real life and decision making.
PSO2	To sensitize students to various economic issues related to Development, Growth, International Economics, Sustainable Development and Environment.
PSO3	To familiarize students to the concepts and theories related to Finance, Investments and Modern Marketing.
PSO4	Evaluate various social and economic problems in the society and develop answer to the problems as global citizens.
PSO5	Enhance skills of analytical and critical thinking to analyze effectiveness of economic policies.



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Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System for all UG courses including Lab Hours

First Year – Semester-I

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	5
Part-2	English	3	5
Part-3	Core Courses & Elective Courses [in Total]	11	14
Part-4	Skill Enhancement Course SEC-1	2	2
	Foundation Course	2	2
	NME	2	2
		23	30

Semester-II

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	5
Part-2	English	3	5
Part-3	Core Courses & Elective Courses including laboratory [in Total]	11	14
Part-4	Skill Enhancement Course -SEC-2	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
	NME	2	2
		23	30

Second Year – Semester-III

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	5
Part-2	English	3	5
Part-3	Core Courses & Elective Courses including laboratory [in Total]	11	14
Part-4	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	2	2
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	Environmental Studies	2	2
		23	30

Semester-IV

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	5
Part-2	English	3	5
Part-3	Core Courses & Elective Courses including laboratory [in Total]	11	14
Part-4	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-6 & 7 (Discipline / Subject Specific)	2	2
	Value Education	2	2
		23	30

**Third Year
Semester-V**

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based	22	28
	Internship / Industrial Visit / Field Visit	2	-
Part-4	Ability Enhancement Course	2	2
		26	30

Semester-VI

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based & LAB	23	28
Part-4	Ability Enhancement Course	2	2
Part-5	Extension Activity	1	-
		26	30

Total Credits: 144

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	11	11	11	11	22	23	89
Part IV	6	6	6	6	4	2	30
Part V	-	-	-	-	-	1	1
Total	23	23	23	23	26	26	144

*** Part I, II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

Part I – Tamil / Other Languages

Part II - English

Part III – Core Papers, Electives and Project

Part IV – Non Major Elective, Environmental Studies, Value Based Education, Skill Enhancement Courses, Foundation Course and Internship

Part V – Extension Activity

**Curriculum Design & Credit Distribution for
UG Programme in B.Sc Artificial Intelligence and Data Science**

Semester-1									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours	Max Marks			
						CIA	ESE	Total	
26UTL11	I	Language-I	Tamil-I	5	3	50	50	100	3
26UHI11	I		Hindi -I						
26UMY11	I		Malayalam- I						
26UFR11	I		French - I						
26UEN11	II	Language-II	English-I	5	3	50	50	100	3
26UCAD11	III	Core- I	Core- Python Programming	4	3	50	50	100	4
26UCADP1	III	Core -II	Core Practical Python Programming Lab	6	3	50	50	100	4
26UEAD11	III	EC - I	Elective: Statistics for data science	4	3	50	50	100	3
26UEAD12			Applied mathematics						
26USADP1	IV	SEC - I	Practical: Office Automation Lab	2	3	50	50	100	2
26UFAD11	IV	FC	Programming for Problem Solving	2	2	50	50	100	2
26UNAD11	IV	NME - I	Introduction to HTML	2	2	50	50	100	2
Total				30				800	23

Semester-2									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours	Max Marks			
						CIA	ESE	Total	
26UTL21	I	Language-I	Tamil-II	5	3	50	50	100	3
26UHI21	I		Hindi -II						
26UMY21	I		Malayalam- II						
26UFR21	I		French - II						
26UEN21	II	Language-II	English-II	5	3	50	50	100	3
26UCAD21	III	Core- III	Core- Data Structures	4	3	50	50	100	4
26UCADP2	III	Core -IV	Core Data Structures Lab	6	3	50	50	100	4
26UEAD21	III	EC - II	Elective: Optimization Techniques	4	3	50	50	100	3
26UEAD22			Fundamentals of Artificial Intelligence						
26USADP2	IV	SEC - II	Practical Internet Basics Lab	2	3	50	50	100	2
26USAD21	IV	SEC – III	Discrete Mathematics	2	3	50	50	100	2
26UNAD21	IV	NME – II	Basic Programming Design	2	2	50	50	100	2
Total				30				800	23

Semester-3									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination			Credits	
					Duration in Hours	Max Marks			
						CIA	ESE		Total
26UTL31	I	Language-I	Tamil-III	5	3	50	50	50	3
26UHI31	I		Hindi -III						
26UMY31	I		Malayalam- III						
26UFR31	I		French - III						
26UEN31	II	Language-II	English-III	5	3	50	50	50	3
26UCAD31	III	Core- V	Core- Programming with Java	4	3	50	50	50	4
26UCADP3	III	Core -VI	Core Practical Java Programming Lab	6	3	50	50	50	4
26UEAD31	III	EC - III	Elective: Artificial Neural Networks	4	3	50	50	50	3
26UEAD32			Data Analytics						
26USADP3	IV	SEC - IV	Web designing lab	2	3	50	50	50	2
26USADP4	IV	SEC – V	STATISTICS Lab Using Python	2	3	50	50	50	2
26UEVS31	IV	Common	Environmental Studies	2	2	50	50	100	2
Total				30				800	23

Semester-4

Course Code	Part	Course category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours	Max Marks			
						CIA	ESE	Total	
26U1TL41	I	Language– I	Tamil–IV	5	3	50	50	100	3
26U1HD41	I		Hindi –IV						
26U1MY41	I		Malayalam–IV						
26U1FR41	I		French - IV						
26U2EN41	II	Language– II	English–IV	5	3	50	50	100	3
26UCAD41	III	Core– VII	R PROGRAMMING	4	3	50	50	100	4
26UCADP4	III	Core –VIII	Practical - R PROGRAMMING Lab	6	3	50	50	100	4
26UEAD41	III	EC - IV	Cloud Computing	4	3	50	50	100	3
26UEAD42			Fundamentals of Data Science						
26UEAD43			Human Computer Interaction						
26USADP5	III	SEC –VI	Practical - Advanced Excel	2	3	50	50	100	2
26USADP6	IV	SEC - VII	Practical -PHP Programming	2	3	50	50	100	2
26UVBE41	V	Common	Value Based Education	2	3	50	50	100	2
Total				30				800	23

Semester - 5									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination			Credits	
					Duration in hrs.	Max Marks			
						CIA	ESE		Total
26UCAD51	III	Core - IX	Data Base Management Systems	4	3	50	50	100	4
26UCAD52		Core – X	Machine Learning	4	3	50	50	100	4
26UCADP5		Core – XI	Data Base Management Systems Lab	6	3	50	50	100	4
26UCADP6		Core -XII	Machine Learning Lab	6	3	50	50	100	4
26UEAD51		Elective - V	Cognitive Computing	4	3	50	50	100	3
26UEAD52			Software Engineering						
26UEAD53		Elective - VI	Data Communication & Networking	4	3	50	50	100	3
26UEAD54			IOT and its Applications						
26UFIK51	IV	Internship	Internship/Industrial Visit/Field Visit/Knowledge Updation Activity	-	3	50	50	100	2
26UAEC51	IV	AEC - I	Empowered Vocational English	2	3	50	50	100	2
Total				30				800	26

Semester - 6

Course Code	Part	Course Category	Course Name	Hours / Week	Examination				Credits
					Duration in hrs.	Max Marks			
						CIA	ESE	Total	
26UCAD61	III	Core – XIII	Big Data Analytics With Nosql Database	4	3	50	50	100	4
26UCAD62	III	Core – XIV	Operating Systems	4	3	50	50	100	4
26UCADP7	III	Core – XV	BIG DATA ANALYTICS LAB	6	3	50	50	100	4
26UCAD6P	III	Core – XVI	Major Project with Viva Voce	6	3	50	50	100	5
26UEAD61	III	Elective - VII	Pattern Recognition	4	3	50	50	100	3
26UEAD62			Robotics & its Applications						
26UEAD63	III	Elective - VIII	Natural Language Processing	4	3	50	50	100	3
26UEAD64			Simulation & Modeling						
26UEAD65			Graph Theory & its Applications						
26UAEC61	IV	AEC - II	Design Thinking	2	3	50	50	100	2
26U5EA61	V	Common	Extension Activity	-	-	-		100	1
Total				30				800	26
Grand Total				180				4800	144

Internship (minimum of 30 hours): The students should submit certificate of attendance from the industry stating the nature of work done, duration and role played along with report (minimum of 20 pages) at the end of V semester for external evaluation.

Industrial Visit/ Field Visit : A report based on the observation and learning outcome to be submitted (minimum of 10 pages) along with suitable evidences at the end of V semester for external evaluation.

Knowledge Updation Activity : A report to be submitted (minimum of 10 pages) based on the study made along with the completion certificate stating the work done (MOOC/NPTEL) at the end of V semester for external evaluation.

Internship/Industrial Visit/Field Visit/Knowledge Updation Activity: Internal –50 Marks, External – 50 Marks

Project : Group Project report should be submitted for external evaluation. Internal – 50 Marks, External – 50 Marks

Extension Activity (NSS/ NCC/ YRC/ RRC/ Games and Sports/ Youth Welfare Activities Outreach Programmes /Migration Awareness in the Tamil Nadu Education System): Individual report should be submitted at the end of VI semester for external evaluation.

External – 100 Marks

Ability Enhancement Compulsory Course: Empowered Vocational English and Design Thinking subjects is given to students.

Internal Marks – 50 Marks, External – 50 Marks

Semester-1

Semester–1									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours	Max Marks			
						CIA	ESE	Total	
26UTL11	I	Language–I	Tamil–I	5	3	50	50	100	3
26UHI11	I		Hindi –I						
26UMY11	I		Malayalam– I						
26UFR11	I		French - I						
26UEN11	II	Language–II	English–I	5	3	50	50	100	3
26UCAD11	III	Core– I	Core- Python Programming	4	3	50	50	100	4
26UCADP1	III	Core –II	Core Practical Python Programming Lab	6	3	50	50	100	4
26UEAD11	III	EC - I	Elective: Statistics for data science	4	3	50	50	100	3
26UEAD12			Applied mathematics						
26USADP1	IV	SEC - I	Practical: Office Automation Lab	2	3	50	50	100	2
26UFAD11	IV	FC	Programming for Problem Solving	2	2	50	50	100	2
26UNAD11	IV	NME - I	Introduction to HTML	2	2	50	50	100	2
Total				30				800	23

FIRST YEAR – SEMESTER – I

CORE – I: Python Programming

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCAD11	4	0	0	I	4	4	50	50	100
Learning Objectives									
LO1	To understand basic concepts and syntax of Python programming.								
LO2	To develop programs using control structures and functions.								
LO3	To learn data structures like lists, tuples, and dictionaries.								
LO4	To understand modules, strings, and arrays in Python.								
LO5	To perform file handling operations using Python.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Basics of Python Programming: History of Python-Features of Python Literal-Constants-Variables - Identifiers–Keywords-Built-in Data Types-Output Statements – Input Statements-Comments – Indentation- Operators Expressions-Type conversions. Python Arrays: Defining and Processing Arrays – Array methods.								12
II	Control Statements: Selection/Conditional Branching statements: if, if else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. Jump Statements: break, continue and pass statements.								12
III	Functions: Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. Function Arguments: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments-Recursion. Python Strings: String operations- Immutable Strings - Built-in String Methods and Functions - String Comparison. Modules: import statement-The Python module – dir() function – Modules and Namespace – Defining our own modules. .								12
IV	Lists: Creating a list -Access values in List-Updating values in Lists-Nested lists -Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples. Dictionaries: Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.								12
V	Python File Handling: Types of files in Python - Opening and Closing files								12

	Reading and Writing files: write() and write lines() methods- append() method – read() and read lines() methods – with keyword – Splitting words – File methods - File Positions- Renaming and deleting files.	
TOTAL		60
CO	Course Outcomes	
CO1	Understand Python syntax, data types, and operators.	
CO2	Apply control statements and loops in programming.	
CO3	Develop programs using functions and modules	
CO4	Use Python data structures such as lists, tuples, and dictionaries.	
CO5	Perform file handling operations in Python programs..	
Textbooks		
1	Programming in Python, ReemaThareja, Oxford University Press, 1st Edition, 2017	
2	Dr.R.Nageswara Rao, “Core Python Programming”, FirstEdition, 2017, Dreamtech Publishers.	
Reference Books		
1	Python Crash Course, Eric Matthes, No Starch Press, 2nd Edition, 2019	
2	Learning Python, Mark Lutz, O’Reilly Media, 5th Edition, 2013	
3	Core Python Programming, Wesley J. Chun, Prentice Hall, 2nd Edition, Year : 2006	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	1	-	-
CO2	3	3	2	1	-
CO3	3	3	2	1	1
CO4	3	3	3	2	1
CO5	3	3	2	2	2
Weightage of course contributed to each PSO	15	14	10	6	4

CORE – II PYTHON PROGRAMMING LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCADP1	0	0	6	I	4	6	50	50	100
Learning Objectives									
LO1	To understand basic Python programming concepts and syntax.								
LO2	To develop programs using control statements and loops..								
LO3	To implement functions, recursion, and data structures								
LO4	To apply exception handling and object-oriented programming concepts								
LO5	To improve problem-solving skills through practical programming.								
Prerequisites:									
Contents									
1. Write a Python program to read and print values of variables of different data types. 2. Write a Python program to perform addition, subtraction, multiplication, division, integer division and modulo division on two integer numbers.. 3. Write a Python program to determine whether the character entered is a vowel or not using conditional statement 4. Write a Python program to calculate the factorial of a number using loop. 5. Write a Python program to calculate the square root of a number. Use break, continue and pass statements. 6. Write a Python program using function and return statement to check whether a number is even or odd. 7. Write a Python program to print the Fibonacci series using recursion. 8. Write a Python program to reverse the order of the items in the array. 9. Write a Python program that accepts a string from the user and redisplay the same string after removing vowels from it. 10. Write a Python program to remove all duplicates from a list. 11. Write a Python program that has a list of numbers. (Both positive and negative). Make new tuple that has only positive values from this list. 12. Write a Python program that creates a dictionary of radius of a circle and its circumference. 13. Write a Python program Exception handling 14. Write a Python program using Object-Oriented Programming to store and display student details.									
Total Hours: 90									
CO	Course Outcomes								
CO1	Develop Python programs using basic data types and operators.								
CO2	Apply conditional and looping statements to solve problems.								
CO3	Implement functions, recursion, and arrays/lists.								
CO4	Use tuples, dictionaries, and exception handling in programs.								

CO5	Develop programs using object-oriented programming concepts..
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CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	1	-	-
CO2	3	3	2	1	-
CO3	3	3	3	2	1
CO4	3	3	2	2	1
CO5	3	3	3	2	2
Weightage of course contributed to each PSO	15	14	11	7	10

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD11	4	0	0	I	3	4	50	50	100
Learning Objectives									
LO1	Understand different types of data, measurement scales, and methods of data collection and presentation.								
LO2	Apply descriptive statistical techniques to summarize and interpret data using tables, graphs, and numerical measures.								
LO3	Analyze relationships between variables using correlation and paired data methods.								
LO4	Develop probability models and understand random variables along with standard probability distributions.								
LO5	Apply statistical inference techniques such as analysis of variance and goodness-of-fit tests for decision-making.								
Unit	Contents							No. of Hours	
I	Introduction to Statistics: Types of data: primary, secondary - quantitative and qualitative data. Types of Measurements: nominal, ordinal, discrete and continuous data. Presentation of data by tables: construction of frequency distributions for discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions							12	
II	Descriptive statistics: Describing Data Sets Frequency Tables and Graphs-Histograms, Ogives, and Stem and Leaf Plots-Summarizing Data Sets Sample Mean, Sample Median, and Sample Mode Sample Variance and Sample Standard Deviation Sample Percentiles -Chebyshevs Inequality Normal Data Sets-Paired Data Sets Correlation: Karl Pearson coefficient of correlation, Spearman's rank correlation coefficient							12	
III	Random variables and expectation: The Bernoulli and Binomial Random Variables-Computing the Binomial Distribution Function-The Poisson Random Variable-Computing the Poisson Distribution Function - Normal Random Variables Exponential Random Variables-The Poisson Process-The Gamma Distribution-The Chi-Square Distribution-The t-Distribution-The F Distribution							12	
IV	Analysis of variance: -One-Way Analysis of Variance-Multiple Comparisons of Sample Means One-Way Analysis of Variance with Unequal Sample Sizes-Two-Factor Analysis of Variance: 4Goodness of fit tests and categorical data analysis: Goodness of Fit Tests When All Parameters Are Specified-Determining the Critical Region by Simulation-Goodness of Fit Tests When Some Parameters Are Unspecified-The Kolmogorov-Smirnov Goodness of Fit Test for Continuous Data							12	

V	Elements of Probability: classical, empirical and axiomatic approaches to probability, conditional probability and independent events, Laws of total probability, Baye’s theorem and its applications Axioms of Probability- Sample Spaces Having Equally Likely Outcomes	12
TOTAL HOURS		60
CO	Course Outcomes	
CO1	Classify and present data effectively using frequency distributions, histograms, and cumulative graphs.	
CO2	Compute and interpret measures of central tendency, dispersion, and correlation for real-world datasets.	
CO3	Apply probability concepts and distributions to solve practical problems involving uncertainty.	
CO4	Perform analysis of variance (ANOVA) to compare multiple data sets and draw meaningful conclusions.	
CO5	Conduct goodness-of-fit tests and analyze categorical data for statistical validation.	
Textbooks		
1.	Sheldon M. Ross, Introduction to Probability and Statistics for Engineers And Scientists, Elsevier Academic Press, UK, Fifth Edition, 2023	
2.	Rohatgi V.K and Saleh E, An Introduction to Probability and Statistics, 3rd edition, John Wiley & Sons Inc., New Jersey, 2015.	
3.	Gupta S.C and Kapoor V.K, Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand & Sons, New Delhi, 2014.	
Reference Book		
4.	Jim Frost, Introduction to Statistics: An Intuitive Guide for Analyzing Data and Unlocking Discoveries	

Mapping Table:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	2	2
CO2	3	3	2	3	2	2
CO3	3	3	3	3	2	2
CO4	3	3	2	3	2	2
CO5	3	3	2	3	2	2
Weightage of course contributed to each PSO	15	14	11	15	10	10

ELECTIVE COURSE–I B: APPLIED MATHEMATICS

Subject Code	L	T	P	Semester	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD12	4	0	0	I	3	4	50	50	100
Learning Objectives									
LO1	Understand the fundamental concepts of matrices and vectors, including their representation and operations.								
LO2	Perform matrix operations such as addition, multiplication, transpose, and inverse, and analyze their properties.								
LO3	Apply matrix techniques to real-time data problems, including dimensionality reduction using eigenvalues and eigenvectors (PCA).								
LO4	Gain practical knowledge of Octave for numerical computation, including variable handling and matrix manipulation.								
LO5	Develop skills in data visualization and processing using Octave, including plotting and analyzing datasets.								
Unit	Contents							No. of Hours	
I	Linear Algebra: Matrix, Representation, Examples of matrix Data, Vectors, examples, Representation, Matrix Addition, Scalar Multiplication, Multiplication properties, Matrix Vector Multiplication, Matrix Multiplication, Inverse and Transpose.							12	
II	Applications of Matrix operations on Real Time Data, Parallel Matrix Multiplication, Dimensionality Reduction by Principal Component Analysis and Eigen Values, Eigen Vectors.							12	
III	Basic operations of Octave: Installation of Octave, Logical & Arithmetic Operations, Assignment of Different Variables, Assigning Matrices, Vector Representation, Histogram of matrices, Diagonal Matrices.							12	
IV	Data Visualization and Processing using Octave: Finding the size of a Matrix, Loading Data into Octave, Viewing the Workspace of Octave, Accessing the elements of Matrix, Arithmetic operations on matrices- Addition, Multiplication, log, exponentiation, Transpose, Maximum and Minimum Value of a Matrix							12	
V	Control Statements in Octave, Visualizing Data in Octave-Plotting Data, giving labels, axes and titles, Victimization, Vector implementation, Advantages.							12	
TOTAL HOURS								60	
CO	Course Outcomes								
CO1	Represent and manipulate matrices and vectors to solve mathematical and real-world problems.								
CO2	Implement matrix operations and apply them in data analysis and computational tasks.								

CO3	Apply concepts like eigenvalues, eigenvectors, and principal component analysis for dimensionality reduction
CO4	Use Octave effectively for performing numerical computations and matrix-based operations.
CO5	Visualize and interpret data using plots and graphical tools in Octave for better decision-making.
Textbooks	
1.	Jason Lachniet, “Introduction to GNU Octave”
2.	Lectures of Professor Dr. Andrew Ng, Stanford University, Coursera
3.	Gene H.Golub, Charles F.Van Loan, “Matrix Computations”, John Hopkins University Press.
4.	Randolf H. Reiss, B.S, “Eigen Values and Eigen Vectors in Data dimension Reduction for Regression”, San Marcos, Texas.
5.	Gilbert Strang, “Linear Algebra and its Applications”, Thomson Learning Inc., 4th Edition
Web Reference	
6.	https://www.tutorialspoint.com/discrete_mathematics

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	2	3
CO 5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

SKILL ENHANCEMENT COURSE (SEC-1) – PRACTICAL-OFFICE AUTOMATION

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USADP1	0	0	2	I	2	2	50	50	100

Learning Objectives

LO1	To develop document preparation skills using MS Word.
LO2	To perform data analysis and calculations using MS Excel
LO3	To create effective presentations using MS PowerPoint.
LO4	To design and manage simple databases using MS Access
LO5	To develop practical office management and productivity skills using Microsoft Office tools.

Prerequisites:

Contents

MS – Word

1. Create and format documents using fonts, alignment, spacing, and borders.
2. Create tables for student mark lists and apply formatting.
3. Prepare letters using Mail Merge.
4. Create project reports using styles, headers, and footers.
5. Create a News Paper with images, WordArt, shapes, and text boxes.

MS – Excel

1. Prepare student result sheets using formulas.
2. Use functions: SUM, AVERAGE, IF, MAX, MIN.
3. Create charts: Column, Pie, Line.
4. Perform sorting and filtering of data.
5. Prepare payroll sheets with salary calculations.

MS – PowerPoint

1. Create presentations using themes and layouts.
2. Apply animations and transitions.
3. Insert charts and SmartArt.
4. Prepare seminar/project presentations.

MS – Access

1. 1, Create a student database and tables with appropriate data types and Enter 10 records.
 - i. Create queries to calculate Total, Average and Result.
 - ii. Design data entry forms Student Database.
 - iii. Generate reports Student Database.

Total Hours : 30

CO	Course Outcomes
CO1	Create professional documents using MS Word.
CO2	Perform calculations and data analysis using MS Excel
CO3	Design multimedia presentations using MS PowerPoint
CO4	Create databases, queries, forms, and reports using MS Access
CO5	Integrate MS Word, MS Excel, MS PowerPoint, and MS Access to develop effective office automation solutions for academic and professional applications.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	2	3	3	2
CO2	2	3	2	3	2
CO3	2	2	3	3	2
CO4	2	3	2	3	2
Weightage of course contributed to each PSO	8	10	10	12	8

FOUNDATION COURSE (FC) -Programming for Problem Solving

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UFAD11	2	0	0	I	2	2	50	50	100
Learning Objectives									
LO1	To analyse a problem with appropriate problem solving techniques								
LO2	To understand the main principles of imperative, functional and logic oriented programming languages.								
LO3	To increase the ability to learn new programming languages.								
LO4	Recognize the need for programming languages and problem solving techniques								
LO5	Develop programming skills to solve real time computational problems								
Unit	Contents							No. of Hours	
I	Introduction to Programming: Introduction to computers, Computer characteristics, Hardware vs software, Steps to develop a Program, Software development life cycle, Structured programming, Types of programming languages, Introduction to c, Developing a c program, Console input and output functions, Error diagnostics, Debugging techniques.							6	
II	Operators and Expressions: Identifiers and keywords, Data types Constants, Variables, Declarations, Expressions, Statements, Arithmetic operators, Unary operators, Relational and logical operators, Assignment operators, Conditional operator Branching, ifelse statement, switch statement, goto statement, Looping, while statement, do- while statement, for statement, Nested control structures, break statement, continue statement.							6	
III	Arrays and Strings: Defining an array, Processing an array, Multidimensional arrays, Searching algorithm, Linear search, Sorting algorithm, Bubble sort algorithm, Strings, Defining a string Initialization of strings, Reading and writing a string, Processing the strings.							6	
IV	Functions: Functions, Overview, Defining a function, Accessing a function, Function prototypes, Passing arguments to a function Passing arrays to functions, Recursion.							6	
V	Pointers - File handling - Opening and Closing File - Input / Output operations on File.							6	
TOTAL								30	
CO	Course Outcomes								
CO1	Outline the Computer fundamentals and various problem solving concepts in Computers								
CO2	Describe the basic computer organization, software, computer languages, software development life cycle and the need of structured programming in solving a computer problem.								

CO3	Apply memory management concepts and function based modularization
CO4	Recognize the bugs in the C program
CO5	Develop simple C programs to illustrate the applications of different data types such as arrays, pointers, functions.
Textbooks	
1.	Byron Gottfried, “Schaum's Outline of Programming with C”, 3rd edition, 2016, McGraw Hill Education (India), ISBN: 9780070145900
2.	Balagurusamy, E “Programming in ANSI C”, 7th edition, McGraw Higher Ed, 2016, ISBN:9789339219666
Reference Books	
1.	Yashavant Kanetkar, “Let Us C”, 15th edition, 2016, Bpb Publications, ISBN:9788183331630
2.	Herbert Schildt, “The Complete Reference C”, 4th edition, 2017, McGraw Hill Education (India), 2017, ISBN:978007041183

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	2
CO2	3	2	2	2	3
CO3	3	3	3	3	2
CO4	3	2	2	2	2
CO5	3	3	2	2	3
Weightage of course contributed to each PSO	15	12	11	11	12

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UNAD11	2	0	0	I	2	2	50	50	100

Learning Objectives	
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LO1	Insert a graphic within a web page
LO2	Create a link within a web page
LO3	Create a table within a web page.
LO4	Insert heading levels within a web page
LO5	Insert ordered and unordered lists within a web page. Create a web page.

Unit	Contents	No. of Hours
I	Introduction : Web Basics : What is Internet – Web browsers –What is Webpage - HTML Basics : Understanding tags	6
II	Tags for Document structure (HTML, Head, Body Tag). Block level text elements : Headings paragraph tag–Font style elements : (bold, italic, font, small, strong, strike, big tags)	6
III	Lists: Types of lists: Ordered, Unordered – Nesting Lists –Other tags : Marquee, HR, BR – Using Images – Creating Hyperlinks.	6
IV	Tables: Creating basic Table, Table elements, Caption –Table and cell alignment – Rowspan, Colspan–Cell padding.	6
V	Frames: Frameset–Targeted Links–Noframe–Forms: Input, Textarea, Select, Option.	6
TOTAL		30

CO	Course Outcomes
CO1	Knows the basic concept in HTML Concept of resources in HTML
CO2	Knows Design concept. Concept of Meta Data Understand the concept of save the files
CO3	Understand the page formatting. Concept of list
CO4	Creating Links. Know the concept of creating link to email address
CO5	Concept of adding images Understand the table creation

[illegible]

1.	“Mastering HTML5 and CSS3 Made Easy”, TeachUComp Inc., 2014.
2.	Thomas Michaud, “Foundations of Web Design: Introduction to HTML & CSS”

	Web Resources
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1.	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf Yashavant Kanetkar, “Let Us C”, 15th edition, 2016, Bpb Publications,ISBN:9788183331630
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CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	2	3	3	2
CO2	2	3	2	3	2
CO3	2	2	3	3	2
CO4	2	3	2	3	2
Weightage of course contributed to each PSO	8	10	10	12	8

Semester-2

Semester-2

Course Code	Part	Course Category	Course Name	Hours/ Week	Examination			Credits	
					Duration in Hours	Max Marks			
						CIA	ESE		Total
26UTL21	I	Language-I	Tamil-II	5	3	50	50	100	3
26UHI21	I		Hindi -II						
26UMY21	I		Malayalam- II						
26UFR21	I		French - II						
26UEN21	II	Language-II	English-II	5	3	50	50	100	3
26UCAD21	III	Core- III	Core- Data Structures	4	3	50	50	100	4
26UCADP2	III	Core -IV	Core Data Structures Lab	6	3	50	50	100	4
26UEAD21	III	EC - II	Elective: Optimization Techniques	4	3	50	50	100	3
26UEAD22			AI Principles and Applications						
26USADP2	IV	SEC - II	Practical Internet Basics Lab	2	3	50	50	100	2
26USAD21	IV	SEC – III	Discrete Mathematics	2	3	50	50	100	2
26UNAD21	IV	NME – II	Basic Programming Design	2	2	50	50	100	2
Total				30				800	23

CORE COURSE (CC-III)–DATA STRUCTURE AND ALGORITHMS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCAD21	4	0	0	II	4	4	50	50	100
Learning Objectives									
LO1	To understand the concept of Abstract Data Types (ADTs) and linear data structures.								
LO2	To implement lists, stacks, and queues using array and linked representations.								
LO3	To learn tree structures and their applications in problem solving.								
LO4	To understand graph representations and traversal algorithms.								
LO5	To apply searching, sorting, and hashing techniques for efficient data processing.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Abstract Data Types (ADTs)- List ADT-array-based implementation- linked list implementation singly linked lists-circular linked lists- doubly-linkedlists-applications of lists-All operations-Insertion-Deletion-Merge-Traversal								12
II	Stack ADT-Operations-Applications-Evaluating arithmetic expressions Conversion of infix to postfix expression-Queue ADT-Operations- Circular Queue-Priority Queue-DE Queue applications of queues.								12
III	Tree ADT-tree traversals-Binary Tree ADT-expression trees- applications of trees-binary search tree - AVL Trees- Heap-Applications of heap.								12
IV	Sorting and Searching-Bubble sort – selection sort – insertion sort – merge sort – quick sort – linear search – binary search – hashing – hash functions – collision handling – load factors, rehashing, and efficiency								12
V	Definition-Representation of Graph-Types of graph-Breadth first traversal– Depth first traversal. Graph Algorithms: Definitions – Topological Sort – Shortest path algorithms: UnWeighted shortest paths- Minimum Spanning tree: Prim’s algorithm- Krushkal’s algorithm								12
TOTAL								60	
CO	Course Outcomes								
CO1	Explain Abstract Data Types and implement list operations using arrays and linked lists.								
CO2	Apply stack and queue operations to solve computational problems such as expression evaluation								
CO3	Implement trees including binary trees, BST, heaps, and their applications.								
CO4	Analyze graphs using traversal algorithms and shortest path techniques								
CO5	Apply searching, sorting, and hashing methods to optimize data organization.								
Textbooks									
1	Weiss, Mark Allen. <i>Data Structures and Algorithm Analysis in C</i> . 2nd ed., Pearson Education.								

	2007.
2	Horowitz, Ellis, SartajSahni, and Susan Anderson-Freed. <i>Fundamentals of Data Structures in C</i> . 2nd ed., Universities Press, 2008.
3	Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, —Data Structures & Algorithms in Pythonl, John Wiley & Sons Inc., 2013
Reference Books	
1	Cormen, Thomas H., et al. <i>Introduction to Algorithms</i> . 3rd ed., MIT Press, 2009.
2	Tenenbaum, Aaron M., YedidyahLangsam, and Moshe J. Augenstein. <i>Data Structures Using C</i> . 2nd ed., Pearson Education, 2006.
3	Samanta, Debasis. <i>Classic Data Structures</i> . 2nd ed., PHI Learning, 2009.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	2	—	2
CO2	3	3	2	1	2
CO3	3	3	3	2	2
CO4	3	3	2	2	2
CO5	3	3	2	2	2
Weightage of course contributed to each PSO	15	14	11	7	10

CORE (CC IV) –PRACTICAL DATA STRUCTURE AND ALGORITHMS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCADP2	0	0	6	II	4	6	50	50	100
Learning Objectives									
LO1	To understand the concepts of ADTs.								
LO2	To learn linear data structures -lists, stacks, queues.								
LO3	To learn Tree structures and application of trees.								
LO4	To learn graph structures and application of graphs.								
LO5	To understand various sorting and searching.								
Prerequisites:									
Contents									
1) Implementation of Single Linked List.									
2) Implementation of Stack- Push and Pop.									
3) Implementation of Queue– Enquire and Dequeue									
4) Implementation of Binary Tree Traversals using recursion. a) Pre-order b)In-order c)Post-Order									
5) Implementation of Breadth First Search algorithm.									
6) Implementation of Depth First Search algorithm.									
7) Implementation of bubble sort.									
8) Search an element in a list using Binary Search.									
Total Hours: 90									
CO	Course Outcomes								
CO1	Understand basic data structures such as List, Linked list.								
CO2	Understand basic data structures such as arrays, linked lists, stacks and queues.								
CO3	Describe the hash function and concepts of collision and Its resolution methods.								
CO4	Solve problem involving graphs, trees and heaps.								
CO5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.								
Textbooks									

1	Mark Allen Weiss,—Data Structures and Algorithm Analysis in C++, Pearson Education 2014, 4 th Edition. .
2	Reema Thareja,—Data Structures Using C, Oxford Universities Press 2014, 2 nd Edition .
Reference Books	
1	Thomas H.Cormen, Chales E.Leiserson, Ronald L.Rivest, Clifford Stein, — Introduction to Algorithms, McGraw Hill 2009, 3 rd Edition.
2	Aho, Hopcroft and Ullman,—Data Structures and Algorithms, Pearson Education 2003 .

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	1	–	2
CO2	3	3	2	1	2
CO3	3	3	2	2	2
CO4	3	3	3	2	2
CO5	3	3	2	2	2
Weightage of course contributed to each PSO	15	14	10	7	10

ELECTIVE COURSE (EC-2 A)–OPTIMIZATION TECHNIQUES

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD21	4	0	0	II	3	4	50	50	100

Learning Objectives

LO1	To apply various optimization techniques for decision making.
LO2	To introduce the use of variables for formulating complex mathematical models in management, science and industrial applications.
LO3	To formulate and solve linear programming problems using graphical and simplex methods.
LO4	To analyze transportation, assignment, and network optimization problems for efficient resource allocation.
LO5	To evaluate and apply optimization models to real-world business, engineering, and industrial Decision-making scenarios.

Unit	Contents	No. of Hours
I	INTRODUCTION OPERATIONS RESEARCH The Nature and Meaning of OR–Management–Applications of OR– Modeling in OR– General methods for solving OR models	12
II	LINEAR PROGRAMMING PROBLEM Linear Programming Problem: Formulation of LP problems– Graphical solution of LP problems–General formulation of LPP	12
III	ASSIGNMENT PROBLEMS Assignment Problem: Mathematical formulation–Hungarian method–Unbalanced assignment problem	12
IV	TRANSPORTATION PROBLEMS Transportation Model: Mathematical formulation – Matrix form–Methods for finding Initial Basic Feasible solution and Optimal solution.	12
V	PERT and CPM Techniques: Basic Steps–Network Diagram representation–Labeling Fulkerson’s I–J Rule – Time Estimates and Critical Path in Network Analysis –PERT.	12
TOTAL		60

CO	Course Outcomes
CO1	Formulate and solve Linear Programming Problems.
CO2	Analyze the usage of optimal solution.
CO3	Analyze the usage of Assignment Problems
CO4	Evaluate Transportation Models.
CO5	Apply PERT and CPM techniques to find the optimal solution

Textbooks

1.	S.D. Sharma, “Operations Research”, Tenth Edition, Pearson, 2017.

Reference Books	
1.	Hamdy A Taha, "Operations Research" Ninth Edition, Pearson, 2016
2.	V. Sundaresan, K. S. Ganapathy Subramanian, K. Ganesan, "Resource Management Techniques", Ninth Edition, A. R. Publications, 2015

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	2	2
CO2	2	3	2	3	2	2
CO3	2	3	2	2	3	1
CO4	1	2	2	1	3	2
CO5	2	2	2	1	3	3
Weightage of course contributed to each PSO	10	12	10	10	13	10

ELECTIVE COURSE-2 B: AI PRINCIPLES AND APPLICATIONS

Subject Code	L	T	P	Semester	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD22	4	0	0	II	3	4	50	50	100
Learning Objectives									
LO1	To introduce the Basics of Prolog Programming language and execute AI problems using the same.								
LO2	To learn Artificial Intelligence from the scratch								
LO3	To understand the evaluation of models.								
LO4	To train the students on the various Heuristic Search Techniques and Knowledge Systems.								
LO5	To develop intelligent systems using AI concepts such as reasoning, learning, and Problem-solving.								
Unit	Contents								No.of Hours
I	Introduction to Artificial Intelligence: What is Artificial Intelligence - Foundation of AI - History of AI - agents - Abstraction-Applications of AI - AI Representation - Future of AI - Issues in Design of Search Programs – Blind Search or Depth First Search - Breadth First Search - Logic Programming. Introduction to intelligent program and intelligence agents. Expert Systems - Utilization and Functionality, Architecture of Expert System, Steps to Build Expert Systems.								12
II	Problem Solving techniques: Problems in AI - Problem solving techniques – properties of search algorithms - basic problem solving method- state space search, problem characteristics, production systems characteristics, issues in design of intelligent search algorithm.								12
III	Programming languages: Fundamentals concepts of programming languages like prolog or Lisp. Introduction to Logic Programming by Prolog, Writing a Prolog Program, Structure of Prolog Program, Types, Search, Backtracking in Prolog, Lists.								12
IV	Heuristic Search Techniques: Heuristic Search Methods – Generate and Test, Hill Climbing, Sleepst Ascent Hill Climbing, Simulated Annealing. – Best First Search, The A* Algorithm, And-Or Graphs, Problem Reduction: AO* Algorithm, Means-end Analysis, Constraint Satisfaction.								12
V	Knowledge Representation: Knowledge Representation: Knowledge Representation issues. Knowledge Representation using predicate logic: Unification resolution. Rule based systems: Forwarded versus backward reasoning conflict resolution. Structured knowledge Representation: Semantic Nets, Frames, conceptual dependency, scripts. Inductive learning, decision trees, computational learning Theory, Explanation based learning.								12

TOTAL HOURS		60
CO	Course Outcomes	
CO1	Understand the basics of Artificial Intelligence	
CO2	Be familiar with the Prolog Programming Language and build logic using the same.	
CO3	Understand the Basic Heuristic Search Techniques.	
CO4	Understand the Advanced Heuristic Search Techniques.	
CO5	Be familiar with the Expert Systems and its Applications	
Textbooks		
1.	Ela Kumar,” Artificial Intelligence “, I.K. International Publishing House, 2011.	
2.	Neeta Deshpande (2008), “Artificial Intelligence”, Technical Publications.	
3.	V. S. Janakiraman, K. Sarukesi, P. Gopalakrishnan (2007),“Foundations of Artificial Intelligence and Expert Systems”, Trinity Press.	
Reference Book		
1.	Elaine Rich and Kevin Knight, (2003) “Artificial Intelligence”, Second Edition, Tata McGraw-Hill.	
Web Reference		
1.	https://nptel.ac.in/courses/106/105/106105077/	
2.	https://www.tutorialspoint.com/artificial_intelligence/index.htm	
3.	https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/	
4.	https://lecturenotes.in/materials/29314-note-for-artificial-intelligence-ai-by-jaswanth-chowdary	

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	2	3
CO 5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

SKILL ENHANCEMENT COURSE (SEC II) –PRACTICAL INTERNET BASICS LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USADP2	0	0	2	II	2	2	50	50	100

Learning Objectives

LO1	Introduce the fundamentals of Internet and the Web functions.
LO2	Impart knowledge and essential skills necessary to use the internet and its various components.
LO3	Find, evaluate, and use online information resources.
LO4	Use Google Apps for education effectively.
LO5	To develop practical skills in using internet tools, online communication platforms, and cloud-based services for academic and professional purposes.

Prerequisites:

Contents

- 1) Create an email account in Gmail. Using the account created compose a mail to invite other college students for your college fest, enclose the invitation as attachment and send the mail to at least 10 recipients. Use CC and BCC options accordingly
- 2) Open your inbox in the Gmail account created, check the mail received from your peer from other college inviting you for his college fest, and download the invitation. Reply to the mail with a thank you note for the invite and forward the mail to other friends
- 3) Assume that you are studying in final year of your graduation and are eagerly looking for a job. Visit any job portal and upload your resume.
- 4) Create a label and upload bulk contacts using import option in Google Contacts
- 5) Create one-page story in your mother tongue by using voice recognition facility of Google Docs
- 6) Create your own Google classroom and invite all your friends through email id. Post study material in Google classroom using Google drive. Create a separate folder for every subject and upload all unit wise E-Content Materials.
- 7) Create and share a folder in Google Drive using share a link‘option and set the permission to access that folder by your friends only.
- 8) Create a meet using Google Calendar and record the meet using Google Meet.
- 9) Create a registration form for your Department Seminar or Conference using Google Forms.
- 10) Create a question paper with multiple choice types of questions for a subject of your choice, using Google Forms.

Total Hours: 30

CO	Course Outcomes
CO1	Understand basic data structures such as List, Linked list.
CO2	Understand basic data structures such as arrays, linked lists, stacks and queues.

CO3	Describe the hash function and concepts of collision and Its resolution methods.
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CO4	Solve problem involving graphs, trees and heaps.
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CO5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.
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Textbooks	
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1	Ian Lamont, Google Drive & Docs in 30 Minutes, 2nd Edition.
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Reference Books	
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1	Sherry Kinkoph Gunter, My Google Apps, 2014.
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CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	1	–	2
CO2	3	3	2	1	2
CO3	3	3	2	2	2
CO4	3	3	3	2	2
CO5	3	3	2	2	2
Weightage of course contributed to each PSO	15	14	10	7	10

SKILL ENHANCEMENT COURSE (SEC-III)-DISCRETE MATHEMATICS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USAD21	2	0	0	II	2	2	50	50	100
Learning Objectives									
LO1	To understand basic concepts of sets, relations, and functions..								
LO2	To develop logical thinking using mathematical logic.								
LO3	To learn matrix operations and their properties.								
LO4	To introduce basic concepts of graph theory.								
LO5	To improve problem-solving skills using mathematical methods.								
Unit	Contents								No. of Hours
I	Set theory-Sets and elements-Specifications of sets-Identity and Cardinality-Set inclusion-Equality of sets-proper sets- Power sets-Universal set-Operations on sets-ordered pairs- Cartesian product of sets								6
II	Relations and functions-Definition-example-Relations on sets- Equivalence relations-Equivalence Class – Functions								6
III	MATHEMATICAL LOGIC Introduction – Statement (Propositions) – Laws of Formal Logic – Basic Set of Logical operators/operations - Propositions and Truth Tables – Algebra Propositions - Tautologies and Contradictions								6
IV	Matrices: Introduction–.Notation & Definition – Types of Matrices- Operations on Matrices - Transpose of a matrix- Determinants of a Matrix – Inverse of a Matrix								6
V	Graph Theory: Definition of a Graph, Finite and infinite Graphs, Incidence and Degree of a vertex, Null Graph, Sub graphs, Walks, Paths, Circuits, Connected, Disconnected graphs and Components, Euler Graph, Hamiltonian Path and Hamiltonian Circuits.								6
TOTAL								30	
CO	Course Outcomes								
CO1	Explain concepts of sets and perform set operations.								
CO2	Understand relations, equivalence relations, and functions.								
CO3	Apply logical laws and truth tables in problem solving.								
CO4	Solve problems using matrices, determinants, and inverse.								
CO5	Apply graph theory concepts like paths, circuits, and graphs.								
Textbooks									

1.	Discrete Mathematics, Swapan Kumar, Chakraborty and BikashKanti Sarkar, OXFORD University Press
2.	Alexis Leon, Mathews Leon,” Fundamental of Information Technology”, 2nd Edition
Reference Books	
1.	Discrete Mathematics, Third Edition, Seymour LipschutzAnd Marc Lars Lipson, Tata Mcgraw Hill Education Private Limited.
2.	Discrete Mathematics, Third Edition, Seymour LipschutzAnd Marc Lars Lipson, Tata Mcgraw Hill Education Private Limited

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	2	1	-	-
C02	3	2	1	-	-
C03	3	3	2	1	-
C04	3	2	1	-	-
C05	3	3	2	1	1
Weightage of course contributed to each PSO	15	12	7	2	1

1.	Introduction to Computer Science, ITL Education Solutions Limited, 2/e, Pearson
Reference Books	
1.	Fundamentals of Computers, V.Rajaram, 5th Edition, PHI
2.	Introduction to Computers, Peter Norton, 7/e, TMH.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	1	2
CO2	2	2	3	3	2
CO3	2	3	3	2	2
CO4	2	2	3	3	2
CO5	2	3	3	2	2
Weightage of course contributed to each PSO	11	12	13	11	10

Semester-3

Semester–3

Course Code	Part	Course Category	Course Name	Hours/ Week	Examination			Credits	
					Duration in Hours	Max Marks			
						CIA	ESE		Total
26UTL31	I	Language–I	Tamil–III	5	3	50	50	100	3
26UHI31	I		Hindi –III						
26UMY31	I		Malayalam– III						
26UFR31	I		French - III						
26UEN31	II	Language–II	English–III	5	3	50	50	100	3
26UCAD31	III	Core– V	Core- Programming with Java	4	3	50	50	100	4
26UCADP3	III	Core –VI	Core Practical Java Programming Lab	6	3	50	50	100	4
26UEAD31	III	EC - III	Elective: Artificial Neural Networks	4	3	50	50	100	3
26UEAD32			Data Analytics						
26USADP3	IV	SEC - IV	Web designing lab	2	3	50	50	100	2
26USADP4	IV	SEC – V	STATISTICS Lab Using Python	2	3	50	50	100	2
26UEVS31	IV	Common	Environmental Studies	2	2	50	50	100	2
Total				30				800	23

SECOND YEAR - SEMESTER – III
CORE COURSE (CC-V)–Java Programming

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCAD31	4	0	0	III	4	4	50	50	100
Learning Objectives									
LO1	To provide fundamental knowledge of object-oriented programming.								
LO2	To equip the student with programming knowledge in Core Java from the basics up.								
LO3	To enable the students to use AWT controls, Event Handling and Swing for GUI.								
LO4	To provide fundamental knowledge of object-oriented programming.								
LO5	To equip the student with programming knowledge in Core Java from the basics.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction: Review of Object Oriented concepts – History of Java – Java buzzwords – JVM architecture – Data types - Variables - Scope and life time of variables - arrays - operators – control statements - type conversion and casting - simple java program - constructors - methods - Static block - Static Data – Static Method String and String Buffer Classes.								12
II	Inheritance: Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword. Packages: Definition-Access Protection –Importing Packages. Interfaces: Definition–Implementation–Extending Interfaces.								12
III	Multithreaded Programming: Thread Class - Runnable interface –Synchronization– Using synchronized methods– Using synchronized statement- Interthread Communication								12
IV	Event Handling: Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes- AWT Controls: The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Colour - Fonts								12
V	Swing: Introduction to Swing - Hierarchy of swing components. Containers - Top level containers - JFrame - JWindow - JDialog - JPanel - JButton - JToggleButton - JCheckBox - JRadioButton - JLabel,JTextField - JTextArea - JList - JComboBox - JScrollPane.								12
TOTAL								60	

CO	Course Outcomes
CO1	Understand the basic Object-oriented concepts. Implement the basic constructs of Core Java.
CO2	Implement inheritance, packages, interfaces and exception handling of Core Java.
CO3	Implement multi-threading and I/O Streams of Core Java.
CO4	Implement AWT and Event handling.
CO5	Use Swing to create GUI.
Textbooks	
1.	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010
Reference Books	
1	Ashok N Kamthane, “Object-Oriented Programming with ANSI and Turbo C++”, Pearson Education 2003
2	Maria Litvin& Gray Litvin, “C++ for you”, Vikas publication 2002

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	2	2	2
CO2	2	3	2	2	2
CO3	2	3	3	3	2
CO4	2	3	2	2	2
CO5	3	3	2	2	2
Weightage of course contributed to each PSO	12	14	11	11	10

CORE COURSE (CC-VI) –Java Programming Lab

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCADP3	0	0	6	III	4	6	50	50	100
Learning Objectives									
LO1	To provide fundamental knowledge of object-oriented programming.								
LO2	To equip the student with programming knowledge in Core Java from the basics up.								
LO3	To enable the students to know about Event Handling.								
LO4	To enable the students to use String Concepts								
LO5	To equip the student with programming knowledge in to create GUI using AWT controls.								
List of Exercises									
1 Write a JAVA program using Multiple Constructors.									
2 Write a JAVA program using overloading method									
3 Write a JAVA program using Overriding Method									
4 Write a JAVA program using one-dimensional arrays.									
5 Write a JAVA program using Two-dimensional array									
6 Write a program to do String Manipulation using Character Array and perform the following string operations:									
a. String length									
b. Finding a character at a particular position									
c. Concatenating two strings									
d. To extract substring from given string									
e. Reverse a string									
7 Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.									
8 Write a threading program which uses the same method asynchronously to print the numbers 1 to 10 using Thread1 and to print 90 to100 using Thread2.									
9 Write a program to demonstrate the use of following exceptions10 Write a C++ program to manipulate a Text File.									
a. Arithmetic Exception									
b. Number Format Exception									
c. Array Index Out of Bound Exception									
d. Negative Array Size Exception									
10 Write a JAVA program for handling keyboard events									

- 11 Write a program to accept a text and change its size and font. Include bold italic options. Use frames and controls.
- 12 Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).
- 13 Write a Java program using swing that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.
- 14 Use Swing to create GUI type Login Form.

TOTAL		90 Hrs
CO	Course Outcomes	
CO1	Explain and apply object-oriented programming concepts using Java.	
CO2	Develop Java programs using control structures, classes, and methods.	
CO3	Implement event handling techniques in Java applications.	
CO4	Apply string manipulation techniques in Java programming.	
CO5	Design GUI applications using AWT components and layouts.	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	1	2	2
CO2	3	3	1	3	2
CO3	2	3	1	3	2
CO4	2	2	1	2	2
CO5	2	3	2	3	2
Weightage of course contributed to each PSO	12	13	6	13	10

ELECTIVE COURSE–3 A: Artificial Neural Networks

Subject Code	L	T	P	Semester	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD31	4	0	0	III	3	4	50	50	100
Learning Objectives									
LO1	Basic neuron models: McCulloch-Pitts model and the generalized one, distance or similarity based neuron model, radial basis function model, etc.								
LO2	Basic neural network models: multilayer perceptron, distance or similarity based neural networks, associative memory and self-organizing feature map, radial basis function based multilayer perceptron, neural network decision trees, etc.								
LO3	Basic learning algorithms: the delta learning rule, the back propagation algorithm, self-organization learning								
LO4	Applications: pattern recognition, function approximation, information visualization, etc.								
LO5	To design, train, and evaluate artificial neural network models for solving real-world problems.								
Unit	Contents								No.of Hours
I	Introduction to Neural networks: Neural processing- Neural networks- an overview – the raise of neuro computing – introduction to artificial neural networks : introduction- artificial neural networks – historical development of neural networks – biological neural networks – comparison between the brain and the computer – artificial and biological neural networks – basic building blocks of artificial neural networks - activation functions.								12
II	Neural Network Architecture: Single layer Feed-forward networks. Multilayer Feed-forward networks. Recurrent Networks.								12
III	Back propagation Networks: Back Propagation networks, Architecture of Back-propagation(BP) Networks, Back-propagation Learning, Variation of Standard Back propagation algorithms.								12
IV	Kohonen self - organizing feature maps - counter propagation network: introduction-Full counter propagation network-Forward only propagation network.								12
V	Applications of Neural Networks: Applications of neural networks in Arts-Bioinformatics – Knowledge Extraction – Forecasting - Bankruptcy forecasting-Healthcare-Intrusion - Detection.								12
TOTAL HOURS								60	
CO	Course Outcomes								
CO1	Explain the fundamentals of artificial neural networks, biological neural systems, and activation functions.								
CO2	Describe and compare different neural network architectures, including feed-forward and recurrent networks.								

CO3	Apply back propagation learning algorithms for training neural network models.
CO4	Analyze self-organizing feature maps and counter propagation networks for pattern recognition tasks.
CO5	Evaluate and apply neural network techniques to real-world applications such as forecasting, healthcare, bioinformatics, and intrusion detection.
Textbooks	
1.	Introduction to Neural Networks using MATLAB 6.0., S N Sivanandam S Sumathi S N Deepa , McGraw Hill, 2006.
2.	Neural Networks: A Comprehensive Foundation, Simon Haykin, Pearson Education, 2007.
3.	Fundamentals of Neural Networks: Architectures, Algorithms and Applications, Laurene Fausett, Pearson Education, 2004.
Reference Book	
1.	Artificial neural Networks B.Yegnanarayana, Prentice Hall India, 2005.
2.	Neural Networks Alogorithms, Applications and programming Techniques, James A Freeman David M Skapura, Pearson Education.
3.	Neural Networks for Pattern Recognition, Christopher M. Bishop, Indian Edition, OXFORD University Press.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	2	3
CO 5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

ELECTIVE COURSE–3 B: Data Analytics

Subject Code	L	T	P	Semester	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD32	4	0	0	III	3	4	50	50	100
Learning Objectives									
LO1	To study the basic inferential statistics and sampling distribution.								
LO2	To understand the concept of estimation of parameters using fundamental tests and testing of hypotheses.								
LO3	To understand the techniques of analysis of variance.								
LO4	To gain knowledge in predictive analytics techniques.								
LO5	To perform a case study with any available sample data sets.								
Unit	Contents								No.of Hours
I	Introduction Data Analytics – Data Analysis Vs Data Analytics – Data Analytics – Types - Data Analytics – Framework – Data Analytics – Tool - R language - Understanding R -features - Installing R and RStudio – Packages and Library.								12
II	Importing and Exporting Files: CSV File – JSON File – txt File –Excel File – Xml File - Command Line Vs. Scripts. - Data Pre-Processing – Missing Value – Omitting Null Values – Data Transformation – Data Selection – Data Integration.								12
III	Command Line Vs. Scripts Data Manipulation: Slicing - Subscripts and Indices – Data Subset – Dplyr Package: Select Function - Filter Function - Mutate Function - Arrange Function.								12
IV	Data Summarization & Visualization - Mean – Median – Mode - Variability Measures - Variance – Range - IQR – Standard Deviation – Sum of Squares –Identifying Outliers using IQR								12
V	Data Analytics Case Studies – Marketing – Logistic Management – Insurance Behavioural Analytics – Data Analytics on Diamond Dataset.								12
TOTAL HOURS								60	
CO	Course Outcomes								
CO1	Understand and critically apply the concepts and methods of analytics.								
CO2	Analyze the concept of sampling.								
CO3	Demonstrate the skills to perform various tests in the given data.								
CO4	Apply the knowledge to derive hypotheses for given data.								
CO5	Perform statistical analytics on a data set.								

Textbooks	
1.	V. Bhuvaneswari, “Data Analytics with R Step by Step”, Scitech Publisher, ISBN – 978-81- 929131-2-4, Edition 2016.
2.	Roger D.Peng, “R Programming for Data Science”, Lean Publishing, 2014.
3.	Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, Packt Publishing, ISBN- 978-1 78216-328-2, 2013.
4.	Sholom Weiss, et.al, “The Text Mining Handbook: Advanced Approaches in Analysing Unstructured Data”, Springer, Paperback 2010.
5.	Emmanuel Paradis, “R for Beginners”, 2005.
Reference Book	
1.	. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
2.	Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
3.	David Spiegelhalter, “The Art of Statistics: Learning from Data”, Pelican Books, 2020.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	2	3
CO 5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

SKILL ENHANCEMENT COURSE (SEC-IV) – WEB DESIGNING LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USADP3	0	0	2	III	2	2	50	50	100

Learning Objectives

LO1	To get the knowledge about HTML tags.
LO2	To understand the usage of ordered and unordered lists.
LO3	To understand the usage of links.
LO4	To understand the usage of tables.
LO5	To understand the usage of frames.

Prerequisites:

Contents

1. Write HTML code to design a page containing some text in a paragraph by giving suitable heading style.
2. Create a page to show different character formatting (B, I, U, SUB, SUP) tags.
3. Apply various colors to suitably distinguish key words, also apply font styling like italics, underline and two other fonts to words you find appropriate, also use header tags.
4. Create a web page showing an ordered list of all second semester courses.
5. Create a web page showing an unordered list of names of all the Diploma Programmes (Branches) in your institution.
6. Write a program using HTML to design a Bio-Data.
7. Create a web page for internal links; when the user clicks on different links on the web page it should go to the appropriate locations/sections in the same page.
8. Use tables to provide layout to your HTML page describing your college infrastructure.
9. Create a web page using HTML5 and tags to display audio and video clips (modern replacement for frames).
10. Write an HTML program to create a feedback form with text fields, email field, textarea and submit button.
11. Create an image gallery using and tags to display images with captions.
12. Create a web page with external links to websites and email links using tag.

Total Hours:30

CO	Course Outcomes
CO1	Describe the basics of HTML and web design.
CO2	The students are able to understand the usage of lists.
CO3	The students are able to understand the usage of links.
CO4	The students are able to understand the usage of tables.
CO5	The students are able to understand the usage of frames.

Sl.No	Textbooks
1	C. Xavier, <i>World Wide Web Design with HTML</i> , First Edition, Tata McGraw Hill Publication, 2000.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	1	2	3
CO2	3	3	2	2	3
CO3	3	3	2	3	3
CO4	3	2	3	2	3
CO5	3	2	2	2	3
Weightage of course contributed to each PSO	15	12	10	11	15

SKILL ENHANCEMENT COURSE (SEC-V) – STATISTICS LAB USING Python

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USADP5	0	0	2	III	2	2	50	50	100
Learning Objectives									
LO1	To introduce Python programming concepts for statistical data analysis.								
LO2	To apply graphical methods for the representation and interpretation of data.								
LO3	To compute and analyze measures of central tendency, dispersion, skewness, and kurtosis using Python.								
LO4	To evaluate relationships between variables using correlation and regression techniques.								
LO5	To perform statistical computations and interpret results for real-world data using Python.								
Prerequisites:									
Contents									
1. Graphical representation of data. 2. Problems based on measures of central tendency. 3. Problems based on measures of dispersion. 4. Problems based on moments, skewness and kurtosis. 5. Karl Pearson and rank correlation coefficient. 6. Lines of regression, angle between lines and estimated values of variables. 7. Calculate price and quantity index numbers using simple and weighted average of price relatives.									
Total Hours: 30									
CO	Course Outcomes								
CO1	Create graphical representations of data using Python.								
CO2	Calculate and interpret measures of central tendency and dispersion.								
CO3	Analyze data using moments, skewness, and kurtosis.								
CO4	Apply correlation and regression techniques to study relationships between variables.								
CO5	Compute index numbers and perform statistical analysis using Python for decision-making.								
Text Book									
➤	Introduction to Probability and Statistics Using Python, Amit Kumar, McGraw Hill Education, 2016.								
➤	Statistics with Python, Robert D. Johansson, Packt Publishing, 2019.								
Reference Books									
1.	Think Stats: Exploratory Data Analysis in Python, Allen B. Downey, O'Reilly Media, 2014.								
2.	Practical Statistics for Data Scientists, Peter Bruce, Andrew Bruce and Peter Gedeck, O'Reilly Media, 2020.								

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	1	2	3
CO2	3	3	2	2	3
CO3	3	3	2	3	3
CO4	3	2	3	2	3
CO5	3	2	2	2	3
Weightage of course contributed to each PSO	15	12	10	11	15

COMMON - ENVIRONMENTAL SCIENCE

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEVS31	2	0	0	III	2	2	50	50	100
Learning Objectives									
LO1	To study the multidisciplinary nature of environmental studies, including the scope, importance, and sustainable management of natural resources such as forests, water, minerals, food, energy, and land.								
LO2	To understand different types of ecosystems, energy flow, ecological succession, food chains, food webs, and ecological pyramids.								
LO3	To examine the levels of biodiversity, its distribution in India and globally, threats to biodiversity, and conservation strategies including in-situ and ex-situ methods.								
LO4	To identify causes, effects, and control measures of various types of pollution, and to understand solid waste management and disaster management techniques.								
LO5	To analyze social and environmental issues such as climate change, global warming, and population growth, along with environmental protection laws and sustainable development practices.								
Prerequisites:									
Unit	Contents								No. of Hours
I	THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES Definition, scope and importance Natural resources and associated problems: a) Forest resources: Use and over-exploitation, deforestation, timber extraction, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, dams-benefits and problems, water conservation and watershed management. c) Mineral resources: Use and exploitation, environmental effects. d) Food resources: World food problems, changes, effects of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewables lion renewable energy sources, alternate energy sources. f) Land resources: Land as a resource, land degradation, man-induced landslides, soil erosion and desertification.								6
II	ECOSYSTEMS a) Forest Ecosystem b) Grassland Ecosystem c) Desert ecosystem d)Aquatic Ecosystem (Ponds, rivers, oceans, estuaries) Energy flow in the ecosystem Ecological succession Food Chains, Food Webs and Ecological Pyramids.								6

III	BIODIVERSITY AND ITS CONSERVATION Introduction Definition: Genetic, species and ecosystem diversity. Biogeographically classification of India ,Values of Biodiversity, Biodiversity at global, national and local levels India as a mega-diversity nation, Hot-Spots of biodiversity Threats to biodiversity Endangered and endemic species of India , Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity	6
IV	ENVIRONMENTAL POLLUTION Definition- Causes, effects and control measures of:- a) Air Pollution b) Water Pollution c) Soil Pollution d) Marine Pollution e) Noise Pollution f) Thermal Pollution Solid Waste Management, Disaster Management: Floods, earthquake, cyclone and Landslides.	6
V	SOCIAL ISSUES AND THE ENVIRONMENT Climatic change, global warming, acid rain, ozone depletion. Wasteland reclamation Consumerism and Waste products, use and through plastics Environment Protection Act Air (Prevention and Control of Pollution) Act Water (Prevention and Control of Pollution) Act Wildlife Protection Act Forest Conservation Act Population Explosion - Family Welfare Programme Human Rights	6

TOTAL		30
CO	Course Outcomes	
CO1	Students will be able to explain the scope and importance of environmental studies and analyze the use, over-exploitation, and conservation of natural resources.	
CO2	Students will be able to describe ecosystem types, energy flow, ecological succession, and relationships such as food chains, food webs, and ecological pyramids.	
CO3	Students will be able to assess biodiversity at different levels, identify threats, and explain conservation methods including in-situ and ex-situ approaches.	
CO4	Students will be able to identify various types of pollution, analyze their causes and effects, and suggest control measures along with waste and disaster management practices.	
CO5	Students will be able to evaluate major environmental issues such as climate change and population growth, and understand environmental protection laws and sustainable practices.	

Reference Books

1	N. Arumugam and V. Kumaresan, 2014, Environmental studies, 4th edition, Saras Publication, Nagercoil, TamilNadu.
2	M. Basu, and S. Xavier, 2016, Fundamentals of Environmental Studies, Cambridge University Press.
3	A.K. Mitra and R. Chakraborty, 2016, Introduction to Environmental Studies, Book Syndicate.
4	J.S. Singh, S.P.Singh, and S.R. Gupta, 2014, Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	2	2
CO2	2	3	2	2	2	2
CO3	2	3	3	3	2	2
CO4	2	3	2	2	2	2
CO5	3	3	2	2	2	2
Weightage of course contributed to each PSO	12	14	11	11	10	10

Semester-4

Semester–4

Course Code	Part	Course category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours	Max Marks			
						CIA	ESE	Total	
26U1TL41	I	Language– I	Tamil–IV	5	3	50	50	100	3
26U1HD41	I		Hindi –IV						
26U1MY41	I		Malayalam–IV						
26U1FR41	I		French - IV						
26U2EN41	II	Language– II	English–IV	5	3	50	50	100	3
26UCAD41	III	Core– VII	R PROGRAMMING	4	3	50	50	100	4
26UCADP4	III	Core –VIII	Practical - R PROGRAMMING Lab	6	3	50	50	100	4
26UEAD41	III	EC - IV	Cloud Computing	4	3	50	50	100	3
26UEAD42			Fundamentals of Data Science						
26UEAD43			Human Computer Interaction						
26USADP5	III	SEC –VI	Practical - Advanced Excel	2	3	50	50	100	2
26USADP6	IV	SEC - VII	Practical -PHP Programming	2	3	50	50	100	2
26UVBE41	V	Common	Value Based Education	2	3	50	50	100	2
Total				30				800	23

SECOND YEAR - SEMESTER – IV
CORE COURSE (CC-VII) – R PROGRAMMING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCAD41	4	0	0	IV	4	4	50	50	100
Learning Objectives									
LO1	To Understanding and being able to use basic programming concepts in R.								
LO2	To automate data Analyze using control structures and data structures in R.								
LO3	To understanding and working with list and data frames in R.								
LO4	To Knowing and use factors, table and build in functions in R.								
LO5	To Understanding and implement the concept of object oriented programming using R.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction: Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations.								12
II	Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations								12
III	Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DATA FRAMES, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations								12
IV	FACTORS AND TABLES, Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables ,Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions								12
V	OBJECT-ORIENTED PROGRAMMING: S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analyze								12

	with R, data manipulation	
TOTAL		60
CO	Course Outcomes	
CO1	Implement of basic R programming framework and data structures.	
CO2	Make use of critical R programming language concepts such as control structures and recursion.	
CO3	Analyze the mathematical and statistical operations data in R.	
CO4	Examine data-sets to create testable hypotheses and identify appropriate statistical tests.	
CO5	Make use of appropriate statistical tests using R and Create and edit visualizations with regression models.	
Textbooks		
1.	R Programming for Data Science by Roger D.Peng	
2.	The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning India	
Reference Books		
1	Tilman M. Davies, The Book of R: A First Course in Programming and Statistics, 1st edition, 2019.	
Web References		
1	<u>Tilman M. Davies, The Book of R: A First Course in Programming and Statistics, 1st edition, 2019.</u>	
2	<u>https://www.javatpoint.com/r-tutorial</u>	
3	<u>https://www.tutorialspoint.com/r/index.htm</u>	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	1	3	2	2
CO2	3	1	3	2	1
CO3	3	2	3	3	3
CO4	3	1	3	2	2
CO5	3	1	3	2	2
Weightage of course contributed to each PSO	15	6	15	11	10

CORE – CC-VIII R PROGRAMMING LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UADP4	0	0	6	IV	4	6	50	50	100

Learning Objectives

LO1	To understanding and use basic concepts in R.
LO2	To acquire programming skills in R.
LO3	To understanding and implement the data structures in R.
LO4	To use mathematical and statistical functions in R.
LO5	To understand and use object oriented concepts in R.

Prerequisites:

Contents

1. Write a R-Program to demonstrate working with operators (Arithmetic, Relational, Logical, Assignment operators).
2. Write a R Program to Check if a Number is Odd or Even.
3. Write a R Program to check if the given Number is a Prime Number.
4. Write a R Program to Find the Factorial of a Number.
5. Write a R Program to Find the Fibonacci sequence Using Recursive Function
6. Write a R Program to Make a Simple Calculator.
7. Write a R Program to Find L.C.M of two numbers.
8. Write a R Program to Find the elements of a vector that are not in another
9. Write a R Program to sort the elements of an array.
10. Write a R Program to Find columns and rows with NA in R Data Frame
11. Write a R Program to Find the row and column index of maximum and minimum value in a matrix in R
12. Write a R Program to Concatenate two given factors in a single factor in R
13. Write a R Program to create a table and find the second largest cell.
14. Write a R Program to implement mathematical function in R.
15. Write a R Program to implement statistical function in R.
16. Write a R Program to create a S3 Class and S3Objects.
17. Write a R Program to write a own generic function in S3 Class.
18. Write a R Program to create a S4 Class and S4 Objects.
19. Write a R Program to write a own generic function in S4 Class.
20. Write a R Program to create Reference Class and modify its Methods

Total hours :90

CO	Course Outcomes
CO1	Understand various basic concepts in R
CO2	Analyze various concepts of R to solve the problem in an efficient way.
CO3	Applying various data structures supported by R.
CO4	Make use of mathematical and statistical function in R
CO5	Understand and implement the concept of OOP using R.

Textbooks	
1.	R Programming for Data Science by Roger D.Peng
2.	The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning India

Reference Books	
1	Tilman M. Davies, The Book of R: A First Course in Programming and Statistics, 1st edition, 2019.

Web References	
1	https://www.programiz.com/r

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	1	-	-
CO2	3	3	2	1	-
CO3	3	3	3	2	1
CO4	3	3	2	2	1
CO5	3	3	3	2	2
Weightage of course contributed to each PSO	15	14	11	7	10

ELECTIVE COURSE–IV A: Cloud Computing

Subject Code	L	T	P	Semester	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD41	4	0	0	III	3	4	50	50	100
Learning Objectives									
LO1	To impart fundamental concepts of Cloud Computing.								
LO2	To impart a working knowledge of the various cloud service types and their uses and pitfalls.								
LO3	To enable the students to know the common features and differences in the service offerings of the three major Cloud Computing service providers, namely Amazon, Microsoft and Google.								
LO4	To provide know-how of the various aspects of application design, benchmarking and security on the Cloud.								
LO5	To study the legal issues involve in cloud computing								
Unit	Contents							No.of Hours	
I	Foundations of cloud: Inception and need for cloud computing: Motivations from distributed computing predecessors - Evolution - Characteristics - Business Benefits – Challenges in cloud computing - Exploring the Cloud Computing Stack - Fundamental Cloud Architectures							12	
II	Service Delivery and Deployment Models: Service Models (XaaS): Infrastructure as a Service (IaaS) - Platform as a Service (PaaS) - Software as a Service(SaaS) – Deployment Models: Types of cloud - Public cloud - Private cloud - Hybrid cloud – Service level agreements - Types of SLA – Lifecycle of SLA- SLA Management							12	
III	Cloud Resource Virtualization: Virtualization as Foundation of Cloud – Understanding Hypervisors – Understanding Machine Image and Instances - Managing Instances – Virtual Machine Provisioning and Service Migrations Cloud Computing Applications and Paradigms							12	
IV	Resource Management and Scheduling in Cloud: Policies and Mechanisms for Resource Management – Stability of a Two-Level Resource Allocation Architecture Scheduling Algorithms for Computing Clouds - Resource Management and Dynamic Application Scaling							12	
V	Cloud Platforms and Application Development: Comparing Amazon web services, Google App Engine, Microsoft Azure from the perspective of architecture (Compute, Storage Communication) services and cost models.							12	

	Advances is Cloud: Media Clouds - Security Clouds – Computing Clouds - Mobile Clouds – Federated Clouds – Hybrid Clouds	
TOTAL HOURS		60
CO	Course Outcomes	
CO1	To understand the concepts and technologies involved in Cloud Computing.	
CO2	To understand the concepts of various cloud services and their implementation in the Amazon, Microsoft and Google cloud computing platforms.	
CO3	To understand the aspects of application design for the Cloud.	
CO4	To understand the concepts involved in benchmarking and security on the Cloud.	
CO5	To understand the way in which the cloud is used in various domains.	
Textbooks		
1.	Rajkumar Buyya, James Broberg, Andrzej, M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 1st Edition, 2013.	
2.	Sosinsk, Barrie, Cloud Computing Bible, John Wiley & Sons, 1st Edition, 2011.	
3.	Arshdeep Bahga, Vijay Madisetti, Cloud Computing – A Hands On Approach, Universities Press (India) Pvt. Ltd., 2018.	
Reference Book		
1.	Anthony T Velte, Toby J Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Tata McGraw-Hill, 2013.	
2.	Barrie Sosinsky, Cloud Computing Bible, Wiley India Pvt. Ltd., 2013.	
3.	David Crookes, Cloud Computing in Easy Steps, Tata McGraw Hill, 2012.	
Web Resources		
1.	https://www.youtube.com/watch?v=8O32k26RWA	
2.	https://www.youtube.com/watch?v=8O32k26RWA	

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	2	3
CO 5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

ELECTIVE COURSE–IV B: Fundamentals of Data Science

Subject Code	L	T	P	Semester	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD42	4	0	0	IV	3	4	50	50	100
Learning Objectives									
LO1	To acquire skills in data preparatory and preprocessing steps								
LO2	To understand the mathematical skills in statistics								
LO3	To learn the tools and packages in Python for data science								
LO4	To gain understanding in classification and Regression Model								
LO5	To acquire knowledge in data interpretation and visualization techniques								
Unit	Contents							No.of Hours	
I	Need for data science –benefits and uses –facets of data –data science process –setting the research goal –retrieving data –cleansing, integrating and transforming data –exploratory data analysis –build the models –presenting and building applications.							12	
II	Frequency distributions –Outliers –relative frequency distributions –cumulative frequency distributions –frequency distributions for nominal data –interpreting distributions –graphs – averages –mode –median –mean –averages for qualitative and ranked data.							12	
III	Normal distributions –z scores –normal curve problems –finding proportions –finding scores – more about z scores –correlation –scatter plots –correlation coefficient for quantitative data – computational formula for correlation coefficient.							12	
IV	Basics of Numpy arrays, aggregations, computations on arrays, comparisons, structured arrays, Data manipulation, data indexing and selection, operating on data, missing data, hierarchical indexing, combining datasets –aggregation and grouping, pivot tables.							12	
V	Visualization with matplotlib, line plots, scatter plots, visualizing errors, density and contour plots, histograms, binnings, and density, three dimensional plotting, geographic data.							12	
TOTAL HOURS								60	

CO	Course Outcomes
CO1	Apply the skills of data inspecting and cleansing
CO2	Determine the relationship between data dependencies using statistics
CO3	Understand the can handle data using primary tools used for data science
CO4	Represent the useful information using mathematical skills
CO5	Apply the knowledge for data describing and visualization using tools
Textbooks	
1.	David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016
2.	Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
3.	Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.
Reference Book	
1.	Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	2	1	1	3	3	3
CO2	2	1	1	3	3	3
CO 3	3	2	1	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	2	3	3	3
Weightage of course contributed to each PSO	13	10	8	15	15	15

ELECTIVE COURSE–IV C: Human Computer Interaction

Subject Code	L	T	P	Semester	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD43	4	0	0	IV	3	4	50	50	100
Learning Objectives									
LO1	To learn about the foundations of Human Computer Interaction.								
LO2	To learn the design and software process technologies.								
LO3	To learn HCI models and theories.								
LO4	To learn the mobile ecosystem.								
LO5	To learn the various types of Web Interface Design.								
Unit	Contents								No. of Hours
I	FOUNDATIONS OF HCI:• The Human: I/O channels – Memory-• Reasoning and problem solving; The Computer: Devices – Memory – Processing and Networks;• Interaction: Models – Frameworks – Ergonomics – Styles – Elements – Interactivity – Paradigms – Case Studies								12
II	DESIGN & SOFTWARE PROCESS: Interactive Design: Basics–process–scenarios -Navigation: screen design Iteration and prototyping - HCI in software process: Software life cycle– usability engineering– Prototyping in practice–design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.								12
III	MODELS AND THEORIES: HCI Model: Cognitive models:-Socio-Organizational issues and stakeholder requirements Communication and collaboration models-Hypertext, Multimedia and WWW.								12
IV	Mobile HCI: Mobile Ecosystem: Platforms, Application frameworks - Types of Mobile Applications: Widgets, Applications, Games -Mobile Information Architecture, Mobile2.0 - Mobile Design: Elements of Mobile Design, Tools. -Case Studies								12
V	WEB INTERFACE DESIGN: Designing Web Interfaces–Drag& Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies								12
TOTAL HOURS								60	
CO	Course Outcomes								

CO1	Understand the design and software process technologies.
CO2	Understand HCI models and theories.
CO3	Understand the mobile ecosystem, types of mobile applications, mobile architecture, and design.
CO4	Understand the various types of Web Interface Design.
CO5	Understand the fundamentals of HCI.
Textbooks	
1.	Alan Dix, Janet Finlay, Gregory Abowd, and Russell Beale, Human–Computer Interaction, III Edition, Pearson Education, 2004. (Unit I, II & III)
2.	Brian Fling, Mobile Design and Development, I Edition, O’Reilly Media Inc., 2009. (Unit IV)
3.	Bill Scott and Theresa Neil, Designing Web Interfaces, First Edition, O’Reilly, 2009. (Unit V)
Reference Book	
1.	Ben Shneiderman, Designing the User Interface: Strategies for Effective Human Computer Interaction, V Edition, Pearson Education.
Web Reference	
1.	https://www.interaction-design.org/literature/topics/human-computer-interaction Ben Edition, Pearson Education.
2.	https://link.springer.com/10.1007/978-0-387-39940-9_192
3.	https://en.wikipedia.org/wiki/Human%E2%80%93computer_interaction

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	3	2	3	3	2	2
CO2	3	3	3	3	2	2
CO 3	3	3	3	2	3	3
CO 4	3	3	3	3	2	2
CO 5	3	3	2	3	2	2
Weightage of course contributed to each PSO Missing	15	14	14	14	11	11

SKILL ENHANCEMENT COURSE (SEC-VI) – Advanced Excel Lab

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USADP5	0	0	2	IV	2	2	50	50	100
Learning Objectives									
LO1	To handle large amounts of data.								
LO2	To aggregate numeric data and summarize into categories and subcategories.								
LO3	To perform filtering, sorting, and grouping of data or subsets of data.								
LO4	To create Pivot Tables to consolidate data from multiple files								
LO5	To present data in the form of charts and graphs.								
Prerequisites:									
Contents									
1. Logical Operations – Consider the design of a light switch system that can turn the same light on or off in three different places. One switch (A) is installed in the hall on the first floor, another switch (B) on the upstairs landing, and the third switch (C) on the ground floor. Each switch has two states (ON/OFF). When an odd number of switches are ON, the bulb remains OFF; otherwise, the bulb glows. Design a truth table and find the various states of the bulb. 2. Given the name, gender, attendance, assignment, midterm and final grades of five students, find the total assessment marks. Students pass if the total score ≥ 50. Display “Pass” or “Fail” in the Description column. 3. Create worksheet with columns Full Name, Last Name, First Name and E-Mail. Using text functions, extract Last Name, First Name and generate E-mail (LastName_FirstName@gmail.com). 4. Use Date and Time functions: DATE, DATEVALUE, DAY, DAYS, MINUTE, MONTH 5. Data Validation – Create Excel table with columns Emp Name, Emp No, Salary, Bonus, Date of Entry, Department. Apply rules: Emp No = 5 characters; Salary range 600–2000; Bonus $\leq 10\%$ salary; Date of entry = Today; Department from list. 6. Sorting and Filtering – Create Excel table with Course, Level, Instructor Name, Day, Start Time, Duration, Course Fee. Sort by Course Level → Start Time → Course Fee. Filter: Instructor specific, Day = Monday, Time after 17:00. 7. Create Column, Line, Bar, Pie and Scatter charts for marks of six semesters. 8. Share chart with Word and PowerPoint.									
									Total Hours: 30
CO	Course Outcomes								
CO1	Perform logical operations.								
CO2	Apply Excel functions.								
CO3	Perform data validation.								
CO4	Perform sorting and filtering.								
CO5	Create charts and share outputs.								
Text Book									

1	Excel 2019 All
2	Microsoft Excel 2019 Pivot Table Data Crunching
Reference Books	
1.	Excel 2019 All-in-One for Dummies, Greg Harvey, 1st edition
Web Resources	
1.	https://www.simplilearn.com

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3
Weightage of course contributed to each PSO	15	12	15	15	15

SKILL ENHANCEMENT COURSE (SEC-4) – PHP PROGRAMMING LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USADP4	0	0	2	IV	2	2	50	50	100
Learning Objectives									
LO1	To provide the necessary knowledge on basics of PHP.								
LO2	To design and develop dynamic, database-driven web applications using PHP version.								
LO3	To get an experience on various web application development techniques.								
LO4	To learn the necessary concepts for working with the files using PHP.								
LO5	To get a knowledge on OOPS with PHP.								
Prerequisites:									
Contents									
1. Get name of a user from a form and show greeting text. 2. Write a PHP program to check whether given string is palindrome or not. 3. Write a PHP program to check whether given number is Armstrong or not. 4. Write a PHP program using function. 5. Create, Insert, Update, delete records using PHP & MySQL. 6. Write a PHP program for Array manipulation. 7. Write a PHP program to create, write and read a file. 8. Create a PHP page for login page with sql connection. 9 Create a web page to advertise a product of the company using images and audio. 10. Create a PHP page for login system using session.									
Total Hours: 30									
CO	Course Outcomes								
CO1	Write PHP scripts to handle HTML forms.								
CO2	Write regular expressions including modifiers, operators, and met characters.								
CO3	Create PHP Program using the concept of array.								
CO4	Create PHP programs that use various PHP library functions.								
CO5	Manipulate files and directories.								
Text Book									
➤	VIKRAM VASHWANI- PHP and MY SQL McHill- 2005 Head First PHP & MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison								
➤	The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL- Alan Forbes								
Reference Books									
1.	PHP: The Complete Reference-Steven Holzner. DT Editorial Services (Author), —HTML 5 Black Book (Covers CSS3, JavaScript, XML,								

2.	XHTML, AJAX, PHP, jQuery)l, Paperback 2016, 2ndEdition.
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CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	1	2	3
CO2	3	3	2	2	3
CO3	3	3	2	3	3
CO4	3	2	3	2	3
	3	2	2	2	3
Weightage of course contributed to each PSO	15	12	10	11	15

COMMON - VALUE BASED EDUCATION

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UVBE41	2	0	0	IV	2	2	50	50	100
Learning Objectives									
LO1	To provide basic knowledge of the Indian Constitution and its framework.								
LO2	To understand fundamental rights, duties, and directive principles.								
LO3	To create awareness about human rights and their protection mechanisms.								
LO4	To develop analytical skills regarding constitutional and human rights issues.								
LO5	To promote values of equality, justice, and democracy among students.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction to Indian Constitution Introduction: Meaning and importance of Constitution - Historical background of Indian Constitution - Making of the Constitution (Constituent Assembly) - Salient features of Indian Constitution - Preamble – Meaning, Objectives and Values.								6
II	Fundamental Rights and Duties Fundamental Rights – Types and significance - Right to Equality, Freedom, Religion, Cultural & Educational Rights - Right to Constitutional Remedies - Fundamental Duties – Meaning and importance.								6
III	Directive Principles of State Policy Meaning and objectives - Classification of Directive Principles - Relationship between Fundamental Rights and DPSP - Role in governance and welfare state.								6
IV	Human Rights – Concepts and Development Meaning and definition of Human Rights - Evolution of Human Rights - Universal Declaration of Human Rights (UDHR) - Types of Human Rights – Civil, Political, Economic, Social & Cultural								6
V	Human Rights in India Human Rights Protection Act, 1993 - National Human Rights Commission (NHRC) – Structure and functions - Role of NGOs in Human Rights protection - Issues: Women, Children, Minorities & Environment - Contemporary Human Rights challenges in India.								6
TOTAL									30

CO	Course Outcomes
CO1	Explain the structure and features of the Indian Constitution.
CO2	Identify and interpret Fundamental Rights and Duties.
CO3	Analyze the role of Directive Principles in governance.
CO4	Understand the concept and importance of Human Rights.
CO5	To create a congenial climate in the organization
Text Books	
1	Durga Das Basu – Introduction to the Constitution of India
Reference Books	
1	V.N. Shukla – Constitution of India
2	M. Laxmikanth – Indian Polity
3	Upendra Baxi – The Future of Human Rights
4	H.O. Agarwal – Human Rights
5	P.M. Bakshi – The Constitution of India

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	2	2
CO2	2	3	2	2	2	2
CO3	2	3	3	3	2	2
CO4	2	3	2	2	2	2
CO5	3	3	2	2	2	2
Weightage of course contributed to each PSO	12	14	11	11	10	10

Semester-V

Semester - 5

Course Code	Part	Course Category	Course Name	Hours/ Week	Examination			Credits	
					Duration in hrs.	Max Marks			
						CIA	ESE		Total
26UCAD51	III	Core - IX	Data Base Management Systems	4	3	50	50	100	4
26UCAD52		Core – X	Machine Learning	4	3	50	50	100	4
26UCADP5		Core – XI	Data Base Management Systems Lab	6	3	50	50	100	4
26UCADP6		Core -XII	Machine Learning Lab	6	3	50	50	100	4
26UEAD51		Elective - V	Cognitive Computing	4	3	50	50	100	3
26UEAD52			Software Engineering						
26UEAD53		Elective - VI	Data Communication & Networking	4	3	50	50	100	3
26UEAD54			IOT and its Applications						
26UFIK51		IV	Internship	Internship/Industrial Visit/Field Visit/Knowledge Updation Activity	-	3	50	50	100
26UAEC51	IV	AEC - I	Empowered Vocational English	2	3	50	50	100	2
Total				30				800	26

THIRD YEAR - SEMESTER - V**CORE COURSE – IX: DATABASE MANAGEMENT SYSTEMS**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCAD51	4	0	0	V	4	4	50	50	100
Learning Objectives									
LO1	The primary learning objectives of DBMS is to master the principles of Organizing, Maintaining, Retrieving and Securing data efficiently.								
LO2	Students learn structured query language management								
LO3	Understand the relationship among the defining elements of the database environment.								
LO4	Understand the operational problems inherent in the flat file approach.								
LO5	Improve ourselves by taking valuable face backs.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction to Databases and Database System Concepts Introduction – Characteristics of the Database Approach – Actors on the Scene and Workers behind the Scene – Advantages of Using the Database Management System Approach – Database Applications – Data Models, Schemas, and Instances – Three-Schema Architecture of a Database Management System – Data Independence – Database Languages and Interfaces – Database System Environment – Architectures for Database Management Systems Database Management Systems – Classification of Database Management Systems.								12
II	Entity Relationship Model and Relational Model : Entity Types, Entity Sets, Attributes, and Keys – Relationship Types – Steps to Model an Entity Relationship Diagram – Relational Model Concepts – Relational Model Constraints and Relational Database Schemas – Update Operations, Transactions, and Dealing with Constraint Violations – Mapping Entity Relationship Model to Relational Data Model.								12
III	Relational Algebra and Structured Query Language : Unary Relational Operations: SELECT and PROJECT – Relational Algebra Operations from Set Theory – Binary Relational Operations: Cartesian Product – Equi Join – Left Outer Join – Right Outer Join – Full Outer Join – Data Definition Language – Data Manipulation Language – Transaction Control Language – Aggregate Functions – Joins – Nested Queries –Views – Stored Procedures – Cursors – Functions – Triggers.								12
IV	Database Normalization: Functional Dependencies – First Normal Form –								12

	Second Normal Form – Third Normal Form – Boyce-Codd Normal Form – Multivalued Dependency and Fourth Normal Form – Join Dependencies and Fifth Normal Form.	
V	Transaction Processing and Concurrency Control : Introduction to Transaction Processing – Transaction and System Concepts – Properties of Transactions – Characterizing Schedules Based on Recoverability – Characterizing Schedules Based on Serializability – Transaction Support in SQL – Concurrency Control Techniques – Two Phase Locking Techniques for Concurrency Control – Concurrency Control Based on Timestamp Ordering.	12
TOTAL		60
CO	Course Outcomes	
CO1	Understand the concept of relational algebra	
CO2	To analyse the problem in data base	
CO3	To design and develop queries to the problem in accessing and creating database	
CO4	Built ability to investigate various relational databases	
CO5	Modern tools can be used to implement various SQL queries	
Text Books		
1	Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Seventh Edition, Pearson Education, 2016.	
2	Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Seventh Edition, McGraw Hill Education, 2020.	
Web Resources		
1	http://www.uoitc.edu.iq/images/documents/informaticsinstitute/Competitive_exam/Database_Systems.pdf An Introduction Relational Database Theory, Hugh Darwen,	
2	http://www.zums.ac.ir/files/research/site/ebooks/it-programming/an introduction to-relational-database-theory.pdf	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	3	3	2	2
CO2	3	3	3	3	2	2
CO3	3	3	3	2	2	3
CO4	3	3	3	3	3	2
CO5	3	3	2	3	2	2
Weight age of course contributed to each PSO	15	14	14	14	11	11

CORE COURSE - X: MACHINE LEARNING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCAD52	4	0	0	V	4	4	50	50	100
Learning Objectives									
LO1	To Identify key learning problems, perspectives, and issues.								
LO2	To Apply performance metrics to assess model effectiveness.								
LO3	To Evaluate algorithm suitability based on data characteristics.								
LO4	To Analyze the strengths and limitations of locally weighted learning methods.								
LO5	To Understand and implement the back propagation algorithm for training deep networks.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction: Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search								12
II	Workflow and Types of Machine Learning Algorithms: Process of Machine Learning - Machine Learning Workflow– Types of Common Machine Learning Algorithms– Performance Metrics.								12
III	Concepts: Data Pre-processing– Feature Engineering– Regression Concepts– Classification algorithms– Clustering algorithms								12
IV	Instant Based Learning: K- Nearest Neighbour Learning – Locally weighted Regression – Self Organizing Map – Vector Quantization - Locally Weighted Learning.								12
V	Advanced Learning: Neural Network Representation Perceptrons – Multilayer Networks, Activation Functions, Gradient Descent Rule, Stochastic Gradient Descent Optimization, Back Propagation Algorithm								12
TOTAL								60	
CO	Course Outcomes								
CO1	Outline the importance of machine learning in terms of designing intelligent machines								
CO2	Identify suitable machine learning techniques for the real time applications								
CO3	Analyze the theoretical concepts and how they relate to the practical aspects of machine learning.								
CO4	Assess the significance of principles, algorithms and applications of machine learning through a hands								
CO5	Compare the machine learning techniques with respective functionality								
Text Books									
1	“Machine Learning”, Tom M. Mitchell, McGraw-Hill Education (India) Private Limited, 2013.								

2	“Introduction to Machine Learning (Adaptive Computation and Machine Learning)”, Ethem Alpaydin, The MIT Press, 2004.Publication, 2015.
3	Ethem Alpaydin, “Introduction to Machine Learning” Third Edition, MIT, 2014.
Reference Books	
1	Bertt Lantz, "Machine Learning with R," Packt Publishing, 2013
2	Jason Bell, "Machine Learning: Hands-On for Developers and Technical Professionals," Wiley Publication, 2015. 3 “Machine Learning: An Algorithmic Perspective, Stephen Marsland, CRC Press, 2009.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

CORE COURSE –XI: DATABASE MAGEMENT LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCADP5	0	0	6	V	4	6	50	50	100
Learning Objectives									
LO1	To provide strong foundation in DBMS concepts and practice								
LO2	To practice SQL programming through a variety of database problems								
LO3	To understand the relational database design principles								
LO4	To demonstrate the use of concurrency and transactions in database								
LO5	To design and build database application for real world problems.								
Prerequisites:									
Contents									
1. Data Definition Language – Create – Alter – Drop – Enforcing Primary Key and Foreign Key Constraints									
2. Data Manipulation Language – Insert – Delete – Update–Transaction Control Language – Commit – Rollback – Save Points. (Separate programs)									
3. Cartesian Product – Equi Join – Left Outer Join – Right Outer Join – Full Outer Join.									
4. Set Operations – Creating Views – Creating Sequence – Indexing – Aggregate Functions – Analytic Functions – Nested Queries.(separate programs)									
5. Creating Stored Procedures, Functions and Triggers (separate programs)									
.									
Total Hours: 90									
CO	Course Outcomes								
CO1	Create databases with with different level queries								
CO2	Utilizing DLL, DML, DCL.								
CO3	Constructing and execute queries to manipulate and retrieve data from database								
CO4	Develop application program using PL SQL								
CO5	Establish database connectivity through ODBC								

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

CORE COURSE –XII: MACHINE LEARNING LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCADP6	0	0	6	V	4	6	50	50	100
Learning Objectives									
LO1	To Apply Statistical and Analytical Techniques Using Python								
LO2	To Develop scatter plots to explore relationships between variables.								
LO3	To Construct and interpret decision trees for classification tasks.								
LO4	To Understand database operations in the context of data science workflows.								
LO5	To Predict outcomes such as housing costs using regression models.								
Prerequisites:									
Contents									
Exercises using Python									
1. Find the standard deviation for speed of a cars using numpy									
2. Find the percentile of a marks of students									
3. Draw the histogram for Normal Distribution									
4. Draw the scatter Plot									
5. Polynomial Regression									
6. Draw the decision tree.									
7. Create Table and insert values using Python MySQL									
8. Construct the query for retrieving relevant information from the table Python MySQL									
9. Execute Linear Regression using suitable Training and Testing data set for predicting the cost of a flat.									
Total Hours: 90									
CO	Course Outcomes								
CO1	Successfully compute measures such as standard deviation and percentiles using NumPy for real-world datasets.								
CO2	Create histograms, scatter plots, and other visualizations to interpret distributions and relationships in data.								
CO3	Develop and evaluate models such as polynomial regression, decision trees, and linear regression for predictive tasks.								
CO4	Design tables, insert values, and construct queries using Python-MySQL to manage and retrieve structured data.								
CO5	Train and test regression models to predict outcomes (e.g., housing costs), demonstrating the ability to handle complete machine learning workflows.								

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

ELECTIVE COURSE– V-A: COGNITIVE COMPUTING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD51	4	0	0	V	3	4	50	50	100
Learning Objectives									
LO1	To Understand the Foundations of Cognitive Science and Computing								
LO2	To Explore Knowledge-Based AI and Cognitive Architectures								
LO3	To Apply Machine Learning Techniques in Cognitive Decision-Making								
LO4	To Develop Skills in Knowledge Representation and Natural Language Processing								
LO5	To Integrate Big Data with Cognitive Computing								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction: Cognitive science and cognitive Computing with AI, Cognitive Computing - Cognitive Psychology - The Architecture of the Mind - The Nature of Cognitive Psychology – Cognitive architecture – Cognitive processes – The Cognitive Modeling Paradigms - Declarative / Logic based Computational cognitive modeling – connectionist models – Bayesian models.								12
II	Introduction to Knowledge-Based AI – Human Cognition on AI – Cognitive Architectures Intelligent Decision making, Fuzzy Cognitive Maps, Learning algorithms: Non linear Hebbian Learning – Data driven NHL								12
III	Hybrid learning, Fuzzy Grey cognitive maps, Dynamic Random fuzzy cognitive Maps. Machine learning Techniques for cognitive decision making								12
IV	Hypothesis Generation and Scoring - Natural Language Processing - Representing Knowledge - Taxonomies and Ontologies - Deep Learning.								12
V	Big Data and Cognitive Computing : Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data								12
TOTAL								60	
CO	Course Outcomes								
CO1	Demonstrate Understanding of Cognitive Science and Architectures								
CO2	Apply Knowledge-Based AI and Cognitive Decision-Making Techniques								
CO3	Utilize Machine Learning and Natural Language Processing in Cognitive Systems								
CO4	Integrate Knowledge Representation Frameworks								
CO5	Analyze and Apply Big Data Architectures in Cognitive Computing								

Text Books	
1	Hurwitz, Kaufman, and Bowles, Cognitive Computing and Big Data Analytics, Wiley, Indianapolis, IN, 2005, ISBN: 978-1-118-89662-4.
2	Masood, Adnan, Hashmi, Adnan ,Cognitive Computing Recipes Artificial Intelligence Solutions Using Microsoft Cognitive Services and TensorFlow, 2015
Reference Books	
1.	Peter Fingar, Cognitive Computing: A Brief Guide for Game Changers, PHI Publication, 2015
2.	GerardusBlokdyk ,Cognitive Computing Complete Self-Assessment Guide, 2018

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

ELECTIVE COURSE – V-B: SOFTWARE ENGINEERING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD52	4	0	0	V	3	4	50	50	100
Learning Objectives									
LO1	To understand the software engineering concepts and to create a system model in real life applications								
LO2	To Compare their strengths, weaknesses, and applicability to different project contexts.								
LO3	To Differentiate between function-oriented and object-oriented design approaches.								
LO4	To Distinguish between unit, integration, system, black-box, and white-box testing.								
LO5	To Explore the scope, architecture, and evolution of CASE tools in supporting the software life cycle.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction: The software engineering discipline, programs vs. software products, emergence of software engineering, Notable changes in software development practices, computer systems engineering. Software Life Cycle Models: Classical waterfall model, iterative waterfall model, prototyping model, evolutionary model, spiral model, comparison of different life cycle models.								12
II	Requirements Analysis and Specification: Requirements gathering and analysis, Software requirements specification (SRS) Software Design: Functional independence - cohesion and coupling, software design approaches, object- oriented vs function-oriented design								12
III	Function-Oriented Software Design: Overview of SA/SD methodology, structured analysis, data flow diagrams (DFD's), structured design, detailed design. User-Interface design: Good interface; basic concepts; types of user interfaces; component based GUI development, a user interface methodology.								12
IV	Coding and Testing: Coding; code review; testing; testing in the large vs testing in the small; unit testing; black-box testing; white-box testing; debugging; program analysis tools; integration testing; system testing; some general issues associated with testing.								12
V	Software Maintenance: Characteristic of software maintenance; software reverse engineering; software maintenance process models; estimation of maintenance cost; Computer Aided Software Engineering: CASE and its scope; CASE environment; CASE support in software life cycle; other characteristics								12

	of CASE tools; towards second generation CASE tool; architecture of a CASE environment.	
TOTAL		60
CO	Course Outcomes	
CO1	Gain basic knowledge of analysis and design of systems.	
CO2	Ability to apply software engineering principles and techniques.	
CO3	Model a reliable and cost-effective software system.	
CO4	Ability to design an effective model of the system.	
CO5	Perform Testing at various levels and produce an efficient system.	
Text Books		
1	Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, Prentice-Hall of India, 2018	
Reference Books		
1	Richard Fairley, Software Engineering Concepts, Tata McGraw Hill publishing company Ltd, Edition 1997.	
2	Roger S. Pressman, Software Engineering, Seventh Edition, McGraw-Hill. James A. Senn, Analysis & Design of Information Systems, Second Edition, McGraw-Hill International Editions.	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	3	3	2	2
CO2	3	3	3	3	2	2
CO3	3	3	3	2	2	3
CO4	3	3	3	3	3	2
CO5	3	3	2	3	2	2
Weight age of course contributed to each PSO	15	14	14	14	11	11

ELECTIVE COURSE – VI-A: DATA COMMUNICATION & NETWORKING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD53	4	0	0	V	3	4	50	50	100
Learning Objectives									
LO1	To understand the concept of Data communication and Computer network								
LO2	To impart knowledge about networking and inter								
LO3	To impart knowledge about networking and internetworking devices								
LO4	To gain the knowledge on Security over Network communication								
LO5	To Integrate Application Layer Services in Real-World Scenarios								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction – DATA COMMUNICATIONS – NETWORKS - PROTOCOLS AND STANDARDS - Network Models - THE OSI MODEL - TCP/IP PROTOCOL SUITE								12
II	Bandwidth Utilization: Multiplexing and Spreading – MULTIPLEXING - SPREAD SPECTRUM Transmission Media - GUIDED MEDIA - UNGUIDED MEDIA: WIRELESS Svitching - CIRCUIT-SWITCHED NETWORKS - DATAGRAM NETWORKS - VIRTUAL CIRCUIT NETWORKS								12
III	Data Link Layer: Error Detection and Correction - Types of Errors -BLOCK CODING - CYCLIC CODES – CHECKSUM								12
IV	Network Layer: Internet Protocol – IPv4 – IPv6 -Delivery, Forwarding, and Routing Transport Layer - PROCESS-TO-PROCESS DELIVERY - USER DATAGRAM PROTOCOL (UDP) – TCP – SCTP - Congestion Control and Quality of Service								12
V	Application Layer: Domain Name System - DOMAIN NAME SPACE - Remote Logging, Electronic Mail, and File Transfer – HTTP - SIMPLE NETWORK MANAGEMENT PROTOCOL (SNMP)								12
TOTAL								60	
CO	Course Outcomes								
CO1	To Understand the basics of Network architecture, OSI & TCP/IP reference models								
CO2	To gain knowledge on Telephone systems and Satellite communications								
CO3	To impart the concept of Elementary data link protocols								
CO4	To analyze the characteristics of Routing and Congestion control algorithms								
CO5	To understand network security & defines protocols such as FTP, HTTP, Telnet, DNS								
Text Books									
1	B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition, 2017.								
Reference Books									
1.	A. S. Tanenbaum, “Computer Networks”, 4th Edition, Prentice Hall of India, 2008.								
2.	F. Halsall, “Data Communications, Computer Networks and Open Systems”, Pearson Education, 2008.								
3.	D. Bertsekas and R. Gallager, “Data Networks”, 2nd Edition, PHI, 2008.								
4	Lamarca, “Communication Networks”, Tata McGraw- Hill, 2002								

CO/PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

ELECTIVE COURSE – VI-B: IOT and its Applications

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD54	4	0	0	V	3	4	50	50	100
Learning Objectives									
LO1	To use of Devices, Gateways and Data Management in IOT.								
LO2	To Design IOT applications in different domain and be able to analyze their performance.								
LO3	To implement basic IOT applications on embedded platform.								
LO4	To gain knowledge on Industry Internet of Things.								
LO5	To learn about the privacy and Security issues in IOT.								
Prerequisites:									
Unit	Contents								No. of Hours
I	IOT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IOT Universe, IOT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IOT Related Standardization.								12
II	M2M to IOT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IOT Value Chains, An emerging industrial structure for IoT, M2M to IOT-An Architectural Overview–Building an architecture, Main design Principles and needed capabilities, Sensors – types, characteristics.								12
III	IOT Architecture –State of the Art – Introduction, State of the art, Architecture. Reference Model- Introduction, Reference Model and architecture, IOT reference Model, IOT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.								12
IV	IOT Applications - Smart Light, smart agriculture, smart vehicle, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IOT for Retailing Industry, IOT For Oil and Gas Industry, Opinions on IOT Application and Value for Industry, Home Management								12
V	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smarty Approach. Data Aggregation for the IoT in Smart Cities, Security								12

TOTAL		60
CO	Course Outcomes	
CO1	Identify and Assess the infrastructure, networks, and communication protocols essential for IoT implementations.	
CO2	Describe the new industrial structures that are emerging due to the proliferation of IoT technologies..	
CO3	Analyze the functional view and the information view of IoT architecture, highlighting their roles and contributions.	
CO4	Evaluate the impact of IoT technologies on the industries sector, focusing on efficiency, safety, and value addition.	
CO5	Identify and describe initial steps necessary to develop a secure IoT platform, including threat modeling and risk assessment.	
Text Books		
1	Vijay Madiseti and Arshdeep Bahga,“Internet of Things:(A Hands-on Approach)”, Universities Press(INDIA) Private Limited 2014, 1stEdition.	
Reference Books		
1.	Michael Miller,“ The Internet of Things: How Smart TVs, Smart Cars, Smart Homes,and Smart Cities Are Changing the World”,kindle version.	
2.	Francisda Costa,“Re thinking the Internet of Things: A Scalable Approach to Connecting Everything”, A press Publications 2013,1st Edition,.	
Reference Books		
1	https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/	
2	https://www.javatpoint.com	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	1	2	2	2	3
CO2	2	1	2	2	2	3
CO3	3	1	3	3	2	3
CO4	2	1	2	2	2	3
CO5	3	1	2	2	2	3
Weightage of course contributed to each PSO	13	5	11	11	10	15

INTERNSHIP / INDUSTRIAL TRAINING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UFIK51	-	0	0	V	3	-	50	50	100
Learning Objectives									
LO1	To learn and develop new skills relevant to the field of study or career interests.								
LO2	To understand different departments, roles, and functions within the organization to broaden knowledge and explore potential career paths.								
LO3	To apply the knowledge gained in academic studies to real-world scenarios.								
LO4	To bridge the gap between classroom learning and professional life. .								
LO5	To gain exposure to different tasks, projects, and challenges relevant to the chosen field.								
Prerequisites:									
TOTAL								45	
CO	Course Outcomes								
CO1	Identify different career paths within the industry and gain insights into potential future roles.								
CO2	Apply theoretical concepts and academic knowledge to real-world situations and challenges encountered during the internship.								
CO3	Analyze problems, generate innovative solutions, and make informed decisions.								
CO4	Evaluate how to manage time effectively and prioritize tasks to meet deadlines and deliver quality work.								
CO5	Create a portfolio of the work, projects, and achievements during the internship.								

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	2	3	2	-
CO2	2	1	3	2	2
CO3	3	3	2	2	1
CO4	2	3	2	3	3
CO5	2	2	3	3	2
Weightage of course contributed to each PSO	11	11	13	12	8

ABILITY ENHANCEMENT COURSE – I: EMPOWERED VOCATIONAL ENGLISH

Subject Code		L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
26UAEC51		2	0	0	V	2	2	50	50	100
Learning Objectives										
LO1		To build self assurance in students by mastering interpersonal, team management, and leadership abilities.								
LO2		To equip aspiring learners with skills that transform them into effective young managers.								
LO3		To sharpen communication proficiency for professional and workplace contexts.								
LO4		To foster strategic thinking and problem solving through advanced writing & presentation techniques.								
LO5		To develop etiquette and corporate ready competencies for modern business environments								
Prerequisites:										
Unit		Contents							No. of Hours	
I		Communication Skills , Current English Usage , Aptitude and Attitude , Team Building and Leadership , Psychological Tests , Effective Resume Writing							6	
II		Précis Writing, Essay Writing, Goal Setting ,Conflict Management, Appearing for an Interview , Myths regarding Group Discussion							6	
III		Debates, Presentation for Small and Large Groups , Prioritization ,Time Management ,Stress Interview , Prerequisites of a Group Discussion							6	
IV		Marketing and Business Presentations, Report Writing , Cross Cultural Communication, Lateral Thinking, Qualities of a Candidate for an Interview, Generating Ideas for Discussion							6	
V		Telephone Etiquette, Email Etiquette, Concepts of Leadership, Insights from Great Leaders, Mock Interview, Mock Group Discussion							6	
		TOTAL							30	
CO		Course Outcomes								
CO1		Students will demonstrate strong interpersonal and leadership skills in team settings.								
CO2		Learners will apply effective communication strategies in current English usage.								
CO3		Graduates will craft professional résumés and master interview ready writing styles.								
CO4		Participants will manage conflicts, set goals, and deliver impactful presentations.								
CO5		Individuals will exhibit polished telephone & email etiquette alongside refined leadership insights								
Text Books										
1	Covey, Stephen R. _The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change_. Simon & Schuster, 1989.									
2	Khera, Shiv. _You Can Win: A Step by Step Tool for Top Achievers_. Macmillan, 1998.									

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	2	2
CO2	2	3	2	2	2	2
CO3	2	3	3	3	2	2
CO4	2	3	2	2	2	2
CO5	3	3	2	2	2	2
Weightage of course contributed to each PSO	12	14	11	11	10	10

Semester-VI

Semester - 6

Course Code	Part	Course Category	Course Name	Hours / Week	Examination				Credits
					Duration in hrs.	Max Marks			
						CIA	ESE	Total	
26UCAD61	III	Core – XIII	Big Data Analytics With Nosql Database	4	3	50	50	100	4
26UCAD62	III	Core – XIV	Operating Systems	4	3	50	50	100	4
26UCADP7	III	Core – XV	BIG DATA ANALYTICS LAB	6	3	50	50	100	4
26UCAD6P	III	Core - XVI	Major Project with Viva Voce	6	3	50	50	100	5
26UEAD61	III	Elective - VII	Pattern Recognition	4	3	50	50	100	3
26UEAD62			Robotics & its Applications						
26UEAD63	III	Elective - VIII	Natural Language Processing	4	3	50	50	100	3
26UEAD64			Simulation & Modeling						
26UEAD65			Graph Theory & its Applications						
26UAEC61	IV	AEC - II	Design Thinking	2	3	50	50	100	2
26U5EA61	V	Common	Extension Activity	-	-	-		100	1
Total				30				800	26
Grand Total				180				4800	144

SEMESTER – VI

CORE COURSE - XIII: BIG DATA WITH NōSQL DATABASES

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCAD61	4	0	0	VI	4	4	50	50	100
Learning Objectives									
LO1	To explain big data concepts.								
LO2	To identify the hadoop eco systems.								
LO3	To experience on various NoSQL Databases.								
LO4	To classify NoSQL categories								
LO5	To implement in ECO systems like Apache Hadoop and Apache Spark.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction: Introduction to big data– sources of big data – real time application of big data – challenges in collecting and validating big data.								12
II	Hadoop: Hadoop – Hadoop ecosystem for processing big data –Hadoop cluster-Hadoop distributed file system – working with files in HDFS – map reduce technique for big processing – Joining data from different sources using map reduce.								12
III	Hive and Pig: Hive and pig – need for high-level tools in big data processing – unstructured and structured data – Not Only SQL (NOSQL) commands – use of Hive as an interface to Hadoop – Use of pig as a programming Tool for big data processing								12
IV	Introduction to NoSQL: An Overview of NoSQL - Defining NoSQL - What NoSQL is and what it is not - List of NoSQL Databases - Characteristics of NoSQL -RDBMS approach – Challenges								12
V	NoSQL Storage Types: NoSQL Storage Types - Column-oriented databases - Document store – Key value store -Multi-storage type databases - Advantages and Drawbacks - Transactional application - Computational application - Web-scale application								12
TOTAL								60	
CO	Course Outcomes								
CO1	Apply big data concepts in various domains								
CO2	Understand hadoop ecosystems								
CO3	Apply the concepts of pig and hive								
CO4	Implement NoSQL Databases								

CO5	Explain various NoSQL storage types
Reference Books	
1	Gaurav Vaish, “Getting Started with NoSQL”, Published by Packt Publishing Ltd., 2013, ISBN 978-1-84969-4-988
2	“Big data analysis for Dummies”, Dummies press, 2011. 4. 56. 7
3	Hadoop Fundamentals, packet Publications, 2012.
4	Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley, 2014
5	Soumendra Mohanty, Madhu Jagadeesh, and Harsha Srivatsa, “Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics”, Published by Apress Media, 2013.
6	Ankam, Venkat, Big Data Analytics. India, Packt Publishing, 2016.
7	Prabhu, C.S.R., Big Data Analytics: Systems, Algorithms, Applications, Springer, 2019.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD62	4	0	0	VI	4	4	50	50	100
Learning Objectives									
LO1	To Demonstrate Understanding of Operating System Structures and Processes								
LO2	To Apply Synchronization and CPU Scheduling Techniques								
LO3	To Analyze and Resolve Deadlocks								
LO4	To Implement Efficient Memory and Storage Management								
LO5	To Integrate File System Interfaces and Protection Mechanisms								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction: Computer System Organization – Computer System Architecture – Operating System Structure - Operating System Operations - Process Management. Operating-System Structures: Operating System Services – User and Operating- System Interface – System Calls – System Programs – Operating System Design and Implementation - System Boot.								12
II	Processes: Process Concept- Process Scheduling –Operations on Processes- Interprocess Communication – Communication in Client – Server Systems. Process Synchronization: Background - The Critical Section Problem-Paterson’s Solution –Mutex Locks - Semaphores – Classic Problems of Synchronization.								12
III	CPU Scheduling: Scheduling Criteria- Scheduling Algorithms-Thread Scheduling- Real Time CPU Scheduling- Algorithm Evaluation. DeadLocks: System Model-Deadlock Characterization- Methods for Handling Deadlocks- Deadlock Prevention-Deadlock Avoidance-Deadlock Detection - Recovery from Deadlock.								12
IV	Memory Management: Swapping - Contiguous Memory Allocation – Segmentation – Paging. Virtual Memory: Background - Demand Paging - Copy on Write- Page Replacement-Allocation of Frames - Thrashing.								12
V	Mass-Storage Structure: Mass-Storage Structure-Disk Structure - Disk Scheduling - Disk Management -RAID Structure. File System Interface: File Concept-Access Methods-Directory and Disk Structure								12

	- File Sharing- Protection. File System Implementation: File System Structure - File System Implementation- Directory Implementation- Allocation Methods - Free Space Management – Recovery.	
TOTAL		60
CO	Course Outcomes	
CO1	Demonstrate Knowledge of Operating System Structures and Processes	
CO2	Apply Synchronization and CPU Scheduling Techniques	
CO3	Analyze and Resolve Deadlocks	
CO4	Implement Efficient Memory and Storage Management	
CO5	Design and Evaluate File System Structures.	
Text Books		
1	Operating System Concepts – Abraham Silberscartz, Peter Baer Galvin, and Greg Gange. Addison Wesley Publishing Company – Ninth Edition.	
Reference Books		
1.	Operating System: Internal and Design Principles – Fifth Edition, William Stalling, PHI Learning Private Limited.	
2.	Understanding Operating Systems: Ida M.Flynn, Ann McIverMcHoes	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

CORE COURSE –XV: BIG DATA ANALYTICS LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCADP7	0	0	6	VI	4	6	50	50	100
Learning Objectives									
LO1	To install Hadoop Distributed File System.								
LO2	To install Hadoop Ecosystems.								
LO3	To implement hive queries.								
LO4	To implement distributed computing frameworks.								
LO5	To manage NoSQL databases and apply machine learning approaches.								
Prerequisites:									
Contents									
1. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System 2. Installation of Hadoop Ecosystem - Pig 3. Installation of Hadoop Ecosystem - Hive 4. Write a hive query to load the data into table from any local file on the system. 5. Write a hive query, which returns the contents of the whole table. 6. Demonstrate the usage of Hive functions. 7. Installation of MongoDB 8. Reading CSV file and loading into MongoDB 9. Reading JSON file and Loading into MongoDB 10. Reading MongoDB and writing into MySQL.									
Total Hours: 90									
CO	Course Outcomes								
CO1	Install Hadoop distributed file system								
CO2	Install Hadoop ecosystems								
CO3	Write hive queries								
CO4	Implement MongoDB for unstructured data								
CO5	Use read and write various files in MongoDB								

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

ELECTIVE COURSE – VII-A: PATTERN RECOGNITION

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD61	4	0	0	VI	3	4	50	50	100
Learning Objectives									
L01	To learn the fundamentals of Pattern Recognition techniques								
L02	To learn the various Statistical Pattern recognition techniques								
L03	To learn the linear discriminate functions and unsupervised learning and clustering								
L04	To learn the various Syntactical Pattern recognition techniques .								
L05	To learn the Neural Pattern recognition techniques								
Prerequisites:									
Unit	Contents							No. of Hours	
I	PATTERN RECOGNITION OVERVIEW: Pattern recognition, Classification and Description-Patterns and feature Extraction with Examples-Training and Learning in PR systems-Pattern recognition Approaches							12	
II	STATISTICAL PATTERN RECOGNITION: Introduction to statistical Pattern Recognition-supervised Learning using Parametric and Non-Parametric Approaches.							12	
III	LINEAR DISCRIMINANT FUNCTIONS AND UNSUPERVISED LEARNING AND CLUSTERING: Introduction-Discrete and binary Classification Problems-Techniques to directly Obtain linear Classifiers - Formulation of Unsupervised Learning Problems-Clustering for unsupervised learning and classification							12	
IV	SYNTACTIC PATTERN RECOGNITION: Overview of Syntactic Pattern Recognition-Syntactic recognition via parsing and other grammars–Graphical Approaches to syntactic pattern recognition-Learning via grammatical inference.							12	
V	NEURAL PATTERN RECOGNITION: Introduction to Neural Networks Feed forward Networks and training by Back Propagation-Content Addressable Memory Approaches and Unsupervised Learning in Neural PR							12	
TOTAL							60		
CO	Course Outcomes								
CO1	Understand the concepts, importance, application and the process of developing Pattern recognition over view								
CO2	To have basic knowledge and understanding about parametric and non-parametric related								

	concepts.
CO3	To understand the framework of frames and bit images to animations
CO4	Speaks about the multimedia projects and stages of requirement in phases of project.
CO5	Understanding the concept of cost involved in multimedia planning, designing, and producing
Text Books	
1	Robert Schalkoff, “Pattern Recognition: Statistical Structural and Neural Approaches”, John wiley& sons.
2	Duda R.O., P.E.Hart& D.G Stork, “ Pattern Classification”, 2nd Edition, J.Wiley.
3	Duda R.O.& Hart P.E., “Pattern Classification and Scene Analysis”, J.wiley.
Reference Books	
1.	Earl Gose, Richard johnsonbaugh, Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India, Pvt Ltd, New Delhi.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

ELECTIVE COURSE- VII-B: ROBOTICS & ITS APPLICATIONS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD62	4	0	0	VI	3	4	50	50	100
Learning Objectives									
LO1	To Understand the Fundamentals of Robotics								
LO2	To Analyze Actuators and Sensors in Robotic Systems.								
LO3	To Apply Kinematic Principles to Robots and Mobile Systems.								
LO4	To Evaluate Localization, Path Planning, and Vision Systems.								
LO5	To Explore Real-World Applications of Robotics								
Prerequisites:									
Unit	Contents							No. of Hours	
I	Introduction : Brief history, components of robotics, classification, workspace, work envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.							12	
II	Actuators and sensors: Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions purpose of sensor-internal and external sensor common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot							12	
III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.							12	
IV	Path Planning :Introduction, path planning overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement-image data compression-visual inspection-software considerations							12	
V	Application : Ariel robots-collision avoidance robots for agriculture-mining-exploration underwater-civilian- and military applications nuclear applications-space applications Industrial robots-artificial intelligence in robots-application							12	

	of robots in material handling-continuous arc welding-spot welding spray painting-assembly operation-cleaning etc.	
TOTAL		60
CO	Course Outcomes	
CO1	Describe the different physical forms of robot architectures	
CO2	Kinematically model simple manipulator and mobile robots	
CO3	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	
CO4	Analyze the characteristics of routing and congestion control algorithms.	
CO5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty..	
Text Books		
1	RicharedD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001	
2	SaeedB.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011	
Reference Books		
1.	Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008	
2.	Robotics technology and flexible automation by S.R.Deb, THH 2009	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

ELECTIVE COURSE – VIII-A: NATURAL LANGUAGE PROCESSING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD63	4	0	0	VI	3	4	50	50	100
Learning Objectives									
LO1	To understand approaches to syntax and semantics in NLP.								
LO2	To learn natural language processing and apply basic algorithms in this field.								
LO3	To understand approaches to discourse, generation, dialogue and summarization within NLP.								
LO4	To understand the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics, etc.								
LO5	To understand current methods for statistical approaches to machine translation.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction: Natural Language Processing tasks in syntax, semantics, and pragmatics – Issue- Applications – The role of machine learning – Probability Basics—N-gram Language Models–Evaluating language models.								12
II	Word level and Syntactic Analysis: Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection -Words and Word classes Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency.								12
III	Semantic analysis and Discourse Processing: Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution-Discourse Coherence and Structure.								12
IV	Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages - Machine Translation Approaches-Translation involving Indian Languages.								12
V	Information retrieval and lexical resources: Information Retrieval: Design features of Information Retrieval Systems Classical, Non-classical, – valuation Lexical Resources: World Net- Stemmers-POST agger.								12
TOTAL								60	
CO	Course Outcomes								
CO1	Describe the issues, challenges, and applications of NLP in real world systems								
CO2	Analyze and perform Part-of-Speech (POS) tagging for identifying grammatical categories of words in sentences.								
CO3	Identify and analyze different types of semantic ambiguity in natural language sentences.								

CO4	Explain the architecture of Natural Language Generation (NLG) systems and their components.
CO5	Explain the design features and components of Information Retrieval (IR) systems.
Text Books	
1	Daniel Jurafsky, James H.Martin, “Speech & language processing”, Pearson publications.
	Allen, James. Natural language understanding. Pearson,1995.
Reference Books	
1.	Pierre M.Nugues,“ An Introduction to Language Processing with Perl and Prolog”, Springer
Reference Books	
1	https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP
2	https://en.wikipedia.org/wiki/Natural_language_processing

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

ELECTIVE COURSE – VIII-B: SIMULATION & MODELING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD64	4	0	0	VI	3	4	50	50	100
Learning Objectives									
LO1	To provide the knowledge on Data Mining and Warehousing concepts and techniques								
LO2	To study the basic concepts of Data Mining, Architecture and Comparison.								
LO3	To study a set of Mining Association Rules, Data Warehouses.								
LO4	To study about Classification and Prediction, Classifier Accuracy								
LO5	To study the basic concepts of cluster analysis, Cluster Methods								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction To Modeling & Simulation — Complexity Types – Model Types – Simulation Types – M&S Terms and Definitions Input Data Analysis – Simulation Input Modeling – Input Data Collection - Data Collection Problems - – Input Modeling Strategy - Histograms –Probability Distributions - Selecting a Probability Distribution.								12
II	Random Variety Generation – Random Numbers – Random Number Generators – General principles – Inverse Transform Method –Acceptance Rejection Method –Composition Method –Relocate and Rescale Method - Specific distributions-Output Data Analysis – Introduction -Types of Simulation With Respect to Output Analysis - Stochastic Process and Sample Path - Sampling and Systematic Errors - Mean, Standard Deviation and Confidence Interval - Analysis of Finite Horizon Simulations - Single Run - Independent Replications - Sequential Estimation – Analysis of Steady-State Simulations - Removal of Initialization Bias (Warm-up Interval) - Replication-Deletion Approach - Batch-Means Method								12
III	Comparing Systems via Simulation – Introduction – Comparison Problems - Comparing Two Systems - Screening Problems - Selecting the Best - Comparison with a Standard - Comparison with a Fixed Performance Discrete Event Simulations – Introduction - Next-Event Time Advance - Arithmetic and Logical Relationships - Discrete-Event Modeling Approaches – Event Scheduling Approach – Process Interaction Approach								12
IV	Entity Modeling – Entity Body Modeling – Entity Body Visualization – Entity Body Animation – Entity Interaction Modeling – Building Modeling Distributed Simulation – High Level Architecture (HLA) – Federation								12

	Development and Execution Process (FEDEP) – SISO RPR FOM Behavior Modeling – General AI Algorithms - Decision Trees - Neural Networks - Finite State Machines - Logic Programming - Production Systems – Path Planning - Off-Line Path Planning - Incremental Path Planning - Real-Time Path Planning – Script Programming -Script Parsing - Script Execution	
v	Optimization Algorithms – Genetic Algorithms – Simulated Annealing Examples: Sensor Systems Modeling – Human Eye Modeling – Optical Sensor Modeling – Radar Modeling.	12
TOTAL		60
CO	Course Outcomes	
CO1	Introduction To Modeling & Simulation, Input Data Analysis and Modeling.	
CO2	Random Variate and Number Generation. Analysis of Simulations and methods.	
CO3	Comparing Systems via Simulation.	
CO4	Entity Body Modeling, Visualization, Animation.	
CO5	Algorithms and Sensor Modeling.	
Text Books		
1	Jy Banks, “Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practice”, John Wiley & Sons, Inc., 1998.	
2	George S. Fishman, “Discrete-Event Simulation: Modeling, Programming and Analysis”, Springer-Verlag New York, Inc., 2001.	
Reference Books		
1.	Andrew F. Seila, Vlatko Ceric, Pandu Tadikamalla, “Applied Simulation Modeling”, Thomson Learning Inc., 2003.	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

ELECTIVE COURSE – VIII-C: GRAPH THEORY & ITS APPLICATIONS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEAD65	4	0	0	VI	3	4	50	50	100
Learning Objectives									
LO1	Definition of Graph, sub graph their representations, degree and algebraic operations.								
LO2	Connected graphs, weighted graphs and shortest paths.								
LO3	Trees: Characterizations, spanning tree, minimum spanning trees								
LO4	Eulerian and Hamiltonian graphs: Characterization, Necessary and sufficient conditions								
LO5	Special classes of graphs: Bipartite graphs, line graphs, chordal graphs.								
Prerequisites:									
Unit	Contents								No. of Hours
I	INTRODUCTION: Graph-mathematical definition- Introduction – sub graphs –Walks, paths, Circuits connectedness- Components- Euler Graphs- Hamiltonian paths and circuits Trees- properties of Trees- Distance and centers in Tree- Rooted and Binary Trees Directed Graph – undirected graphs								12
II	CONNECTIVITY AND PLANARITY: Introduction to circuits - cut set- properties of cut set- All cut sets –connectivity and separability – Network Flows - 1-Isomorphism - 2 Isomorphism- Combinatorial and Geometric graphs- Planar Graphs – Different representation of planar graph.								12
III	COLORING AND DIRECTED GRAPH: Basics of Colouring & Chromatic number – Chromatic partitioning – Graph Colouring – four colour Problem Chromatic polynomial - Matching – Covering - Directed graphs - Types of Directed Graphs – Diagraphs and binary relations – Directed paths- Euler Graph.								12
IV	GRAPH: REPRESENTATION & TRAVERSAL: Matrix representation of graphs, Sub graphs& Quotient Graphs, Transitive Closure digraph, Euler’s Path & Circuit (only definitions and examples), spanning Trees of Connected Relations, Prim’s Algorithm to construct Spanning Trees, Weighted Graphs, Minimal Spanning Trees by Kruskal’s Algorithm.								12
V	APPLICATIONS OF GRAPH: Traveling Sales Person Problem with Directed and Un directed Graph, - Graph with n vertices and k colours- Shortest path from one to many Cities with directed graph- Shortest Paths with Un directed Graphs-Connected Components.								12
TOTAL								60	
CO	Course Outcomes								

CO1	To Introduce the fundamental concepts in graph theory Graphs, subgraphs, walks, Euler graphs, Hamiltonian Paths Tree Properties , Hamiltonian paths and circuits
CO2	Understanding the concepts of Circuits, Cut set and its Properties, Network Flows, Isomorphism and Combinatorial and Planar Graphs.
CO3	Applying the concept of Colouring with Chromatic Number, Directed Graphs, Matching, Covering Pattern and Euler Graphs
CO4	Analysing the Various Concepts of Representation of Graphs, Euler Paths Circuit, Kruskals and Prims Algorithms, Connected Components.
CO5	Implementation of an application using All Types of Graphs and evaluate the Applications with travelling sales person Problem, K colour Problem with n vertices in a Graph and Shortest Path finding Problem using Directed and Undirected Graphs.
Text Books	
1	Narsingh Deo , “ Graph Theory with Application to Engineering and Computer Science” Prentice Hall of India 2010(Reprint)
Reference Books	
1.	Discrete Maths for Computer Scientists & Mathematicians by Mott, Kandel, Baker
2.	Clark J and Holton DA “ First look at Graph Theory” Allied Publishers 1995
3	D. Bertsekas and R. Gallager, “Data Networks”, 2nd Edition, PHI, 2008
4	Lamarca, “Communication Networks”, Tata McGraw- Hill, 2002

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

CORE -XVI– MAJOR PROJECT WITH VIVA VOCE

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCAD6P	0	0	6	VI	5	6	50	50	100
Learning Objectives									
LO1	To understand software development methodologies and database design principles.								
LO2	To develop real-time applications using programming languages and database systems.								
LO3	To design user-friendly interfaces and integrate frontend with backend technologies.								
LO4	To implement testing, debugging, and deployment techniques for software projects.								
LO5	To develop project management and documentation skills for real-world applications								
Prerequisites:									
TOTAL								90	
CO	Course Outcomes								
CO1	Express their views with ppt illustrations and critical support								
CO2	Organize the views and solutions as modules of the project								
CO3	Analyze the various possible solutions of the chosen problem domain								
CO4	Evaluate the adopted solution with various testing								
CO5	Compile the development of solution as Documentation								

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	2	3	2	2
CO2	3	3	3	2	2
CO3	3	3	2	3	2
CO4	2	3	2	3	3
CO5	2	2	3	3	2
Weightage of course contributed to each PSO	12	14	13	13	11

EXTENSION ACTIVITY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26U5EA61	0	0	0	VI	1	1	-	100	100
Learning Objectives									
L01	To promote community involvement, encourage civic participation, and foster a sense of ownership and responsibility.								
L02	To involve the learners in organizing campaigns, seminars, or public events to educate the public, promote understanding, and advocate for positive change.								
L03	To create platforms for knowledge sharing, partnership development, and collective action.								
L04	To encourage environmental conservation, promote responsible resource management, or foster sustainable livelihoods								
L05	To raise awareness about social issues, advocate for marginalized groups, or implement programs that promote inclusivity and equal opportunities.								
Prerequisites:									
TOTAL									
CO	Course Outcomes								
CO1	Recognize the importance of community service through training and education								
CO2	Interpret ecological concerns, consumer rights, gender issues & legal protection								
CO3	Develop team spirit, verbal/nonverbal communication and organizational ethics by participating in community service								
CO4	Examine the necessity of professional skills & community-oriented services for a holistic development								
CO5	Create awareness on human rights, legal rights, First Aid, Physical fitness and wellbeing								

ABILITY ENHANCEMENT COURSE – II: DESIGN THINKING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UAEC61	2	0	0	VI	2	2	50	50	100

Learning Objectives	
LO1	To recall and describe the key concepts, stages, and principles of Design Thinking.
LO2	To explain the importance of empathy, ideation, and prototyping in solving user-entered problems.
LO3	To apply Design Thinking methods such as brainstorming, empathy mapping, and SCAMPER to real-world problems.
LO4	To analyze user needs and problem statements using observation and structured frameworks.
LO5	To design innovative solutions and develop prototypes based on insights gained through the Design Thinking process.

Prerequisites:

Unit	Contents	No. of Hours
I	Introduction to Design Thinking Introduction to Design Thinking, Essential Design Thinking Skills, Core Principles of Design Thinking, Foundations of Design Thinking, Building an Effective Design Thinking Team, Discussion of Problems from IT sector.	6
II	Design Thinking Phases Stages of Design Thinking, Role of observation in understanding product and process challenges, Preparation of AEIOU and other canvases with defined problem statement, Exploring Design Thinking innovations, Understanding the Role of Design Thinking in Product and Process Innovation, Double Diamond model and its applications.	6
III	Design Thinking Techniques Understanding, listening and Empathizing Techniques, Exploring observation methods, Utilizing a structured, open-ended approach for effective communication, Ideation Labs, Brainstorming techniques for idea generation, Applying innovation to foster creativity, Application of SCAMPER technique to support Problem Statement	6
IV	Prototyping Methods Methods and Tools for Design Thinking Practice; Empathize: Ask five why questions, Empathy map, storytelling, critical items diagram, mind map, journey map; Ideate: Brainstorming, 2x2 matrix, Need-Approach-Benefit-	6

	Competition (NABC) Methods; Prototype: Exploration map, Minimum Viable Product (MVP), Feasibility Testing, Viability Testing, A/B Testing, Sustainability Verification, Collect Feedback, Iterate and Improve, PDC canvas versioning	
V	Case Studies Quick-Commerce Applications – Food and Grocery Delivery (eg. Swiggy, Instamart), Uber, OLA, Rapido, E-Commerce Applications – Online Shopping (eg. Amazon), Online Publishing (eg. Canva), Online Ticket Booking (eg. BookMyShow), Fintech apps (eg. Google Pay, Razorpay etc.)	6
TOTAL		30
CO	Course Outcomes	
CO1	Understand the fundamental principles and importance of Design Thinking in fostering innovation, ethics and its relevance.	
CO2	Apply systematic problem identification, problem framing, articulation, and problem-solving approaches in the context of Design Thinking	
CO3	Analyze and evaluate different tools and methodologies used in Design Thinking, such as observation, ethnographic research and mind mapping to gain insights into users’ needs	
CO4	Develop and refine product concepts by preparing product development canvases (PDC) that consider product experience, functions, features, and sustainable development of the components	
CO5	Create a final working prototype for projects with limitations, documenting the functionality and features, viability, sustainability, scalability, cost and resource utilization for the product	
Open Source and Websites		
1	Google Workspace: Docs, Sheets and Slides	
2	Google Jamboard	
3	Mind-mapping tools: Wisemapping, Freeplane, Semantik	
Reference Books		
1.	Soni, Pavan. Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving. Penguin Random House India Private Limited, 2020	
2.	Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins e-books (2009)	
3	Liedtka, Jeanne, Randy Salzman, and Daisy Azer. Design thinking for the greater good: Innovation in the social sector. Columbia University Press, 2019	

Suggested MOOC Courses

1	B. K. Chakravarthy, Design Technology and Innovation, SWAYAM NPTEL (Online)
2	B. K. Chakravarthy, Innovation by Design, SWAYAM NPTEL (Online)
3	Nina Sabnani, Understanding Design, SWAYAM NPTEL (Online)
Note: Activities are to be performed in a team size of 3-4 students. Report is to be prepared based on these activities	
1	Brainstorm and explore various problems in IT field. Select an appropriate problem, draft a Problem Statement and get it approved for performing further activities.
2	Design AEIOU canvas
3	Design Empathy map

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	2	3
CO2	3	2	2	2	3	2
CO3	3	3	3	3	2	2
CO4	3	2	2	2	2	3
CO5	3	3	2	2	3	2
Weightage of course contributed to each PSO	15	12	11	11	12	12