



Date :

Sr. No.	Category	Course Code	Course Name	Teaching Scheme					Evaluation Scheme			
				L	T	P	Hrs./ Week	Cr	Components	Max	Min for Passing	
1	CC	25BCA1101	Mathematics Foundations to Computer Science -I	3	0	0	3	3	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
2	SEC	25BCA1102	Problem Solving Techniques	3	0	0	3	3	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
3	CC	25BCA1103	Computer Architecture	3	0	0	3	3	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
4	AEC	25BCA1104	General English-I	1	1	0	2	2	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
5	MDE	25BCA1105	Indian Knowledge System-Indian Culture and Civilization	2	0	0	2	2	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
6	VEC	25BCA1106	Environmental Science and Sustainability	2	0	0	2	2	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
7	AEC	25BCA1107	Foreign Language	1	1	0	2	AU	CA1	25		20
									MSE	--		
									CA2	25		
									ESE	--	--	
8	SEC	25BCA1102L	Problem Solving Techniques Laboratory	0	0	4	4	2	CA1	25		40
									CA2	25		
									POE	50	20	
9	CC	25BCA1103L	Computer Architecture Laboratory	0	0	4	4	2	CA1	25		40
									CA2	25		
									POE	50	20	
			Total	15	2	8	25	19		850		
Total Contact Hours-25 Total Credits-19												



Ref No.:

Date :

First Year BCA

SEMESTER II

Sr. No	Category	Course Code	Course Name	Teaching Scheme					Evaluation Scheme						
				L	T	P	Hrs./ Week	Cr	Components	Max	Min for Passing				
1	CC	25BCA1201	Mathematics Foundations to Computer Science-II	3	0	0	3	3	CA1	15		40			
									MSE	20					
									CA2	15					
									ESE	50	20				
2	CC	25BCA1202	Data Structures	3	0	0	3	3	CA1	15		40			
									MSE	20					
									CA2	15					
									ESE	50	20				
3	CC	25BCA1203	Operating Systems	3	0	0	3	3	CA1	15		40			
									MSE	20					
									CA2	15					
									ESE	50	20				
4	SEC	25BCA1204	Object Oriented Programming using Java	3	0	0	3	3	CA1	15		40			
									MSE	20					
									CA2	15					
									ESE	50	20				
5	SEC	25BCA1205	Web Technologies	2	0	0	2	2	CA1	15		40			
									MSE	20					
									CA2	15					
									ESE	50	20				
6	VAC	25BCA1206	Indian Constitution	2	0	0	2	2	CA1	15		40			
									MSE	20					
									CA2	15					
									ESE	50	20				
7	AEC	25BCA1207	Foreign Language	1	1	0	2	AU	CA1	25		20			
									MSE	--					
									CA2	25					
									ESE	--	--				
8	CC	25BCA1202L	Data Structure Laboratory	0	0	2	2	1	CA1	25		20			
									CA2	25					
									POE	--	--				
9	SEC	25BCA1204L	Object Oriented Programming using Java Laboratory	0	0	4	4	2	CA1	25		40			
									CA2	25					
									POE	50	20				
10	SEC	25BCA1205L	Web Technologies Laboratory	0	0	4	4	2	CA1	25		40			
									CA2	25					
									POE	50	20				
			Total	17	1	10	28	21		850					
Total Contact Hours-28												Total Credits-21			



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- * Phone : 02162 - 261122 , 200100
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- * Website :-www.agce.edu.in

- * Institute Code : Engg. DTE EN-6545
- * BCA 6545, MCA 6545, B.Voc. 6545

Date :

SEMESTER-III

Sr. No.	Category	Course Code	Course Name	Teaching Scheme					Evaluation Scheme					
				L	T	P	Hrs ./ Week	Cr	Components	Max	Min for Passing			
1	CC	25BCA2301	Probability and Statistics	3	0	0	3	3	CA1	15		40		
									MSE	20				
									CA2	15				
									ESE	50	20			
2	CC	25BCA2302	Data Base Management System	3	0	0	3	3	CA1	15		40		
									MSE	20				
									CA2	15				
									ESE	50	20			
3	SEC	25BCA2303	Python Programming	2	0	0	2	2	CA1	15		40		
									MSE	20				
									CA2	15				
									ESE	50	20			
4	CC	25BCA2304	Software Engineering	3	0	0	3	3	CA1	15		40		
									MSE	20				
									CA2	15				
									ESE	50	20			
5	DSE	25BCA2305	Professional Elective– I	2	0	0	2	2	CA1	15		40		
									MSE	20				
									CA2	15				
									ESE	50	20			
6	VAC	25BCA2306	Yoga/Sports/NCC /NSS/Disaster Management	0	0	2	2	1	CA1	25		20		
									CA2	25				
									OE	--				
7	CC	25BCA2302L	DataBase Management System Laboratory	0	0	4	4	2	CA1	25		40		
									CA2	25				
									POE	50	20			
8	SEC	25BCA2303L	Python Programming Laboratory	0	0	4	4	2	CA1	25		40		
									CA2	25				
									POE	50	20			
9	CC	25BCA2305L	Professional Elective–I Laboratory	0	0	4	4	2	CA1	25		40		
									CA2	25				
									POE	50	20			
			Total	13	0	14	27	20		850				
Total Contact Hours–27													Total Credits–20	



SAMARTH EDUCATIONAL TRUST
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• BCA 6545, MCA 6545, B.Voc 6545

Ref No.:

Date :

Professional Elective-I:

SR.NO.	COURSECODE	COURSENAME
1	25BCA2304A	Basics of Data Analytics using Spreadsheet
2	25BCA2304B	Feature Engineering
3	25BCA2304C	Web Programming-I

Ref No.:

Date :

Second Year BCA

SEMESTER-IV

Sr. No.	Category	Course Code	Course Name	Teaching Scheme					Evaluation Scheme			
				L	T	P	Hrs./ Week	Cr	Components		Max	Min for Passing
1	CC	25BCA2401	Entrepreneurship and Startup Ecosystem	1	1	0	2	2	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
2	CC	25BCA2402	Computer Networks	3	0	0	3	3	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
3	CC	25BCA2403	Design and Analysis of Algorithm	3	0	0	3	3	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
4	CC	25BCA2404	Artificial Intelligence	3	0	0	3	3	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
5	DSC	25BCA2405	Professional Elective–II	3	0	0	3	3	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
6	SEC	25BCA2406	Design Thinking and Innovation	1	1	0	2	2	CA1	25		20
									MSE	--		
									CA2	25		
									ESE	--		
7	CC	25BCA2402L	Computer Networks Laboratory	0	0	4	4	2	CA1	25		40
									CA2	25		
									POE	50	20	
8	DSC	25BCA2405L	Professional Elective–II Laboratory	0	0	4	4	2	CA1	25		40
									CA2	25		
									POE	50	20	
9	CC	25BCA2404L	Artificial Intelligence Laboratory	0	0	4	4	2	CA1	25		40
									CA2	25		
									POE	50	20	
			Total	14	2	12	28	22		850		
Total Contact Hours–28					Total Credits–22							



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Ref No.:

Date :

Professional Elective–II:

SR.NO.	COURSECODE	COURSENAME
1	25BCA2405A	Data Visualization
2	25BCA2405B	Introduction to ML
3	25BCA2405C	Web Programming–II

Ref No.:

Date :

Third Year BCA

SEMESTER- V

Sr. No.	Category	Course Code	Course Name	Teaching Scheme					Evaluation Scheme			
				L	T	P	Hrs./Week	Cr	Components	Max	Min for Passing	
1	DSC	25BCA3501	Professional Elective–III	3	0	0	3	3	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
2	DSC	25BCA3502	Professional Elective–IV	3	0	0	3	3	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
3	DSC	25BCA3503	Professional Elective–V	3	0	0	3	3	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
4	SEC	25BCA3504	Quantitative Techniques	0	2	0	2	2	CA1	15		40
									MSE	20		
									CA2	15		
									MSE	50	20	
5	SEC	25BCA3505	Capstone Project	0	0	2	2	2	CA1	25		20
									CA2	25		
									OE	--		
6	DSC	25BCA3501L	Professional Elective–III Laboratory	0	0	4	4	2	CA1	25		40
									CA2	25		
									POE	50		
7	DSC	25BCA3501L	Professional Elective–IV Laboratory	0	0	4	4	2	CA1	25		40
									CA2	25		
									POE	50		
8	DSC	25BCA3501L	Professional Elective–V Laboratory	0	0	4	4	2	CA1	25		40
									CA2	25		
									POE	50		
9	SEC	25BCA3506	Internship	0	0	2	2	2	CA1	25		20
									CA2	25		
									OE	--		
			Total	9	2	16	27	21		800		
Total Contact Hours–27				Total Credits–21								



Ref No.:

Date :

Professional Elective–III

SR.NO.	COURSE CODE	COURSE NAME
1	25BCA3501A	Introduction to Data Science
2	25BCA3501B	Neural Network
3	25BCA3501C	Web Programming –III(using Java & Spring boot)

Professional Elective–IV

SR.NO.	COURSE CODE	COURSE NAME
1	25BCA3502A	Time Series Analysis
2	25BCA3502B	Digital Image Processing
3	25BCA3502C	Web programming-IV (using Django & Flask)

Professional Elective–V

SR.NO.	COURSE CODE	COURSE NAME
1	25BCA3503A	Machine Learning
2	25BCA3503B	Natural Language Processing
3	25BCA3502C	Web Programming –V(using React JS)

Ref No.:

Date :

Third Year BCA

SEMESTER-VI

Sr. No.	Category	Course Code	Course Name	Teaching Scheme					Evaluation Scheme			
				L	T	P	Hrs ./ Week	Cr	Components		Max	Min for Passing
1	CC	25BCA3601	Generative AI	2	0	0	2	2	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
2	DSC	25BCA3602	Professional Elective–VI	3	0	0	3	3	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
3	DSC	25BCA3603	Professional Elective–VII	3	0	0	3	3	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
4	AEC	25BCA3604	Soft Skills	2	1	0	3	3	CA1	15		40
									MSE	20		
									CA2	15		
									ESE	50	20	
5	SEC	25BCA3605	Major Project [Initiated in 5th Semester]	0	0	4	4	2	CA1	25		40
									CA2	25		
									OE	50	20	
6	CC	25BCA3601L	Generative AI Laboratory	0	0	2	4	2	CA1	25		40
									CA2	25		
									POE	50	20	
7	CC	25BCA3602L	Professional Elective–VI Laboratory	0	0	2	4	2	CA1	25		40
									CA2	25		
									POE	50	20	
8	DSC	25BCA3603L	Professional Elective–VII Laboratory	0	0	2	4	2	CA1	25		40
									CA2	25		
									POE	50	20	
			Total	11	1	10	27	19		800		
Total Contact Hours–27 Total Credits–19												



Ref No.:

Date :

Professional Electives Course VI:

Sr.No.	Course Code	Course Name
1	25BCA3602A	Big Data Analysis
2	25BCA3602B	Deep Learning For Computer Vision
3	25BCA3602C	Web Programming VI(using UI/UX)

Professional Electives Course VII:

Sr.No.	Course Code	Course Name
1	25BCA3603A	Exploratory Data Analysis
2	25BCA3603B	Predictive Analysis
	25BCA3603C	Web Programming VII(using Git & Git Hub)

Title of the Course: Probability and Statistics	L	T	P	Credit
Course Code: 25BCA2301	3	-	-	3

Course Prerequisite:

Students should have knowledge of basic calculation and logical reasoning.

Course Description:

This course introduces the fundamental concepts of probability and statistics, which are essential tools for data analysis and decision-making.

Course Objectives:

By the end of this course, the students will be able to:

- 1.To understand the basic concepts of probability and its applications
- 2.To learn different types of probability distributions and random variables
- 3.To develop skills in data collection, classification, and presentation
- 4.To apply statistical measures such as mean, median, mode, and standard deviation
- 5.To analyse data using various statistical techniques
- 6.To interpret results and make informed decisions based on data analysis

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understanding of Data and Basic Statistics
CO2	Application of Descriptive Statistics
CO3	Analysis of Relationship Between Variables
CO4	Understanding of Probability and Random Variables
CO5	Statistical Distributions and Inference Techniques

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	2	-	2	-	-	-	2	-	3
CO2	3	3	2	2	-	2	-	-	-	3	-	3
CO3	3	3	3	3	2	2	-	-	-	3	2	3
CO4	3	2	3	3	2	2	-	-	-	2	2	3
CO5	3	3	3	3	2	2	-	-	-	3	2	3

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Basics of Statistics & Data Representation Basic concepts of Statistics, Qualitative and quantitative data, Classification of data, Construction of frequency distribution, Diagrammatic representation of data (bar diagram, histogram, pie chart, ogive etc.).	08
2	Measures of Central Tendency & Dispersion Arithmetic Mean, Median, Mode (properties and calculation), Range, Mean Deviation, Quartile Deviation Variance and Standard Deviation	08
3	Correlation & Regression Definition of correlation, Scatter diagram, Types of correlation, Karl Pearson's correlation coefficient Spearman's rank correlation coefficient Linear regression using least squares method and interpretation.	08
4	Probability & Random Variables Experiment and sample space, Events and operations on events, Probability of an event, Basic probability rules and applications Conditional probability, Discrete and continuous random variables, PMF, PDF, Expectation and variance	08
5	Probability Distributions, Sampling & Inference Binomial, Poisson and Normal distributions, Population and sample, parameter and statistic, Sampling distribution of mean and proportion, Estimation and hypothesis testing (concept only), Z-test and T-test for single population Chi-square test for independence and goodness of fit	08

Text Books			
Sr. No.	Title	Author	Publisher
1	The Practice of Business Statistics	Manish Sharma, Amit Gupta	Khanna Book Publishing Company, 2010 (AICTE Recommended Textbook)
2	Statistical Methods Das N. G Combined Edition, Tata McGraw Hill, 2010	Statistical Methods Das N. G Combined Edition, Tata McGraw Hill, 2010	Statistical Methods Das N. G Combined Edition, Tata McGraw Hill, 2010
3	Introduction to Probability and Statistics for Engineers and Scientists	Ross Sheldon M	6th Edition, Elsevier 2021

Reference Books			
Sr. No.	Title	Author	Publisher
1	Statistics: Concepts and Applications	Pal Nabendu and Sarkar Sahadeb	Second Edition, PHI, 2013
2	Applied Statistics and Probability for Engineers	Montgomery Douglas and Ranger George C	Wiley, 2016.
3	Engineering Mathematics	Reena Garg	Khanna Publishing House, 2024

Title of the Course: Database Management System	L	T	P	Credit
Course Code: 25BCA2302	3	-	-	3

Course Prerequisite:

Basic knowledge of Set Theory

Course Description:

This course provides a comprehensive understanding of database systems, focusing on the design, implementation, and management of data in modern applications. It introduces fundamental concepts such as data, databases, and database management systems, along with their applications, advantages and limitations.

Course Objectives:

By the end of this course, the students will be able to:

1. Introduce fundamental wave optics and its industrial applications.
2. Develop a basic understanding of laser and optical fibres technologies.
3. Provide foundational knowledge of quantum mechanics for nanoscale systems.
4. Understand crystal structure and X-ray applications in materials Science.
5. Classify solids on the basis of Band theory and to calculate carrier concentrations

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understanding Core Concepts of DBMS
CO2	Proficiency in Database Design and SQL
CO3	Application of Advanced Database Techniques
CO4	Apply Relational Algebra and SQL query to retrieve and manipulate data effectively.
CO5	Analyze modern database systems including indexing, NoSQL databases, security mechanisms, big data technologies, data warehousing, OLAP, and data mining concepts.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	1	-	-	-	-	-	-	1
CO2	3	3	2	-	2	-	-	-	-	1	-	1
CO3	3	3	2	3	3	-	-	-	1	1	-	1
CO4	3	3	1	2	3	-	-	-	-	1	-	1
CO5	3	3	2	3	3	2	2	1	1	1	1	2

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Introduction to Databases & Data Models Definition of Data, Database, DBMS, Database applications Advantages and disadvantages of DBMS, Roles of users and database administrators, Data models: Hierarchical, Network, Relational, Object-Oriented Importance of data models	08
2	Database Design & ER Model Keys Primary, Candidate, Super, Foreign, Composite, Alternate, Unique, Surrogate keys Constraints: Primary key, Foreign key, Unique, NOT NULL, CHECK, Entity-Relationship (ER) model Entities, attributes, relationships, ER diagrams, Weak entity sets and extended ER features, Relational model and schema	08
3	SQL Operations Relational algebra: selection, projection, set operations, joins, division Tuple and domain relational calculus, SQL basics: DDL, DML Aggregate functions and predicates Clauses: GROUP BY, HAVING, ORDER BY, LIMIT/TOP, Joins: inner, natural, left, right, full outer, equi join	08
4	Advanced SQL, Normalization & Transaction Management Advanced SQL: views, cursors, triggers, stored procedures, functions, packages, dynamic SQL, Functional dependencies and Armstrong's axioms, Normal forms: 1NF, 2NF, 3NF, BCNF, denormalization Transactions: ACID properties, Concurrency control, 2PL, serializability, recover ability, Deadlocks and crash recovery	08
5	Storage, Indexing, NoSQL, Security & Advanced Topics File organization and indexing, Index data structures and performance tuning, NoSQL databases: document, key-value, column family, graph CAP theorem, BASE vs ACID, MongoDB and CRUD operations Hadoop, Cassandra overview, Database security and access control Data warehousing, OLAP, data mining	08

Text Books			
Sr. No.	Title	Author	Publisher
1	Database Management Systems (3rd Edition)	Raghu Ramakrishnan, Johannes Gehrke	McGraw-Hill, 2018
2	Oracle PL/SQL by Example (5th Edition)	Benjamin Rosenzweig, Elena Rakhimov	Statistical Methods Das N. G Combined Edition, Tata McGraw Hill, 2010
3	Database Management Systems	R.P. Mahapatra, Govind Verma	Khanna Publishing House, 2025

Reference Books			
Sr. No.	Title	Author	Publisher
1	Database System Concepts (7th Edition)	Brad Dayley	McGraw-Hill, 2019
2	NoSQL with MongoDB in 24 Hours (1st Edition)	Montgomery Douglas and Ranger George C	Sams Publishing, 2024.
3	Engineering Mathematics	Reena Garg	Khanna Publishing House, 2024
4	Database System Concepts (7th Edition)	Korth, Silberschatz, Sudarshan	McGraw-Hill, 2019
5	Database Management Systems	R.P. Mahapatra, Govind Verma	Khanna Publishing House, 2025

Title of the Course: Python Programing	L	T	P	Credit
Course Code: 25BCA2303	2	-	-	2

Course Prerequisite:

Understanding of Problem-solving techniques using a programming language and basic data structures

Course Description:

This course offers a comprehensive introduction to Python programming, covering fundamental concepts to intermediate-level applications. It is designed to build a strong foundation in programming logic, problem-solving, and software development using Python..

Course Objectives:

By the end of this course, the students will be able to:

1. To understand the history, features, and application areas of Python and learn the basic structure of Python programs.
2. To develop programming skills using identifiers, keywords, operators, data types, expressions, and input/output statements
3. To gain proficiency in string handling, including string creation, manipulation, slicing, and formatting techniques.
4. To apply control flow mechanisms such as conditional statements, loops, and nested structures for problem-solving
5. To implement modular programming using functions, including user-defined functions, lambda functions, default parameters, and command-line arguments.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Develop modular Python programs.
CO2	Apply suitable Python programming constructs, built-in data structures using Python libraries to solve a problem.
CO3	Understand basic Data visualization and File handling in Python
CO4	Apply object-oriented programming concepts and debugging techniques to develop efficient and real-world applications.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	2	-	-	-	1	1	-	2
CO2	2	3	2	1	3	-	-	-	1	1	-	2
CO3	1	2	2	3	3	-	1	-	1	2	-	2
CO4	2	2	3	2	2	1	1	2	3	2	1	3

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Introduction to Python & Control Flow History and application areas of Python, Structure of Python program Identifiers, keywords, Operators and precedence, Data types and type conversion, Statements and expressions, Input and output statements Strings: creation, storage, operations, String functions, slicing, joining, formatting, Control flow: conditional statements, looping statements, nested loops, break, continue, pass, exit	07
2	Functions & Data Structures Built-in functions, Function definition and calling Scope and lifetime of variables, Default parameters, Command line arguments, Lambda functions, assert statement, importing user defined modules, Mutable and immutable objects, Lists, tuples, dictionaries, Functions on lists, tuples, dictionaries, Passing data structures as function arguments, Introduction to Math and NumPy Modules	07
3	Files and Exception Handling Types of files, Creating, reading, and writing text files Binary files, Pickle module, CSV file handling (read/write) JSON file handling, Exception handling: try-except-else-finally raise statement, Hierarchy of exceptions, Custom exception handling	07
4	Data Visualization & Advanced Python Concepts Introduction to data visualization, 2D and 3D plotting, Histogram Pie charts, Sine and cosine curves, Basic graphical representations using Python libraries	07

Text Books			
Sr. No.	Title	Author	Publisher
1	Introduction to Python Programming	Venkatesh, Nagaraju Y	Khanna Publishing House, 2021
2	Introduction to Computing & Problem Solving with Python	Jeeva Jose	Khanna Publishing House, 2023
3	Python Programming: A Modular Approach (with Graphics, DB, Web)	Sheetal Taneja & Naveen Kumar	Pearson, 2017

Reference Books			
Sr. No.	Title	Author	Publisher
1	Think Python (2nd Edition)	Allen Downey	O'Reilly, 2015
2	An Introduction to Python for Absolute Beginners	Bob Dowling	Cambridge University
3	Introduction to Computation and Programming Using Python (2nd Ed.)	John Gut tag	PHI India, 2016

Title of the Course: Software Engineering	L	T	P	Credit
Course Code: 25BCA2304	3	-	-	3

Course Prerequisite:

Basic understand of Software, Applications, Programming fundamentals

Course Description:

This course provides a comprehensive understanding of the principles, processes, and practices involved in software development. It focuses on the evolving role of software in modern systems and the need for structured methodologies to build high-quality, reliable, and scalable software products

Course Objectives:

By the end of this course, the students will be able to:

1. To understand the evolving role of software, its characteristics, and the concept of layered technology and process frameworks.
2. To study various software process models such as Waterfall, Incremental, Evolutionary models, and the Unified Process.
3. To learn Agile software development principles, methods, and frameworks including Extreme Programming (XP) and Scrum, and compare them with plan-driven approaches.
4. To gain knowledge of software Requirements Engineering, including functional and nonfunctional requirements, requirement elicitation, analysis, validation, and management
5. To understand risk management techniques such as risk identification, analysis, projection, and RMMM (Risk Mitigation, Monitoring, and Management) planning.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	To Acquire a comprehensive understanding of the software development lifecycle and its application in contemporary software engineering practices.
CO2	To Develop proficiency in project management methodologies and strategic decision making for successful software project execution
CO3	To Master the art of software design, development, and testing to produce robust and efficient software solutions
CO4	Solve problems related to kinematics and kinetics of particles using Newton's laws, work-energy, and impulse-momentum principles.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	-	-	1	1	1	1	2
CO2	2	2	2	1	2	1	-	1	2	2	3	2
CO3	3	3	3	3	3	-	-	1	2	1	1	2
CO4	3	3	1	2	2	-	-	-	-	-	-	2

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	SDLC & Agile Software Development The evolving role of software, changing nature of software, layered technology, a process framework, Process models: The waterfall model, incremental process models, evolutionary process models, the unified process. Agile software development: Agility Principles, Agile methods, Plan-driven and agile development, Extreme programming, Scrum, A Tool Set for the Agile Process.	08
2	Software Requirements Engineering Functional and non-functional requirements, the software requirements document, Requirements specification, engineering processes, elicitation and analysis, validation, management.	08
3	Software Architecture, Design & Testing Strategies Design process and quality, concepts, model, software architecture, data design, architectural design, Basic structural modeling, UML diagrams. Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging	08
4	Quality Management Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability.	08
5	Software Project Management, Risk & Quality Management Project Planning: Software pricing, Project scheduling, Agile planning and estimation techniques. Risk Management: Software Project Management, Risk & Quality Management. Release Management: Release planning, development and build plans, release strategies, risk management, and post-deployment monitoring. Product sustenance: Maintenance, updates, End of life, migration strategies.	08

Text Books			
Sr. No.	Title	Author	Publisher
1	Software Engineering	N.S. Gill	Khanna Publishing House, 2023)
2	Software Engineering (9th Edition)	Ian Somerville	Pearson Education
3	Software Engineering: A Practitioner's Approach (8th Edition)	Roger S. Pressman, Bruce R. Maxim	McGraw-Hill Education, 2015

Reference Books			
Sr. No.	Title	Author	Publisher
1	Software Engineering (7th Edition)	Stephen Schach	McGraw-Hill, 2007
2	Software Engineering: Principles and Practice	Hans van Vliet	Wiley

Title of the Course: Professional Elective-I A) Basics of Data Analytics using Spreadsheet Course Code: 25BCA2305A	L	T	P	Credit
	2	-	-	2

Course Prerequisite:

Knowledge on basics of mathematical & Statistical concepts such as arithmetic, percentages, averages, and basic algebra.

Course Description:

This course provides an introduction to the fundamental concepts and practices of data analytics. It focuses on understanding different types of data—structured, unstructured, and semi-structured—and how they are used to extract meaningful insights for decision-making.

Course Objectives:

By the end of this course, the students will be able to:

1. Understand the basics of data analytics and its applications.
2. To develop the ability to apply control structures, user-defined functions, and exception handling to solve logical problems
3. To explain the use of built-in data structures and perform file, string operations.
4. Build and use spreadsheet models for decision making & Communicate data insights effectively

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understand data analytics concepts and perform basic spreadsheet operations.
CO2	Handle, clean, and process data using spreadsheet functions and tools.
CO3	Visualize data and perform descriptive analysis using charts, dashboards, and pivot tables.
CO4	Apply advanced spreadsheet techniques for what-if analysis, statistical analysis, and real-world applications.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	3	2	-	-	-	2	1	2
CO2	3	3	2	2	3	2	-	-	-	2	1	3
CO3	3	3	2	2	3	2	-	-	-	3	1	3
CO4	3	3	3	3	3	2	-	-	-	3	2	3

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Introduction to Data Analytics & Spreadsheets Concept of Data Analytics- Importance and scope of data analytics in business- Types of data (structured, semi-structured, unstructured)- Introduction to spreadsheet software (Excel / Google Sheets)- Spreadsheet interface and basic operations- Data entry, formatting, and basic formulas- Cell referencing (relative, absolute, mixed)	07
2	Data Handling and Basic Analysis in Spreadsheets Sorting and filtering data- Data validation techniques- Basic functions: SUM, AVERAGE, MIN, MAX, COUNT- Logical functions: IF, AND, OR-Text functions and date functions- Cleaning and organizing data in Spreadsheets	07
3	Data Visualization and Descriptive Analytics Charts and graphs in spreadsheets (bar, pie, line, histogram)- Creating dashboards-Conditional formatting- Measures of central tendency (mean, median, mode)- Basic interpretation of data trends Introduction to pivot tables	07
4	Advanced Spreadsheet Analytics & Applications Pivot tables and pivot charts in detail- What-if analysis (Goal Seek, Scenario Manager)-Data analysis tools and add-ins- Introduction to basic statistical analysis in spreadsheets- Real-world applications in business, finance, and marketing- Mini case studies using spreadsheets	07

Text Books			
Sr. No.	Title	Author	Publisher
1	Beginner's Guide for Data Analysis using RProgramming	Jeeva Jose	Khanna Publishing House, 2024

2	I Data analytics	V.K. Jain	Khanna Book Publishing Company, 2024
3	Excel data analysis for dummies	Stephen L. Nelson and E. C. Nelson	John Wiley & Sons, 3rd Edition, 2016

Reference Books			
Sr. No.	Title	Author	Publisher
1	Excel 2019 bible	Michael Alexander, Richard Kusleika, John Walkenbach	John Wiley & Sons, 25 Sept 2018
2	Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics	Cliff T. Ragsdale	Cengage Learning Asia Pvt., 2015
3	Mastering Excel	WebTech Solutions	Khanna Publishing House, 2024

Title of the Course: Professional Elective I B) Feature Engineering Course Code: 25BCA2305B	L	T	P	Credit
	2	-	-	2

Course Prerequisite:

Basic knowledge of data analytics/machine learning and familiarity with any programming language

Course Description:

This course provides a foundational understanding of feature engineering, a critical step in building effective machine learning models. It focuses on the role of features in improving model performance and the techniques used to transform raw data into meaningful inputs for analysis.

Course Objectives:

By the end of this course, the students will be able to:

- 1 Understand the basics of data analytics and its applications. To develop the ability to apply control structures, user-defined functions, and exception handling to solve logical problems.
2. To explain the use of built-in data structures and perform file, string operations.
3. Build and use spreadsheet models for decision making & Communicate data insights effectively
- 4.To apply statistical measures such as mean, median, mode, and standard deviation

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understand data analytics concepts and perform basic spreadsheet operations.
CO2	Apply basic features pre-processing techniques such as handling missing data, data cleaning and features scaling and normalization
CO3	Visualize data and perform descriptive analysis using charts, dashboards, and pivot tables
CO4	Apply advanced spreadsheet techniques for what-if analysis, statistical analysis, and real-world applications.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	3	2	-	-	-	2	1	2
CO2	3	3	2	2	3	2	-	-	-	2	1	3
CO3	3	3	2	2	3	2	-	-	-	3	1	3
CO4	3	3	3	3	3	2	-	-	-	3	2	3

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Introduction to Feature Engineering Definition and importance of feature engineering in data analytics and machine learning- Types of features: numerical, categorical, ordinal, text, date-time, Boolean- Role of feature engineering in model performance- Overview of the feature engineering workflow	07
2	Feature Creation and Transformation Feature extraction techniques-Feature scaling and normalization (Min-Max, Standardization, Robust Scaling)- Feature encoding: One hot encoding, Label encoding, Target encoding- Handling categorical variables, date-time features, and text features- Interaction features and polynomial features	07
3	Feature Selection and Dimensionality Reduction Importance of feature selection- Filter methods: correlation, chi square, ANOVA Wrapper methods: forward selection, backward elimination- Embedded methods: Lasso, Ridge, Tree-based feature importance- Dimensionality reduction: PCA, t-SNE, LDA.	07
4	Feature Engineering in Practice Handling missing values and outliers-Feature aggregation and binning Feature importance evaluation-Feature engineering pipelines in Python (pandas, scikit learn)- Case studies and real-world applications in finance, marketing, and operations	07

Text Books			
Sr. No.	Title	Author	Publisher
1	Data Science and Data Analytics Using Python Programming,	M.C. Trivedi	Khanna Publishing House, 2024. Textbook)
2	Fundamentals of Data Science: Theory and Practice.	Kalita, J. K., Bhattacharyya, D. K., & Roy, S., Tata	Elsevier. ISBN-Edition, Tata
3	Feature engineering for machine learning: Principles and techniques for data scientists	Zheng, Alice, & Casari, Amand	O'Reilly Media, Inc

Reference Books			
Sr. No.	Title	Author	Publisher
1	Pattern classification (2Ed)	John Wiley & Sons, ISBN	Duda, R. O., Hart, P. E., Stork, D
2	Machine Learning	N.Bhaskar, Vasundhara	Khanna Publishing House
3	Machine learning yearning	Han, Jiawei, Kamber, Micheline, & Pei, Jian.	Morgan Kaufmann Publishers

Title of the Course: Professional Elective I	L	T	P	Credit
C) Web Programming -I				
Course Code: 25BCA2305C	2	-	-	2

Course Prerequisite:

Basic understanding of Java, HTML and Java script.

Course Description:

This course provides a comprehensive introduction to PHP, a widely used server-side scripting language for web development. It begins with setting up a PHP development environment and understanding the basics of web development, including how PHP integrates with HTML to create dynamic web pages..

Course Objectives:

By the end of this course, the students will be able to:

1. Understand the fundamentals of web development and PHP, including syntax, data types, variables, operators, and expressions for building dynamic web applications.
2. Apply control structures, functions, and arrays to develop logical and efficient PHP programs with proper error handling mechanisms.
3. Develop interactive web applications by handling user input through forms and integrating PHP with MySQL databases for data storage, retrieval, and security.
4. Implement session management and cookies to maintain state, handle user authentication, and manage user interactions in web applications.
5. Perform file handling and directory operations, including reading, writing, uploading, and managing file permissions in PHP-based systems.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understand data analytics concepts and perform basic spreadsheet operations.
CO2	Apply basic features pre-processing techniques such as handling missing data, data cleaning and features scaling and normalization.
CO3	Visualize data and perform descriptive analysis using charts, dashboards, and pivot tables.
CO4	Apply advanced spreadsheet techniques for what-if analysis, statistical analysis, and real-world applications.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	-	-	-	-	-	-	1
CO2	3	3	2	1	2	-	-	-	1	1	-	1
CO3	3	3	3	3	3	2	1	2	1	2	1	2
CO4	3	3	2	2	3	2	1	3	2	2	1	2

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Introduction to PHP Setting up a PHP development environment, Basics of web development PHP Syntax and Variables: PHP tags and delimiters, PHP data types and variables, Variable scope, Constants and Magic constants Operators and Expressions: Arithmetic, assignment, comparison and logical operators, String and array operators, Precedence and associativity of operators, Type juggling and type casting.	07
2	Control Structures, Function and Arrays Control Structures: Conditional statements: if, else, elseif, switch, Looping statements: for, while, do-while, foreach Break and continue statements. Error handling and exceptions Functions and Arrays: Defining and calling functions Passing arguments to functions, Returning values from functions, Working with arrays: indexed, associative, and multidimensional arrays, Array functions and sorting.	07
3	User Input and Database Working with Forms and User Input: HTML forms and form elements, retrieving user input with \$_GET and \$_POST, Form validation and sanitization, Handling file uploads Working with Database-MySQL: Introduction to databases and MySQL, connecting to a MySQL database, SQL queries: SELECT, INSERT, UPDATE, DELETE, Prepared statements and preventing SQL injection, Retrieving and displaying data from a database	07
4	Session Management and File Handling Understanding sessions and cookies, Creating and destroying sessions, storing session data, managing user authentication and authorization Working with files and directories, reading from and writing to files, File uploads and file permissions, File and directory manipulation Functions	07

Text Books			
Sr. No.	Title	Author	Publisher
1	PHP and MySQL Web Development	Luke Welling, Laura Thomson	Addison-Wesley)
2	Learning PHP, MySQL & JavaScript	Robin Nixon	O'Reilly Media
3	PHP: The Complete Reference	Steven Holzner	McGraw-Hill

Reference Books			
Sr. No.	Title	Author	Publisher
1	Head First PHP & MySQL	Lynn Beighley, Michael Morrison	O'Reilly Media
2	PHP Cookbook	David Sklar, Adam Trachtenberg	O'Reilly Media
3	Web Programming with PHP and MySQL	Tim Converse, Joyce Park	Pearson
4	PHP Solutions: Dynamic Web Design Made Easy	David Powers	Apress
5	Murach's PHP and MySQL	Joel Murach, Ray Harris	Murach Books

Title of the Course: Yoga/sports/NCC/NSS/Disaster Management Course Code: 25BCA2306	L	T	P	Credit
	-	-	2	1

Course Prerequisite:

All the theoretical contents shall be delivered through the practical workshop mode only. No class room teaching is encouraged in this course. Yoga course is designed to provide students with a comprehensive understanding of physical fitness, wellness, and nutrition.

Course Description:

This course explores the meaning and importance of yoga in the modern era, the role of sports in maintaining physical fitness, and the various components of physical wellness. Students will also learn about the significance of nutrition and weight management, equipping them with the knowledge to promote a healthy and balanced lifestyle. Through this course, students will gain insights into the holistic approach to health and well-being.

Course Objectives:

By the end of this course, the students will be able to:

- 1 Understand yoga's significance and its practical applications for holistic well-being.
- 2 Explore subtle energy systems and their role in enhancing health through yogic practices..
3. Examine various paths of yoga to foster self-realization and spiritual growth..
4. Master the Eight Limbs of Yoga for physical, mental, and spiritual harmony..
5. Apply yogic principles to manage psycho-somatic ailments and promote resilience.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Gain a comprehensive understanding of yoga and its modern applications for holistic well-being
CO2	Demonstrate proficiency in yogic anatomy and physiology, enhancing yoga practice and promoting physical and energetic balance.
CO3	Master the Eight Limbs of Yoga and comprehend their psychological impact, fostering personal growth and self-realization. .
CO4	Integrate yoga principles into sports and physical fitness activities to enhance performance and prevent injuries.
CO5	Develop skills in wellness management and nutrition

Assessment Scheme:

Two components of in semester evaluation (CA1 and CA2) having 50% weightage.

Assessment Component	Marks
CA1	25
MSE	-
CA2	25
OE	-

CA1 and CA2 are based on practical performance etc.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Yoga Meaning and definition Importance yoga in 21st century Introduction to Yogic Anatomy and Physiology Yoga & sports, Yoga for healthy lifestyle Types of Yoga: - Hatha yoga, laya yoga, mantra yoga, bhakti yoga, karma yoga, jnana yoga, raj yoga Study of Chakras, Koshas, Pranas, Nadis, Gunas, Vayus and its application in Yogic practices. Ashtang Yoga: - Yama, niyama, asana, pranayama, Pratyahar, dharna, dhyana, Samadhi: Benefits, Utilities & their psychological impact on body and mind. According to yoga concept of normality in modern psychology, concept of personality & its development, yogic management of psycho-somatic ailments: frustration, anxiety, depression	07
2	Sports for Physical Fitness Meaning and definition Physical Activity – Concept, Benefits of Participation in Physical Activities Components and Significance of Physical Fitness -Health, Skill and Cosmetic Fitness Types of Physical Activities – Walking, Jogging, Running, Calisthenics, Rope Skipping, Cycling, Swimming, Circuit Training, Weight training, Adventure Sports Principles of Physical Fitness, Warming Up, Conditioning, Cooling Down, Methods to Develop and Measure Health and Skill related components of Physical Fitness Measurement of Health Related Physical Fitness (HRPF)	07
3	Physical Wellness Concept, Components Types of wellness: psychological, social, emotional, and spiritual. Significance with reference to Positive Lifestyle 2.2 Concepts of Quality of Life and Body Image Factors affecting Wellness Programs. SQL injection, Retrieving and displaying data from a database	07
4	Concept of Nutrients Nutrition, Balanced Diet, Dietary Aids and Gimmicks Energy and Activity- Calorie Intake, Energy Balance Equation Obesity - Concept, Causes, Obesity Related Health Problems Weight Management through Behavioral Modifications	07

Text Books			
Sr. No.	Title	Author	Publisher
1	Yog Dawra Kaya Kalp	Anand O P	Sewasth Sahitya Perkashan. Kanpur
2	Introduction to Physical Education	Lumpkin, A	Thomson-Wadsworth.
3	Active Lifestyle for Wellness	Steven Holzner	McGraw-Hill

Title of the Course: Sports	L	T	P	Credit
Course Code: 25BCA2306	-	-	2	1

Course Prerequisite:

Sports Management course is designed to provide undergraduate students with a broad, foundational understanding of the dynamic field of sports management.

Course Description:

This course will familiarize students with the fundamental principles and concepts of sports management, including its scope, organizational structure, and ethical considerations. Students will gain insights into the roles of marketing and sponsorship in the sports industry, as well as develop proficiency in financial management techniques specific to sports organizations. Additionally, the course will explore the application of analytics and technology in sports, enhancing the strategic decision making and fan engagement capabilities.

Course Objectives:

By the end of this course, the students will be able to:

- 1 Understand the fundamental principles and concepts of sports management, including its scope, organizational structure, and ethical considerations.
- 2 Analyze the role of marketing and sponsorship in the sports industry, with a focus on branding, target audience segmentation, and event management.
3. Develop proficiency in financial management techniques specific to the sports industry, including revenue generation, cost management, and investment strategies...
4. Explore the application of analytics and technology in sports, including performance evaluation, strategic decision-making, and fan engagement.
5. Apply theoretical knowledge to practical scenarios through case studies and projects, fostering critical thinking and problem-solving skills in sports management contexts

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Demonstrate a comprehensive understanding of sports management principles, including organizational structures, legal issues, and ethical considerations.
CO2	Evaluate marketing strategies and sponsorship opportunities in the sports industry, devising effective branding and promotional campaigns.
CO3	Apply financial management techniques to analyze revenue streams, control costs, and make informed investment decisions in sports organizations. .
CO4	Utilize sports analytics tools and technology to enhance performance evaluation, strategic planning, and fan engagement initiatives.
CO5	Synthesize course concepts through practical applications, demonstrating the ability to address real-world challenges in sports management scenarios.

Assessment Scheme:

Two components of in semester evaluation (CA1 and CA2) having 50% weightage each.

Assessment Component	Marks
CA1	25
MSE	-
CA2	25
OE	-

CA1 and CA2 are based on Assignment/ Quiz/Seminar/Group discussions presentation.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Definition and scope of sports management Significance of sports management in society and its evolution over time Organizational structure of sports: amateur, professional, and nonprofit entities Roles and responsibilities of key personnel: managers, coaches, and agents Governance bodies in sports: FIFA, IOC, and NCAA Legal issues: contracts, negotiations, intellectual property rights Ethical considerations: fair play and doping	07
2	Sports Marketing and Sponsorship Unique aspects of sports marketing Fan engagement strategies Target audience identification and segmentation Branding strategies for sports teams and athletes Sponsorship and endorsement deals Negotiating and managing partnerships Event management: planning, organizing, and promoting sports events	07
3	Revenue generation in sports ticket sales, broadcasting rights, merchandise sales Financial models: budgeting and forecasting Cost management: player salaries, facility expenses, operational costs Investment opportunities in sports Risk management techniques specific to sports organizations	07
4	Introduction to sports Analytics Evaluating player performance Devising game strategies Fan engagement through technology Analytical techniques: statistical analysis, data visualization, predictive modeling Key performance indicators (KPIs) in sports Applications of analytics: talent scouting, injury prevention, performance optimization.	07

Text Books			
Sr. No.	Title	Author	Publisher
1	Contemporary Sport Management.	Pedersen, P. M., Thibault, L., & Pedersen, P. M.	Human Kinetics.
2	Sports Management: Principles and Applications.	Lumpkin, A	Routledge.
3	Introduction to Sport Management: Theory and Practice.	Chelladurai, P., & Kerwin, S.	Human Kinetics.

Title of the Course: National Cadet Corps (NCC) Course Code: 25BCA2306	L	T	P	Credit
	-	-	2	1

Course Prerequisite:

This course develops essential skills in discipline, leadership, and tactical operations through structured curriculum and practical exercises

Course Description:

It emphasizes the role of drills in fostering discipline, leadership, and teamwork, and includes comprehensive weapon handling training with a focus on safety protocols. The course teaches map reading, understanding topographical features, and navigating diverse terrains. Practical units cover the history and objectives of the National Cadet Corps (NCC), various maneuvers, parade formations, saluting protocols, and field and battlecraft techniques. By the end, learners will master discipline, leadership, weapon handling, and tactical decision-making, effectively utilizing terrain features for strategic advantages.

Course Objectives:

By the end of this course, the students will be able to:

1. Understand the foundational role of drill in fostering discipline and leadership within a group, enabling effective command towards achieving common goals..
2. Appreciate the importance of grace and dignity in executing foot drill movements, recognizing their significance in enhancing performance and teamwork..
3. Comprehend the criticality of weapon handling and detailed safety measures, emphasizing the importance of accident prevention through strict adherence to safety protocols.
4. Develop an awareness of diverse terrain types and their strategic significance in battle craft, enabling informed decision-making and effective utilization of terrain features for tactical.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Mastery of Discipline and Leadership through Drill Learners would demonstrate the ability to effectively command a group, foster discipline, and work collaboratively towards achieving shared objectives.
CO2	Mastery of Grace and Dignity in Foot Drill Performance Learners would demonstrate and understanding of how these qualities enhance performance and foster teamwork within a group setting.
CO3	Proficient Weapon Handling and Safety Adherence Learners would showcase a thorough understanding of the criticality of safety measures, emphasizing accident prevention through strict adherence to safety protocols.
CO4	Enhanced Tactical Awareness and Strategic Decision-Making Learners would gain the ability to make informed decisions and effectively utilize terrain features to gain tactical advantage during operations.

Assessment Scheme:

Two components of in semester evaluation (CA1 and CA2) having 50% weightage each.

Assessment Component	Marks
CA1	25
MSE	-
CA2	25
OE	-

CA1 and CA2 are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Overview of NCC Its history, aims, objectives, and organizational structure, Incentives and duties associated with NCC cadetship; Maneuvers: Foot drill, Word of Command, Attention, and stand at ease, and Advanced maneuvers like turning and sizing; Parade formations: Parade line, open line, and closed line; Saluting protocols, parade conclusion, and dismissal procedures. Marching styles: style march, double time march, and slow march	07
2	Weapon Training Handling firearms, Introduction and characteristics of the .22 rifle; Handling Firearm techniques, emphasizing safety protocols and Best practices.	07
3	Map Reading (MR) Topographical forms and technical terms, including relief, contours, and gradients, crucial for understanding terrain features; Cardinal points , magnetic variation and grid Convergence	07
4	Field Craft & Battle Craft (FC & BC) Fundamental principles and techniques essential for effective field and battle craft operations; Methods of judging distance, including estimation, pacing, and visual Cues	07

Text Books			
Sr. No.	Title	Author	Publisher
1	Grooming Feeling of National Integration.	Tiwari, R	Edwin Incorporation
2	Grooming Tomorrows Leaders.	Chhetri, R.S.	The National Cadet Corps.
3	The NCC Days	Vanshpal, Ravi	Notion Press

Title of the Course: National Service Scheme (NSS)	L	T	P	Credit
Course Code: 25BCA2306	-	-	2	1

Course Prerequisite:

This course provides students with an in-depth understanding of the National Service Scheme (NSS), including its history, philosophy, aims, objectives, and organizational structure. It equips students with knowledge about various NSS programs and activities, emphasizing their relevance and importance.

Course Description:

The course also develops skills in community mobilization, teaching students effective techniques for engaging and mobilizing community stakeholders. Additionally, it cultivates an appreciation for volunteerism and shramdan (voluntary labor), highlighting their role in community development initiatives. By the end of the course, students will have a comprehensive understanding of NSS, enhanced leadership and team-building skills, and a strong sense of social awareness and patriotism.

Course Objectives:

By the end of this course, the students will be able to:

1. To provide students with an understanding of the history, philosophy, and basic concepts of the National Service Scheme (NSS)..
2. To familiarize students with the aims, objectives, and organizational structure of NSS.
3. To equip students with knowledge about NSS programs, activities, and their relevance.
4. To develop an understanding of community mobilization techniques and their importance in NSS activities.
5. To cultivate an appreciation for volunteerism, shramdan (voluntary labor), and their role in community development initiatives

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	To provide students with an understanding of the history, philosophy, and basic concepts of the National Service Scheme (NSS).
CO2	To familiarize students with the aims, objectives, and organizational structure of NSS..
CO3	To equip students with knowledge about NSS programs, activities, and their relevance.
CO4	To develop an understanding of community mobilization techniques and their importance in NSS activities

Assessment Scheme:

Two components of in semester evaluation (CA1 and CA2) having 50% weightage .

Assessment Component	Marks
CA1	25
MSE	-
CA2	25
OE	-

CA1 and CA2 are based on Assignment/ Quiz/Seminar/Group discussions presentation.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Introduction and Basic Concepts of NSS National Service Scheme (NSS) - history, philosophy, and fundamental concepts, aims and objectives, providing clarity on the organization's overarching goals. Symbols of NSS - Emblem, flag, motto, song, and badge; Organizational structure of NSS	07
2	NSS Programmers and Activities Diverse programmers and activities conducted under the aegis of the National Service Scheme (NSS); Significance of commemorating important days recognized by the United Nations, Centre, State Government, and University; Examination of the methodology for adopting villages/slums and conducting surveys; Financial patterns of the NSS scheme	07
3	Community Mobilization Dynamics of community mobilization within the framework of the National Service Scheme (NSS); Functioning of community stakeholders; The conceptual lens of community development	07
4	Volunteerism and Shramdan in the Indian Context Roles and Motivations within the NSS Framework Ethos of volunteerism and shramdan (voluntary labor) within the cultural context of India and the framework of the National Service Scheme (NSS); Motivations and constraints shaping volunteer engagement; Role of NSS volunteers in initiatives such as the Swachh Bharat Abhiyan and Digital India	07

Text Books			
Sr. No.	Title	Author	Publisher
1	Grooming Feeling of National Integration.	Tiwari, R	Edwin Incorporation
2	Grooming Tomorrows Leaders.	Chhetri, R.S.	The National Cadet Corps.
3	The NCC Days	Vanshpal, Ravi	Notion Press

Title of the Course: Disaster Management	L	T	P	Credit
Course Code: 25BCA2306	-	-	2	1

Course Prerequisite:

This course develops essential skills in discipline, leadership, and tactical operations through structured curriculum and practical exercises

Course Description:

In our rapidly evolving 21st-century world, challenges emerge in diverse forms, transcending borders and intertwining economic, societal, and environmental realms. These challenges profoundly affect vulnerable communities, magnifying their susceptibility to climate related shocks and disasters. As we navigate through these complexities, it becomes increasingly evident that aligning strategies with global Sustainable Development Goals (SDGs) across various geographical scales is paramount. This alignment incorporates perspectives of environmental sustainability, climate adaptation, and disaster resilience. In light of these considerations, this course aims to equip students with the knowledge and skills necessary to address and mitigate the impacts of disasters in a holistic manner.

Course Objectives:

By the end of this course, the students will be able to:

1. To provide understanding of the concepts related to disaster
2. To highlight the importance and role of disaster management
3. To enhance awareness of institutional processes and management strategies to mitigate the impacts of disasters

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Articulate the critical role of disaster management in reducing risks and enhancing resilience
CO2	Identify and describe key institutional frameworks and processes in disaster management.
CO3	Conduct risk assessments and develop disaster management plans for specific scenarios

Assessment Scheme:

Two components of in semester evaluation (CA1 and CA2) having 50% weightage.

Assessment Component	Marks
CA1	25
MSE	-
CA2	25
OE	-

CA1 and CA2 are based on practical performance etc.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Concepts and Terminologies Disaster management Understanding key concepts of Hazards, disasters; Disaster types and causes (Geophysical, Hydrological, Meteorological, Biological and Atmospheric; Human-made); Global trends in disasters - Impacts (Physical, Social, Economic, Political, Environmental and Psychosocial); Defining Vulnerability (Physical Vulnerability; Economic Vulnerability; Social Vulnerability)	07
2	Components of disaster management cycle Response and recovery, Risk assessment, Mitigation and prevention, Preparedness planning, Prediction and warning); Disaster risk reduction (DRR), Community based disaster risk reduction	07
3	Disaster Risk Management and policies Initiatives at national and international level Disaster Risk Management in India and at international level: Related policies, plans, programs and legislation; International strategy for disaster reduction and other initiatives	07
4	Emergency Management Explosion and accidents (Industrial, Nuclear, Transport and Mining) - Spill (Oil and Hazardous material); Threats (Bomb and terrorist attacks) - Stampede and conflicts Training and Demonstration Workshops (at least two workshops) be organized in association with the NIDM, NDRF, NCDC, Param Military, Fire Brigade, CISF, local administration etc.	07

Text Books			
Sr. No.	Title	Author	Publisher
1	Disaster Management.	Sharma, S.C.	Khanna Book Publishing.
2	Disasters and Public Health:	Clements, B. W	Elsevier Inc..
3	Disaster Management and Human Health Risk: Reducing Risk	Singh, R. B	Vulnerability and Mitigation, Rawat Publications,

Title of the Course: Database Management System Laboratory Course Code: 25BCA2302L	L	T	P	Credit
	-	-	4	2

Course Prerequisite:

Knowledge of data: concepts such as data types, file handling, and basic programming logic. Familiarity with basic mathematics and logical: reasoning for understanding relational structures and query processing.

Course Description:

This course provides a comprehensive introduction to database systems covering fundamental concepts of DBMS, data models, relational databases, and database design. It focuses on query processing, SQL programming, transaction management, and database security. Students will learn how to create manage and optimize databases using normalization techniques joins, and indexing. The course also develops skills in understanding concurrency control ACID properties and deadlock handling in real-world database environments.

Course Objectives:

By the end of this course, the students will be able to:

1. To explore wave optics phenomena through laboratory demonstrations.
2. To understand characteristics and engineering applications of lasers and optical fibers.
3. To analyze crystal structure and semiconducting properties using models and instruments.
4. To enhance experimental design, data analysis, and interpretation.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Demonstrate different phenomenon of light and their applications.
CO2	Demonstrate working of the optical fiber and determine its acceptance angle.
CO3	Analyze crystal structure and electrical properties of semiconducting material and semiconducting device.
CO4	Design, develop and demonstrate experimental set up and models for tools applicable in engineering.
CO5	Interpret experimental observations to understand physical phenomena from solid-state physics..

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	3	1	-	-	-	-	1	-	2
CO2	3	3	2	3	2	-	-	-	-	1	-	2
CO3	3	3	2	3	2	-	-	-	-	1	-	2
CO4	3	3	3	3	3	1	-	-	2	2	2	2
CO5	3	2	1	3	1	-	-	-	-	1	-	2

Assessment Scheme:

Two components of in semester evaluation (CA1 and CA2) having 50% weightage each.

Assessment Component	Marks
CA1	25
CA2	25
POE	50

CA1 and CA2 are based on practical performance etc.

Course Contents

Practical No.	List of Experiments	Hours
1	Draw an ER Diagram of Registrar Office	02
2	Create minimum set of six tables using following constraints: a) Primary key b) Foreign key c) Not Null d) Check e) Unique f) On delete/update cascade g) Default	02
3	Use Alter, drop and truncate command on above created table.	02
4	Insert minimum ten records in each of the above created tables and comment on the constraints specified. Use delete, update and select commands on created records.	02
5	Execute Grant and Revoke commands on created tables.	02
6	Execute SQL queries using Aggregate functions on above tables a) count b) sum c) min d) max e) avg . Use group by and having clause	02
7	SQL Queries based on joins (on above created tables): a) Natural Join Left Outer Join c) Right Outer Join d) Full Outer Join	02
8	SQL Queries based on Nested Queries.	02

9	SQL Queries based on Views	02
10	Write a Program using TRIGGER on UPDATE	02

Text Books			
Sr. No.	Title	Author	Publisher
1	Database System Concepts	Silberschatz, Korth Sudershan	McGraw-Hill Education
2	An introduction to Database System	Bipin Desai	Galgotia Publications
3	Database Management System (DBMS)A Practical Approach	Rajiv Chopra	S. Chand Limited

Title of the Course: Python Programming Laboratory	L	T	P	Credit
Course Code: 25BCA2303L	-	-	4	2

Course Prerequisite:

Familiarity with basic programming concepts and syntax, preferably in another language, and an understanding of fundamental computer science principles.

Course Description:

A Python Programming laboratory typically covers the fundamentals of programming using the Python language, including data types, control flow, strings, and data structures. It aims to equip learners with the skills to write Python programs, solve computational problems, and potentially apply these skills in fields like data science, web development, or automation. environments.

Course Objectives:

By the end of this course, the students will be able to:

1. Install and run the Python Interpreter.
2. Learn Control Structures.
3. Understand Lists, Dictionaries in Python.
4. Handle Strings and Files in Python.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Write programs using basic concepts of Python Programming
CO2	Understand Strings, Lists, Tuples, and Dictionaries in Python
CO3	Write programs using a modular approach.
CO4	Develop interactive web applications using Streamlet by integrating Python logic with user interface elements.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	3	-	-	-	1	1	-	2
CO2	3	3	2	1	2	-	-	-	-	1	-	2
CO3	3	3	3	2	3	-	-	-	1	1	-	2
CO4	3	3	3	3	3	-	-	-	2	2	1	2

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), End Semester Oral Examination (POE), have 25%, 25% and 50% weightage, respectively.

Assessment Component	Marks
CA1	25
CA2	25
OE	50

CA1 and **CA2** are based on practical performance etc.

Course Contents

Practical No.	List of Experiments	Hours
1	Write a program to find whether a number is a prime number.	02
2	Write a program to print m raise to power n, where m and n are read from the user.	02
3	Write a program having a parameterized function that returns True or False depending on whether the parameter passed is even or odd.	02
4	Write a program to print the summation of the following series up to n terms:1-2+3-4+5- 6+7..... n	02
5	Write a menu driven program to perform the following operations on strings using string built in functions. a. Find the frequency of a character in a string.	02
6	Write a program that accepts two strings and returns the indices of all the occurrences of the second string in the first string as a list. If the second string is not present in the first string, then it should return -1	02
7	Write a function that takes a sentence as input from the user and calculates the frequency of each letter. Use a variable of dictionary type to maintain the count	02
8	Write a function that reads a file file1 and copies only alternative lines to another file file2. Alternative lines copied should be the odd numbered lines.	02
9	Write a Python program to handle a Zero Division Error exception when dividing a number by zero.	02
10	Write a program that reads a list of integers from the user and throws an exception if any numbers are duplicates.	02

Text Books			
Sr. No.	Title	Author	Publisher
1	Murach's Python Programming	Michael Urban and Joel Murach	Murach's Publication
2	Core Python Programming	Dr. R. Nageswara Rao	Dreamtech Press, 1st Edition
3	An Introduction to Python	2 Guido van Rossum and Fred L. Drake	Jr Network Theory Ltd

Title of the Course: A) Basics of Data Analytics using Spreadsheet Laboratory Course Code 25BCA2305L	L	T	P	Credit
	-	-	4	2

Course Prerequisite:

Knowledge on basic mathematical & Statistical concepts such as arithmetic, percentages, averages, and basic algebra.

Course Description:

This course provides a practical introduction to Microsoft Excel for data handling, analysis, and reporting. It covers the fundamentals of workbooks, worksheets, cells, and ranges along with data entry and formatting techniques. Students will learn to use arithmetic, statistical, logical, and text functions for efficient data processing and analysis.

Course Objectives:

By the end of this course, the students will be able to:

1. Understand the basics of data analytics and its applications. To develop the ability to apply control structures, user-defined functions, and exception handling to solve logical problems.
2. To explain the use of built-in data structures and perform file, string operations.
3. Build and use spreadsheet models for decision making & Communicate data insights effectively

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understand and apply the fundamentals of Excel including workbook structure, worksheets, cells, ranges, and perform basic data entry and formatting operations.
CO2	Use basic arithmetic and statistical functions such as SUM, AVERAGE, MIN, MAX, ROUND, mean, median, and mode for data analysis.
CO3	Import, clean, and organize data from multiple sources while applying techniques such as removing duplicates, handling missing data, and standardizing formats.
CO4	Apply text and logical functions such as LEFT, RIGHT, MID, CONCATENATE, TRIM, CLEAN, IF, AND, OR, and IFERROR for effective data manipulation and validation.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	-	-	-	-	-	-	1
CO2	3	3	1	2	2	-	-	-	-	1	-	1
CO3	3	3	2	3	3	1	1	-	1	2	-	2
CO4	3	3	2	2	3	-	-	-	1	2	-	2

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), End Semester Oral Examination (POE), have 25%, 25% and 50% weightage, respectively.

Assessment Component	Marks
CA1	25
CA2	25
POE	50

CA1 and CA2 are based on practical performance. POE is based on 100% Experiments.

Course Contents

Practical No.	List of Experiments	Hours
1	Getting started with Excel: Workbook, Worksheet, Cells, and Ranges	02
2	Data entry and basic formatting techniques.	02
3	Using basic arithmetic functions: SUM, AVERAGE, MIN, MAX, ROUND	02
4	Importing data from various sources (CSV, text files, web data)	02
5	Data cleaning: removing duplicates, handling missing data, and standardizing formats.	02
6	Using the "Find & Replace" and "Text Functions" (LEFT, RIGHT, MID, CONCATENATE)	02
7	Calculating measures of central tendency: mean, median, mode	02
8	Computing measures of dispersion: range, variance, standard deviation.	02
9	Using logical functions: IF, AND, OR, IFERROR	02
10	Data aggregation techniques: SUMIFS, COUNTIFS, AVERAGEIFS.	02

Text Books			
Sr. No.	Title	Author	Publisher
1	Excel Data Analysis for Dummies	Stephen L. Nelson, E. C. Nelson	Wiley
2	Microsoft Excel 365 Bible	Michael Alexander, Richard Kusleika	Wiley
3	Excel 2021: The Missing Manual	Matthew MacDonald	O'Reilly Media

Title of the Course: B) Feature Engineering Laboratory Course Code: 25BCA2305L	L	T	P	Credit
	-	-	4	2

Course Prerequisite:

Basic knowledge of data analytics/machine learning and familiarity with any programming language.

Course Description:

This course focuses on practical techniques used in data preprocessing and feature engineering, which are essential steps in preparing data for analysis and machine learning models. It provides hands-on experience in cleaning, transforming, and analyzing real-world datasets.

Course Objectives:

By the end of this course, the students will be able to:

1. To understand the importance of data preprocessing in data analytics and machine learning workflows.
2. To learn techniques for handling missing values using statistical methods such as mean, median, and mode.
3. To develop skills in cleaning datasets by identifying and removing invalid or inconsistent data entries.
4. To apply feature scaling techniques such as Min-Max normalization to standardize numerical data.
5. To perform Exploratory Data Analysis (EDA) using visualization techniques like histograms and boxplots.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Demonstrate proficiency in handling and preprocessing missing data, including filling missing values and cleaning invalid data entries.
CO2	Apply feature scaling techniques, such as Min-Max normalization, and perform exploratory data analysis through data visualization methods like histograms and boxplots.
CO3	Implement feature engineering techniques, including binning, polynomial feature creation, and logarithmic transformations on numerical data.
CO4	Perform text data preprocessing tasks, such as tokenization, stemming, lemmatization and apply TF-IDF and Bag-of-Words transformations.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	-	-	-	1	1	-	2
CO2	3	3	2	3	3	-	-	-	1	1	-	2
CO3	3	3	3	3	3			-	1	2	-	2
CO4	3	3	3	3	3	-	-	-	1	2	-	2

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), End Semester Oral Examination (POE), have 25%, 25% and 50% weightage, respectively.

Assessment Component	Marks
CA1	25
CA2	25
OE	50

CA1 and CA2 are based on practical performance etc.

POE is based on 100% Experiments.

Course Contents

Practical No.	List of Experiments	Hours
1	Handle missing values in column(s) of a dataset. For example, fill missing values with the mean/median/mode of the columns such as 'Age', 'Height', 'Weight', 'Grade' for a dataset.	02
2	Clean a dataset by identifying and removing invalid data entries. For example, a dataset having columns 'Name', 'Gender' and 'Age' where 'Name' contains 'invalid data'.	02
3	Scale numerical features using Min-Max normalization for a dataset with columns like 'Height', 'Weight'.	02
4	Perform exploratory data analysis and visualize data distributions using histograms and boxplots.	02
5	Compute and visualize the correlation matrix of a dataset with 2 or more columns..	02
6	Bin numerical data into discrete intervals for a dataset with a column containing numerical values.	02
7	Perform one-hot encoding on categorical features in a dataset with column 'Category' containing categorical values. The distinct values in the Category feature are [Good, Better, Best] and Gender [Male, Female].	02
8	Computing measures of dispersion: range, variance, standard deviation.	02

9	Preprocess text data (stemming) for a dataset with a column 'Text'.	02
10	Preprocess text data (lemmatization) for a dataset with a column 'Text'.	02

Text Books			
Sr. No.	Title	Author	Publisher
1	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	O'Reilly Media
2	Python Machine Learning	Sebastian Raschka, Vahid Mirjalili	Packt Publishing
3	Introduction to Machine Learning with Python	Andreas C. Müller, Sarah Guido	O'Reilly Media

Title of the Course: C) Web Programming	L	T	P	Credit
Laboratory Course Code: 25BCA2305L	-	-	4	2

Course Prerequisite:

Basic understanding of Java, HTML and Javascript.

Course Description:

This course provides a comprehensive introduction to PHP, a widely used server-side scripting language for web development. It begins with setting up a PHP development environment and understanding the basics of web development, including how PHP integrates with HTML to create dynamic web pages.

Course Objectives:

By the end of this course, the students will be able to:

1. Understand the fundamentals of web development and PHP, including syntax, data types, variables, operators, and expressions for building dynamic web applications.
2. Apply control structures, functions, and arrays to develop logical and efficient PHP programs with proper error handling mechanisms.
3. Develop interactive web applications by handling user input through forms and integrating PHP with MySQL databases for data storage, retrieval, and security.
4. Implement session management and cookies to maintain state, handle user authentication, and manage user interactions in web applications
5. Perform file handling and directory operations, including reading, writing, uploading, and managing file permissions in PHP-based systems.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Explain and apply PHP fundamentals including syntax, variables, data types, constants, and operators to develop basic dynamic web pages.
CO2	Develop structured PHP programs using control structures, functions, arrays, and implement error handling mechanisms. .
CO3	Design and implement interactive web applications by handling user input through forms and performing database operations using MySQL with secure coding practices.
CO4	Implement session and cookie management techniques to maintain user state and develop authentication and authorization mechanisms in web applications..

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			2	-	-	-	-	-	-	1
CO2	3	3	2	2	2	-	-	-	1	1	-	1
CO3	3	3	3	3	3	2	1	2	1	2	1	2
CO4	3	3	2	2	3	2	1	3	2	2	1	2

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), End Semester Oral Examination (POE), have 25%, 25% and 50% weightage, respectively.

Assessment Component	Marks
CA1	25
CA2	25
OE	50

CA1 and CA2 are based on practical performance etc. POE is based on 100% Experiments.

Course Contents

Practical No.	List of Experiments	Hours
1	Write a PHP program to find the factorial of a number.	02
2	Write a PHP program to count the total number of words in a string..	02
3	Write a program in PHP to find the occurrence of a word in a string..	02
4	Write a PHP program to demonstrate various functions of regular expression.	02
5	Write a PHP program to find area of triangle and rectangle using functions	02
6	Write a Program for finding the biggest number in an array without using any array Functions..	02
7	Write a Program for finding the smallest number in an array	02
8	Write a PHP program to design a simple calculator.	02
9	Design a simple web page to generate multiplication table for a given number using PHP.	02
10	Design a web page that should compute one's age on a given date using PHP.	02

Text Books			
Sr. No.	Title	Author	Publisher
1	PHP and MySQL Web Development	Luke Welling, Laura Thomson	Addison-Wesley (Pearson)
2	Learning PHP, MySQL & JavaScript	Robin Nixon	O'Reilly Media
3	PHP: The Complete Reference	Steven Holzner	McGraw-Hill Education

Title of the Course: Entrepreneurship and Startup Ecosystem Course Code: 25BCA2401	L	T	P	Credit
	1	1	-	2

Course Prerequisite:

Basic understanding of business concepts and economic principles.

Course Description:

This course provides a comprehensive understanding of entrepreneurship and the dynamics of family businesses. It introduces the concept of entrepreneurship, characteristics of successful entrepreneurs, and different classifications of entrepreneurs. The course highlights the critical role of entrepreneurship in economic development, particularly in the growth of startups and innovation-driven enterprises.

Course Objectives:

1. To understand Entrepreneurship and its types
2. To understand that not all ideas can be turned into viable business models and guestimate business potential of an idea
3. To understand different type of finances available and financing methods
4. To be able to draft business plans on an identified idea
5. To understand the nuances of operating a startup – low budget marketing, stabilizing operations, build a team from scratch and scaling the business
6. To know what is a Family Business and how is it different from Entrepreneurship.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understand basic building blocks of creating a venture
CO2	Be able to identify a business opportunity and translate it into a viable business model
CO3	Identify the elements of the Indian entrepreneurship ecosystem and take relevant benefits from the constituents
CO4	Know the legacy of family businesses and key differentiations from entrepreneurship

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	-	1	1	1	1	2	2	3	2
CO2	2	3	3	2	1	2	1	1	2	2	3	2
CO3	1	2	2	1	1	3	2	2	2	2	3	2
CO4	1	2	2	-	-	2	1	3	2	2	2	2

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and CA2 are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Introduction to Entrepreneurship & Family Business What is Definition and Concept of entrepreneurship, Entrepreneur Characteristics. Classification of Entrepreneurs, Role of Entrepreneurship in Economic Development –Start-ups, Knowing the characteristics of Family business with discussion on few Indian cases of Family Business like Murugappa, Dabur, Wadia, Godrej, Kirloskar etc.	07
2	Evaluating Business opportunity Sources of business ideas and opportunity recognition, Guesstimating the market potential of a business idea, Feasibility analysis of the idea, Industry, competition and environment analysis	07
3	Building Blocks of starting ventures Low cost Marketing using digital technologies, Team building from scratch, Venture Funding, Establishing the value-chain and managing operations, Legal aspects like IPR and compliances .	07

4	Start-up Ecosystem Know the components of the start-up ecosystem including Incubators, Accelerators, Venture Capital Funds, Angel Investors etc. Know various govt. schemes like Start-up India, Digital India, MSME etc. Sources of Venture Funding available in India, Source of Technology, Intellectual Property management	07
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Text Books			
Sr. No.	Title	Author	Publisher
1	Entrepreneurship Development	S. S. Khanka	S. Chand Publishing
2	Entrepreneurship: Successfully Launching New Ventures	Bruce R. Barringer, R. Duane Ireland	Pearson Education
3	Dynamics of Entrepreneurial Development and Management	Vasant Desai	Himalaya Publishing House
Reference Books			
Sr. No.	Title	Author	Publisher
1	Innovation and Entrepreneurship	Peter F. Drucker	Harper Business
2	Family Business in India	Sudipt Dutta	Sage Publications
3	The Lean Startup	Eric Ries	Crown Business
4	Entrepreneurship Development	Poornima M. Charantimath	Pearson Education
5	Start-up India: Stand-up India	Rashmi Bansal	Westland Publications

Title of the Course: Computer Networks	L	T	P	Credit
Course Code: 25BCA2402	3	-	-	3

Course Prerequisite:

1. Basic Networking Knowledge: Familiarity with basic networking concepts such as IP addressing and network topologies.
2. Programming Skills: Ability to write basic network programs and scripts in languages such as Python or C.
3. Operating Systems: Understanding of OS concepts related to networking, such as process management and memory allocation

Course Description:

This course provides a comprehensive introduction to computer networks, focusing on the fundamental concepts, architectures, protocols, and emerging technologies that enable modern communication systems. It begins with an overview of computer networks, their objectives, applications, and key components.

Course Objectives:

1. Understand the fundamental concepts of Computer Networks and their applications.
2. Develop problem-solving skills related to network design, implementation, and troubleshooting.
3. Implement network protocols and configure network devices.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understand the fundamentals of computer networks, network models, topologies, transmission modes, and the functions of networking devices.
CO2	Explain Data Link Layer concepts, Ethernet technologies, IP addressing, subnetting, VLANs, and network protocols used in modern communication systems.
CO3	Analyze Network Layer and Transport Layer operations including routing protocols, NAT, TCP/UDP communication, flow control, and congestion control techniques..
CO4	Apply Application Layer protocols such as HTTP, FTP, SMTP, DNS, and demonstrate the working of network applications including web, email, VoIP, and streaming services.
CO5	Evaluate emerging networking technologies including SDN, NFV, IoT, 5G, network automation, AI in networking, and apply network management and monitoring techniques.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	1	2	-	-	-	-	-	-	1
CO2	3	3	2	2	3	-	-	-	1	1	-	1
CO3	3	3	2	3	3	1	-	-	1	1	1	2
CO4	3	3	2	2	3	2	1	1	1	2	1	2
CO5	3	3	3	3	3	2	2	2	1	2	1	3

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and CA2 are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc. MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents:

Unit No.	Unit Title and Contents	Hours
1	Introduction to Computer Networks Overview of Computer Networks: Definition and Objectives, Applications and Examples Network Components and Architecture Network Models: OSI Model: Layers and Functions, TCP/IP Model: Layers and Functions Comparison between OSI and TCP/IP Models Network Topologies: Physical vs. Logical Topologies, Common Topologies: Star, Ring, Bus, Mesh, Hybrid, Advantages and Disadvantages of Each Topology Data Transmission: Analog vs. Digital Signals, Transmission Modes: Simplex, Half-Duplex, Full-Duplex, Bandwidth and Latency Networking Devices: Routers, Switches, Hubs, Bridges, Gateways, Functions and Configurations of Each Device.	08
2	Data Link Layer and Networking Protocols Data Link Layer Fundamentals: Functions of the Data Link Layer, Framing, Error Detection, and Error Correction, Flow Control Mechanisms. Ethernet: Ethernet Standards and Frame Structure, MAC Addressing and ARP, Ethernet Switching: Basic Concepts and Methods Network Protocols: Introduction to TCP/IP Protocol Suite, IP Addressing: IPv4 and IPv6 Subnetting and CIDR Notation Address Resolution Protocol (ARP): ARP Operation and Table, ARP Spoofing and Security Considerations Virtual LANs (VLANs): Concept of VLANs, VLAN Tagging and Configuration, Benefits and Use Cases	08

3	Network Layer and Transport Layer Network Layer: IP Routing: Static vs. Dynamic Routing, Routing Protocols: RIP, OSPF, BGP, Network Address Translation (NAT) Transport Layer: TCP vs. UDP: Characteristics and Use Cases, TCP Handshake and Connection Management, Flow Control and Congestion Control in TCP Congestion Control Algorithms: Techniques: Slow Start, Congestion Avoidance, Fast Retransmit, Fast Recovery, TCP Variants: TCP Reno, TCP Vegas.	08
4	Application Layer Application Layer Protocols: HTTP/HTTPS: Structure and Operation, FTP, SMTP, POP3, IMAP: Protocols and Uses, DNS: Domain Name System and Resolution Network Applications: Web Browsing, Email Communication, File Transfer, Voice over IP (VoIP) and Streaming.	08
5	Emerging Technologies Software-Defined Networking (SDN), Network Function Virtualization (NFV), Internet of Things (IoT) and Its Impact on Networking Network Management: SNMP: Simple Network Management Protocol, Network Monitoring Tools and Techniques. Future Trends in Networking: 5G and Beyond, Network Automation and Artificial Intelligence in Networking.	08

Text Books			
Sr. No.	Title	Author	Publisher
1	Computer Networks	Andrew S. Tanenbaum,	Pearson Education, 2011.
2	Computer Networking: A Top-Down Approach	James F. Kurose and Keith W. Ross,	8th Edition, Pearson, 2021.

Reference Books			
Sr. No.	Title	Author	Publisher
1	Data Communications and Networking	Behrouz A. Forouzan	5th Edition, McGraw-Hill Education, 2012.
2	Computer Networks: A Systems Approach	Larry L. Peterson and Bruce S. Davie	6th Edition, Morgan Kaufmann, 2019.
3	An Integrated Approach to Computer Networks	Bhavneet Sidhu	Khanna Publishing House, 2023.

Title of the Course:	L	T	P	Credit
Design and Analysis of Algorithms	3	-	-	3
Course Code: 25BCA2403				

Course Prerequisite: Knowledge of Data Structures

Course Description:

This course provides a comprehensive understanding of algorithm design techniques and their efficiency analysis. It introduces the concept of algorithms, their role in problem-solving, and methods to evaluate their performance using time and space complexity.

Course Objectives:

1. This course envisions to impart to students the understanding of basic algorithm designing paradigms.
2. This course introduces the basic knowledge on how to analyse an algorithm.
3. This course expects to enable a student to synthesize efficient algorithms in common design situations and real-life problems.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understand algorithmic fundamentals including time complexity, space complexity, asymptotic notations, and analyze the performance of basic iterative and recursive algorithms.
CO2	Apply Divide and Conquer techniques to design and analyze efficient algorithms such as binary search, merge sort, quick sort, and Strassen's matrix multiplication..
CO3	Design and implement Greedy algorithms for optimization problems including Knapsack, Minimum Spanning Tree, and shortest path problems..
CO4	Apply Dynamic Programming and Graph algorithms to solve complex computational problems such as Floyd-Warshall, 0/1 Knapsack, BFS, DFS, and topological sorting.
CO5	Analyze computational complexity and limitations of algorithmic solutions using Backtracking and concepts of P, NP, NP-Complete, and NP-hard problems.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO10	PO12
CO1	3	3	-	2	2	-	-	-	-	-	-	1
CO2	3	3	3	2	2	-	-	-	1	1	-	1
CO3	3	3	3	3	2	-	-	-	1	1	1	1
CO4	3	3	3	3	3	1	-	-	1	1	1	2
CO5	3	3	2	3	2	1	-	1	-	1	-	3

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and CA2 are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc. MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents:

Unit No.	Unit Title and Contents	Hours
1	Analysis of algorithms What is an algorithm? Design and performance analysis of algorithms, time complexity, space complexity. Asymptotic notations (O , Ω , Θ) to measure growth of a function and application to measure complexity of algorithms. Analysis of sequential search, bubble sort, selection sort, insertion sort, matrix multiplication. Recursion: Basic concept. Analysis of recursive algorithms, Master's theorem.	08
2	The Divide & Conquer Design Technique: The general concept. Binary search, finding the maximum and minimum, merge sort, quick sort. Best and worst case analysis for the mentioned algorithms. Strassen's matrix multiplication. Lower bound for comparison-based sorting.	08
3	The Greedy Design Technique: The general concept. Applications to general Knapsack problem, finding minimum weight spanning trees: Prim's and Kruskal's algorithms, Dijkstra's algorithm for finding single source shortest paths problem.	08
4	The Dynamic Programming Design Technique: The general concept. Computation of Fibonacci series and Binomial coefficients, all pair shortest paths problem (Floyd-Warshall's algorithm), 0/1 Knapsack problem. Algorithms on Graphs: Breadth First Search, Depth First Search, finding connected components, depth first search of a directed graph, topological sorting.	08
5	Limitations of Algorithmic Power: Backtracking Method: n-Queen problem; sum of subsets problem/ Hamiltonian circuit problem/vertex cover problem. Computational Intractability: Overview of non-deterministic algorithms, P, NP, NP-Complete and NP-hard problems.	08

Text Books			
Sr. No.	Title	Author	Publisher
1	Design and Analysis of Algorithms	Gajendra Sharma,	Khanna Publishing House (AICTE Recommended Textbook)
2	Introduction to Algorithms,	Cormen Thomas H., Leiserson Charles E., Rivest Ronald L. and Stein Clifford,	PHI publication, 3rd Edition, 2009.
3	Fundamentals of Computer Algorithms,	Horowitz Ellis, Sahni Sartaj and Rajasekaran Sanguthevar,	University Press (I) Pvt. Ltd., 2012.
4	Introduction to Design and Analysis of Algorithms	Levitin Anany	3rd Edition, Pearson, 2012

Reference Books			
Sr. No.	Title	Author	Publisher
1	The Design & Analysis of Computer Algorithms	Aho Alfred V., Hopcroft John E. & Ullman Jeffrey D.,	Addison Wesley Publications, Boston, 1983
2	Computer Networks: A Systems Approach	Larry L. Peterson and Bruce S. Davie	6th Edition, Morgan Kaufmann, 2019.
3	Algorithm Design,	Kleinberg Jon & Tardos Eva,	Pearson Education, 2006.

Title of the Course: Artificial Intelligence	L	T	P	Credit
Course Code: 25BCA2404	3	-	-	3

Course Prerequisite:

Basic understanding of computer science concepts, including data structures and algorithms. Proficiency in minimum one programming language, such as Python.

Course Description:

This course provides a comprehensive introduction to the fundamental concepts, techniques, and applications of Artificial Intelligence. It focuses on building intelligent systems capable of solving complex problems and making decisions in dynamic environments.

Course Objectives:

- 1 To introduce the fundamental concepts of Artificial Intelligence, including intelligent agents, environments, rationality, and knowledge-based systems.
- 2 To develop an understanding of problem-solving techniques and advanced search algorithms, including uninformed, informed, adversarial, and evolutionary approaches.
- 3 To impart knowledge of logical reasoning, inference mechanisms, planning, and handling uncertainty using probabilistic and fuzzy methods.
- 4 To familiarize students with major domains and real-world applications of AI such as machine learning, computer vision, robotics, NLP, and expert systems, along with ethical considerations.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understand the characteristics of rational agents, and the environment in which they operate, and gain insights about problem-solving agents.
CO2	Gain insights about Uninformed and Heuristic search techniques and apply them to solve search applications.
CO3	Appreciate the concepts of knowledge representation using Propositional logic and Predicate calculus and apply them for inference/reasoning.
CO4	Obtain insights about Planning and handling uncertainty through probabilistic reasoning and fuzzy sets.
CO5	Obtain a basic understanding of the AI domains and their applications and examine the legal and ethical issues of AI

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	-	-	-	-	-	-	1
CO2	3	3	3	2	3	-	-	-	1	1	-	1
CO3	3	3	2	3	2	1	-	-	-	1	-	2
CO4	3	3	2	3	3	1	1	-	1	1	1	2
CO5	3	2	2	2	2	3	2	3	1	2	1	3

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and CA2 are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Introduction to AI What is AI? Intelligent Agents: Agents and environment, the concept of Rationality, the nature of environment, the structure of Agents. Knowledge-Based Agents: Introduction to Knowledge-Based Agents, The Wumpus World as an Example World. Problem-solving: Problem-solving agents.	08
2	Advanced Search Techniques Uninformed Search: DFS, BFS, Iterative Deepening Search. Informed Search: Best First Search, A* search, AO* search. Adversarial Search & Games: Two-player zero-sum games, Minimax Search, Alpha-Beta pruning. Constraints and Constraint Satisfaction Problems (CSPs), Backtracking search for CSP. Introduction to evolutionary algorithms, Genetic algorithms, Applications of evolutionary search in AI.	08
3	Evolutionary Search Techniques Introduction Overview and applications, Comparison with classical optimization Basics of Evolutionary Computation, Population, chromosomes, fitness, Selection, crossover, mutation, Genetic Algorithms (GA) Operators and selection strategies ,Applications Evolution Strategies (ES),Mutation and selection (μ, λ) and $(\mu + \lambda)$ strategies ,Genetic Programming (GP),Tree representation Program evolution	08

4	Logical Reasoning and Uncertainty Logic: Propositional logic, First-order predicate logic, Propositional versus first-order inference, Unification and lifting. Inference: Forward chaining, Backward chaining, Resolution, Truth maintenance systems. Introduction to Planning: Blocks World problem, Strips; Handling Uncertainties: Non-monotonic reasoning, Probabilistic	08
5	Domains and Applications of AI Domains in AI: Introduction to Machine Learning, Computer Vision, Robotics, Natural Language Processing, Deep Neural Networks, and their Applications. Expert Systems: The architecture and role of expert systems include two case studies. Legal and Ethical Issues: Concerns related to AI.	08

Text Books			
Sr. No.	Title	Author	Publisher
1	Classical Approach to Artificial Intelligence	M.C. Trivedi,	Khanna Publishing House (AICTE Recommended Textbook)
2	Artificial Intelligence: A new Synthesis	Nilsson Nils J	Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4.
3	Introduction to Artificial Intelligence & Expert Systems	Dan W Patterson,	PHI Learning 2010.
4	Data Science with Artificial Intelligence, Machine Learning and Deep Learning,	Rajiv Chopra	Khanna Book Publishing Company, 2024.

Reference Books			
Sr. No.	Title	Author	Publisher
1	Introduction to AI and Machine Learning	M.C. Trivedi,	Khanna Book Publishing Company, 2024
2	Artificial Intelligence - A Modern Approach	Russell, S. and Norvig, P.,	3rd edition, Prentice Hall
3	Constraint Satisfaction Problems: Algorithms and Applications. Springer	Van Hirtum	A. & Kolski, C. (2020).

4	Machine Learning and Machine Intelligence	Rajiv Chopra,	Khanna Book Publishing Company, 2024.
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Title of the Course: : Professional Elective II A) Data Visualization	L	T	P	Credit
Course Code: 25BCA2405A	3	0	0	3

Course Prerequisite: Knowledge on basics of mathematical & Statistical concepts such as arithmetic, percentages, averages, and basic algebra.

Course Description:

This course provides a foundational understanding of data analytics, focusing on the collection, processing, and interpretation of data to support decision-making. It introduces different types of data—structured, unstructured, and semi-structured—and explains how they are analyzed to extract meaningful insights.

Course Objectives:

- 1 To introduce the fundamental concepts of data analytics, including types of data (structured, unstructured, semi-structured) and various forms of data analytics.
- 2 To develop an understanding of data collection methods, data sources, and preprocessing techniques such as data cleaning, transformation, and handling missing values and outliers.
- 3 To emphasize the importance of ethical considerations in data analytics and responsible use of data in real-world scenarios.
- 4 To explore practical applications of data analytics across industries such as finance, marketing, and operations through case-based discussions.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understand the fundamentals of data visualization and its importance in decision-making.
CO2	Apply basic charting techniques (bar, line, pie, scatter, histogram, box plots) to represent data effectively.
CO3	Build and use spreadsheet models for decision making & Communicate data insights effectively
CO4	Create advanced visualizations like heatmaps, tree maps, word clouds, geospatial maps, and interactive dashboards.
CO5	Analyze real-world datasets, design dashboards, and communicate insights through projects and case studies.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	1	-	-	-	-	1	-	2
CO2	2	3	2	1	3	-	-	-	-	1	-	1
CO3	2	2	3	2	3	1	-	-	1	3	2	1
CO4	2	2	3	2	3	-	1	-	1	2	1	2
CO5	2	3	3	3	3	1	1	1	2	3	2	2

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and CA2 are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents:

Unit No.	Unit Title and Contents	Hours
1	Introduction to Data Visualization Importance and applications of data visualization Types of data: categorical, numerical, time-series Basic principles of effective visualization, Overview of visualization tools and software	08
2	Charts and Graphs Bar charts, column charts, and pie charts Line charts and area charts, Scatter plots and bubble charts, Histograms and box plots, Choosing the right chart for the data	08
3	Advanced Visualization Techniques: Heatmaps, tree maps, and word clouds, Geospatial visualization (maps), Interactive dashboards Time-series and trend visualization	08
4	Tools and Technologies Microsoft Excel/ Google Sheets visualization features, Introduction to Tableau / Power BI , Python libraries: Matplotlib, Seaborn, Plotly Data preprocessing for visualization	08
5	Case Studies and Projects Analyzing business, social, and scientific data, designing dashboards for real-world datasets, Best practices in presenting data insights Mini-project: Visualization of dataset using Python or Tableau	08

Text Books			
Sr. No.	Title	Author	Publisher
1	Beginner's Guide for Data Analysis using R Programming”	Jeeva Jose	Khanna Publishing House, 2024.
2	Data Analytics	V.K. Jain	Khanna Book Publishing Company, 2024
3	Excel Data Analysis For Dummies"	Stephen L. Nelson and E. C. Nelson, John	Wiley & Sons; 3rd edition, 2016 .
4	Data Analysis Using Microsoft Excel	Michael R. Middleton	Thomson, Brooks/Cole, 3rd edition , 2004

Reference Books			
Sr. No.	Title	Author	Publisher
1	Excel 2019 Bible	Michael Alexander, Richard Kusleika, and John Walkenbach	John Wiley & Sons, 25 Sept 2018
2	Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics	Cliff T Ragsdale	Cengage learning asia pet. 2015
3	Mastering Excel	WebTech Solutions	Khanna Publishing House, 2024.

Title of the Course: Professional Elective II B) Introduction to Machine Learning Course Code: 25BCA2405B	L	T	P	Credit
	3	-	-	3

Course Prerequisite:

Basic knowledge of statistics and probability. Familiarity with fundamental programming concepts and proficiency in Python.

Course Description:

This course provides a comprehensive introduction to machine learning concepts, techniques, and applications. It focuses on enabling students to understand how machines learn from data and make predictions or decisions without explicit programming.

Course Objectives:

- 1 To introduce the fundamental concepts of Machine Learning, including its history, types (supervised, unsupervised, semi-supervised, and reinforcement learning), and real-world applications.
- 2 To develop an understanding of supervised learning techniques, including regression and classification methods, and model evaluation using performance metrics such as accuracy, precision, recall, F1-score, and AUC.
- 3 To impart knowledge of key machine learning algorithms such as Naïve Bayes, K-Nearest Neighbors, Decision Trees, Artificial Neural Networks, Perceptron, and Support Vector Machines.
- 4 To explore unsupervised learning techniques such as clustering (K-Means, Hierarchical Clustering, DBSCAN) and methods to validate clustering performance.
- 5 To emphasize ethical considerations in machine learning and analyze real-world applications through case-based discussions.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understand the fundamentals of Machine Learning, types of learning techniques, and their real-world applications along with the ML workflow.
CO2	Apply supervised learning techniques such as regression and classification algorithms to solve predictive analytics problems.
CO3	Analyze and implement unsupervised learning techniques including clustering and dimensionality reduction for data analysis and pattern discovery.
CO4	Understand the fundamentals of neural networks, deep learning concepts, activation functions, and backpropagation techniques.
CO5	Use Machine Learning tools and Python libraries for data preprocessing, feature engineering, model development, and implementation of real-world ML applications through mini-projects.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	1	-	-	-	1	-	2
CO2	3	3	2	2	3	-	-	-	1	1	-	1
CO3	2	3	2	3	3	1	-	-	1	1	-	2
CO4	3	2	2	2	3	-	-	-	1	1	-	2
CO5	2	3	3	3	3	1	1	1	2	3	2	3

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and CA2 are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents:

Unit No.	Unit Title and Contents	Hours
1	Introduction to Machine Learning Definition and importance of ML ,Types of ML: Supervised, Unsupervised, Reinforcement, Applications of ML in real life ML workflow: data collection, preprocessing, training, evaluation	08
2	Supervised Learning Regression: Linear, Polynomial, Classification: Logistic Regression, k-NN, Decision Trees, Random Forest Model evaluation: Accuracy, Precision, Recall, F1-score.	08
3	Unsupervised Learning Clustering: k-Means, Hierarchical Clustering, Dimensionality Reduction: PCA (Principal Component Analysis) Anomaly detection and market segmentation	08
4	Neural Networks and Deep Learning Introduction to Neural Networks, Perceptron and Multilayer Perceptron (MLP), Activation functions and backpropagation Basics of Deep Learning	08
5	Machine Learning Tools and Applications Python libraries: scikit-learn, TensorFlow, Keras ,Data preprocessing and feature engineering, Real-world applications: healthcare, finance, recommendation systems ,Mini-project: ML solution implementation	08

Text Books			
Sr. No.	Title	Author	Publisher
1	Machine Learning and Machine Intelligence	Rajiv Chopra	Khanna Publishing House, 2024.
2	Introduction to Machine Learning	Jeeva Jose	O'Reilly Media, Inc.
3	Machine Learning	Mitchell T.	McGraw-Hill.
4	Fundamentals of Data Science: Theory and Practice	Kalita, J. K., Bhattacharyya, D. K., & Roy, S.	Elsevier. ISBN9780323917780

Reference Books			
Sr. No.	Title	Author	Publisher
1	Machine Learning: The Art and Science of Algorithms that Make Sense of Data.	Flach, P. A.	Cambridge University Press. ISBN: 9781107422223, 2012.
2	Pattern classification (2Ed)	Duda, R. O., Hart, P. E., Stork, D	John Wiley & Sons, ISBN-13: 978-8126511167.
3	Deep Learning with Python	Chollet, F.	Manning Publications
4	Pattern Recognition and Machine Learning	Bishop, C. M.	Springer.

Title of the Course: Professional Elective II	L	T	P	Credit
Web Programming -II	3	-	-	3
Course Code: 25BCA2405C				

Course Prerequisite: Basic understanding of Java, HTML and JavaScript.

Course Description:

This course provides a comprehensive understanding of web application development using Java technologies. It covers both fundamental web concepts and advanced enterprise-level development techniques required to build scalable and secure web applications.

Course Objectives:

- 1 Explain fundamental web concepts including HTTP, URLs, web architecture, HTML, CSS, JavaScript, and Java-based server-side programming concepts such as servlets and request–response handling.
- 2 Develop dynamic web applications using Java Servlets and JSP, including session management, cookies, filters, listeners, and implementation of MVC architecture.
- 3 Design and implement database-driven web applications using JDBC, connection pooling, JavaBeans, and CRUD operations for persistent data management.
- 4 Build and integrate web services using RESTful and SOAP-based architectures, applying standards such as JSON, XML, JAX-RS, and WSDL for interoperability.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understand the fundamentals of web technologies including HTTP, URLs, request- response cycle, and client-server architecture.
CO2	Develop basic web pages using HTML5, CSS3, and JavaScript for form handling and user interaction.
CO3	Apply core Java concepts and understand the role of JVM, JDK, and servlets in web application development.
CO4	Design and implement dynamic web applications using Servlets and JSP, including handling requests, responses, sessions, and cookies.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		1	2							1
CO2	3	3	2		3				1	1		2
CO3	3	3	2	2	3				1	1		2
CO4	3	3	3	3	3	2	1	2	2	2	1	3

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and CA2 are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	Foundations of Web & Java Web fundamentals: HTTP, URLs, methods (GET/POST), statelessness - HTML5, CSS3, basic JavaScript for form handling - Introduction to Java for web: JVM, JDK, class basics, servlets overview - Web application architecture: client-server, three-tier architecture - Setting up environment: servlet container (e.g., Tomcat), IDE, workspace - Basic servlet lifecycle, request & response objects, web.xml, annotations	08
2	Servlets in depth Do Get/doPost, sessions, cookies, filters, listeners JavaServer Pages (JSP): syntax, directives, scriptlets (though deprecated), JSP EL & JSTL.	08
3	Introduction to web frameworks in Java Spring MVC, JSF (JavaServer Faces) RESTful web services: design, HTTP methods, JSON, JAX-RS SOAP web services (optional), WSDL, XML based services Security in web apps: authentication, authorization, role-based access, HTTPS Web services integration: consuming & exposing services	08

4	Deployment strategies WAR/EAR files, servlet container vs application server (e.g., Wild Fly, Tomcat) Performance tuning: caching, connection pooling, thread-management, load balancing Modern Java EE / Jakarta EE features: dependency injection, CDI, JPA (Java Persistence API) Microservices architecture in Java web apps (optional) Cloud deployment (optional) – basics of hosting, containers (Docker)	08
5	MVC architecture in Java web apps separating model, view, controller JavaBeans, custom tags, tag libraries Database connectivity: JDBC, connection pooling, CRUD operations Deployment descriptors, context parameters, application lifecycle	08

Text Books			
Sr. No.	Title	Author	Publisher
1	Guide to Web Development with Java	Tim Downey	Covers JSP, Spring MVC, JPA.
2	Web Technologies:	Jeffrey C. Jackson	Covers servlets

Title of the Course: Design Thinking and Innovation Course Code: 25BCA2406	L	T	P	Credit
	1	1	-	2

Course Prerequisite: Basic understanding of problem-solving and critical thinking skills. Interest in innovation, creativity, and user-centered design approaches

Course Description:

This course introduces the principles and practices of design thinking as a human-centered approach to innovation and problem-solving. It focuses on understanding user needs, generating creative ideas, and developing practical solutions to real-world challenges.

Course Objectives:

Operating under turbulent and uncertain business environment, ‘innovation’ has become the key driver of organizational success for all companies. Managers are expected to be leading this change by navigating companies into rapid evolution of new products/services and business models.

The primary focus of DTI is to help learners develop creative thinking skills and apply design based approaches/tools for identifying and implementing innovation opportunities into implementable projects. Following a learning-by-doing approach, the objectives of the course are –

1. Introduce students to design-based thinking approach to solve problems
2. Observe and assimilate unstructured information to well framed solvable problems
3. Introduce student to templates of ideation
4. Understand the importance of prototyping in the innovation journey
5. Implementing innovation projects

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Propose real-time innovative product designs and Choose appropriate frameworks, strategies, techniques during prototype development.
CO2	Know wicked problems and how to frame them in a consensus manner that is agreeable to all stakeholders using appropriate frameworks, strategies, techniques during prototype development.
CO3	Apply empathy and problem-definition techniques to identify real-life and “wicked” problems through observation, interaction, and analysis of user behavior.
CO4	Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3		1	1	1	1	2	2	3	2
CO2	2	3	3	2	1	2	1	1	2	2	3	2
CO3	1	2	2	1	1	3	2	2	2	2	3	2
CO4	1	2	2			2	1	3	2	2	2	2

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and CA2 are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents:

Unit No.	Unit Title and Contents	Hours
1	Basics of Design Thinking Understand the concept of innovation and its significance in business Understanding creative thinking process and problem solving approaches , Know Design Thinking approach and its objective Design Thinking and customer centricity – real world examples of customer challenges, use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product. Discussion of a few global success stories like AirBnB, Apple, IDEO, Netflix etc. Explain the four stages of Design Thinking Process – Empathize, Define, Ideate, Prototype, Implement	07
2	Learning to Empathize and Define the Problem Know the importance of empathy in innovation process – how can students develop empathy using design tools. Observing and assimilating information. Individual differences & Uniqueness Group Discussion and Activities to encourage the understanding, acceptance and appreciation of individual differences. What are wicked problems Identifying wicked problems around us and the potential impact of their solutions.	07

3	Ideate, Prototype and Implement Know the various templates of ideation like brainstorming, systems thinking. Concept of brainstorming – how to reach consensus on wicked problems. Mapping customer experience for ideation . Know the methods of prototyping, purpose of rapid prototyping. Implementation	07
4	Feedback, Re-Design & Re-Crete Feedback loop, focus on User Experience, address ergonomic challenges, user focused design. Final concept testing. Final Presentation – Solving Problems through innovative design concepts & creative solution	07

Text Books			
Sr. No.	Title	Author	Publisher
1	Developing Thinking Skills (The way to Success)	E Balaguruswamy	Khanna Book Publishing Company
2	Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation	Tim Brown,	Harvard Business Review
3	Introduction to Artificial Intelligence & Expert Systems	Dan W Patterson,	PHI Learning 2010.

Reference Books			
Sr. No.	Title	Author	Publisher
1	Design Thinking by Nigel Cross	Nigel Cross	Bloomsbury

Title of the Course: Computer Network Laboratory	L	T	P	Credit
Course Code: 25BCA2402L	--	--	4	2

Course Prerequisite:

Familiarity with basic programming concepts and syntax, preferably in another language, and an understanding of fundamental computer science principles.

Course Description:

A Python Programming laboratory typically covers the fundamentals of programming using the Python language, including data types, control flow, strings, and data structures. It aims to equip learners with the skills to write Python programs, solve computational problems, and potentially apply these skills in fields like data science, web development, or automation.

Course Objectives:

1. To understand and configure basic network settings such as IP addressing, subnet mask, and gateway configuration.
2. To implement and analyze basic network protocols including DNS resolution and HTTP client-server communication using programming tools like Python.
3. To design and simulate network topologies using tools like Cisco Packet Tracer and configure routers and switches in a virtual environment.
4. To measure and analyze network performance using tools such as ping, traceroute, and iperf, and interpret results effectively.
5. To understand and implement VLAN configuration on switches and verify network segmentation using simulation tools..

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Configure basic network settings such as IP address, subnet mask, and gateway for system connectivity.
CO2	Implement and test basic network protocols such as DNS resolution and HTTP client- server communication using Python.
CO3	Design, simulate, and analyze network topologies using Cisco Packet Tracer by configuring routers and switches..
CO4	Measure and evaluate network performance using tools like ping, traceroute, and iperf, and interpret network behavior

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3		1	1	1	1	2	2	3	2
CO2	2	3	3	2	1	2	1	1	2	2	3	2
CO3	1	2	2	1	1	3	2	2	2	2	3	2
CO4	1	2	2			2	1	3	2	2	2	2

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), End Semester Oral Examination (POE), have 25%, 25% and 50% weightage, respectively.

Assessment Component	Marks
CA1	25
CA2	25
POE	50

CA1 and CA2 are based on practical performance etc. POE is based on 100% Experiments.

Course Contents:

Practical No.	List of Experiments	Hours
1	Configure Basic Network Settings: a) IP Address Configuration b) Subnet Mask and Gateway Settings	02
2	Write a simple Python script to perform DNS resolution.	02
3	Implement a basic HTTP client-server application.	02
4	Use network simulation tools (e.g., Cisco Packet Tracer) to design and simulate network topologies.	02
5	Configure routers and switches in a simulated environment.	02
6	Performance Measurement: a) Measure network performance using tools like `ping`, `tracert`, and `iperf`. b) Analyze network traffic using Wireshark	02

7	Deploy basic web server and configure HTTP/HTTPS access.	02
8	Perform vulnerability scanning and analyze results.	02
9	Diagnose and resolve common network issues.	02
10	Use troubleshooting commands and techniques to fix connectivity problems	02

Text Books			
Sr. No.	Title	Author	Publisher
1	Computer Networking: A Top-Down Approach	James F. Kurose, Keith W. Ross	Pearson Education
2	Data Communications and Networking	Behrouz A. Forouzan	McGraw-Hill Education
3	Computer Networks	Andrew S. Tanenbaum, David J. Wetherall	Pearson Education

Reference Books			
1	Network Security Essentials	William Stallings	Pearson Education
2	Practical Packet Analysis	Chris Sanders	No Starch Press

Title of the Course: Data Visualization Laboratory	L	T	P	Credit
Course Code: 25BCA2405L	--	--	4	2

Course Prerequisite:

Familiarity with basic programming concepts and syntax, preferably in another language, and an understanding of fundamental computer science principles.

Course Description:

A Python Programming laboratory typically covers the fundamentals of programming using the Python language, including data types, control flow, strings, and data structures. It aims to equip learners with the skills to write Python programs, solve computational problems, and potentially apply these skills in fields like data science, web development, or automation.

Course Objectives:

1. To understand the basics of business intelligence and install and configure Microsoft Power BI Desktop for data analysis and reporting.
2. To explore the Power BI interface including workspace components such as ribbon, panes, and canvas for report development.
3. To import and integrate data from multiple sources such as Excel and CSV files for data analysis.
3. To perform data cleaning and transformation using Power Query Editor, including handling missing values and removing duplicates.
4. To apply data transformation techniques such as merging, appending queries, and creating custom/calculated columns..

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Create and customize interactive visualizations such as bar charts, line charts, pie charts, and other graphical representations.
CO2	Develop calculated columns and measures using DAX for advanced data analysis in Microsoft Power BI Desktop.
CO3	Publish and share reports and dashboards using Power BI Service.
CO4	Schedule data refresh and manage user permissions for secure and updated business reports.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1		2				1	1		2
CO2	2	3	2	1	3				1	1		2
CO3	1	2	2	3	3		1		1	2		2
CO4	2	2	3	2	2	1	1	2	3	2	1	3

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), End Semester Oral Examination (POE), have 25%, 25% and 50% weightage, respectively.

Assessment Component	Marks
CA1	25
CA2	25
POE	50

CA1 and CA2 are based on practical performance .

POE is based on 100% Experiments.

Course Contents

Practical No.	List of Experiments	Hours
1	Install Power BI and explore its interface including ribbon, panes, and canvas.	02
2	Import data from Excel, CSV, and multiple data sources into Power BI.	02
3	Create basic reports using different visual elements and save the reports.	02
4	Perform data cleaning and transformation using Power Query Editor	02
5	Apply data transformation techniques such as splitting columns, changing data types, and renaming fields.	02
6	Merge and append queries and create custom and calculated columns..	02
7	Create relationships between tables and resolve data inconsistencies in data models..	02
8	Develop calculated columns and measures for data analysis.	02
9	Create and customize visualizations including bar, line, pie, and area charts.	02
10	Publish reports to Power BI Service, share dashboards, and manage data refresh and permissions.	02

Text Books			
Sr. No.	Title	Author	Publisher
1	Microsoft Power BI Data Analyst	Microsoft	Microsoft Press
2	Beginning Microsoft Power BI	Dan Clark	Apress
3	The Definitive Guide to DAX	Marco Russo, Alberto Ferrari	Microsoft Press

Reference Books			
1	Learn Power BI	Greg Deckler	Packt Publishing
2	Pro Power BI Desktop	Adam Aspin	Apress

Title of the Course: Introduction to ML	L	T	P	Credit
Laboratory				
Course Code: 25BCA2405L	-	-	4	2

Course Prerequisite:

Understanding of machine learning algorithms and concepts (e.g., classification, clustering, regression). Proficiency in Python programming, with experience using libraries such as NumPy, pandas, Scikit-Learn, NLTK, Matplotlib, and Seaborn.

Course Description:

A Python Programming laboratory typically covers the fundamentals of programming using the Python language, including data types, control flow, strings, and data structures. It aims to equip learners with the skills to write Python programs, solve computational problems, and potentially apply these skills in fields like data science, web development, or automation.

Course Objectives:

1. To understand and apply regression techniques such as linear and logistic regression for predictive modeling and classification tasks.
2. To implement and evaluate supervised learning algorithms including Decision Tree, Naïve Bayes, Random Forest, and Support Vector Machine for classification problems.
3. To apply unsupervised learning techniques such as K-Means, Hierarchical Clustering, and DBSCAN for grouping and pattern discovery in data.
4. To understand and implement dimensionality reduction techniques such as Principal Component Analysis (PCA) for feature optimization and performance improvement.
5. To design and implement simple neural network models like single-layer perceptron using TensorFlow / Keras for basic classification problems..

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Apply regression techniques such as linear regression and logistic regression to model and analyze real-world datasets and visualize results effectively..
CO2	Implement and evaluate supervised learning algorithms including Decision Tree (ID3/CART), Naïve Bayes, Random Forest, and Support Vector Machine for classification problems..
CO3	Apply unsupervised learning techniques such as K-Means, Hierarchical Clustering, and DBSCAN for clustering and pattern discovery in datasets.
CO4	Perform dimensionality reduction using Principal Component Analysis (PCA) and analyze the impact on classification performance..

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1		2				1	1		2
CO2	2	3	2	1	3				1	1		2
CO3	1	2	2	3	3		1		1	2		2
CO4	2	2	3	2	2	1	1	2	3	2	1	3

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), End Semester Oral Examination (POE), have 25%, 25% and 50% weightage, respectively.

Assessment Component	Marks
CA1	25
CA2	25
POE	50

CA1 and CA2 are based on practical performance etc. POE is based on 100% Experiments

Course Contents

Practical No.	List of Experiments	Hours
1	Implement linear regression on a dataset and visualize the regression line.	02
2	Implement logistic regression on a binary classification dataset and plot the decision boundary..	02
3	Implement and evaluate the performance of Decision tree ID3/Cart classifier for any given dataset.	02
4	Implement and evaluate the performance of the Naive Bayes Classifier on a given dataset.	02
5	Build and evaluate a random forest classifier using a numerical dataset.	02
6	Implement a support vector machine for linearly separable classes and visualize the margins and decision boundary.	02
7	Implement K-Means clustering on a point dataset and visualize and evaluate the clusters.	02
8	Implement hierarchical clustering on a dataset and plot the dendrogram.	02
9	Implement DBSCAN clustering on a dataset and visualize and evaluate the clusters.	02
10	Perform Principal Components Analysis (PCA) and apply any one or more classifiers to show the performance variation with or without feature reduction.	02

Text Books			
Sr. No.	Title	Author	Publisher
1	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	O'Reilly Media
2	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer
3	Machine Learning	Tom M. Mitchell	McGraw-Hill

Reference Books			
1	Introduction to Machine Learning with Python	Andreas C. Müller, Sarah Guido	O'Reilly Media
2	Python Machine Learning	Sebastian Raschka, Vahid Mirjalili	Packt Publishing

Title of the Course: Web Programming II Laboratory	L	T	P	Credit
Course Code: 25BCA2405L	--	--	4	2

Course Prerequisite:

Familiarity with basic programming concepts and syntax, preferably in another language, and an understanding of fundamental computer science principles.

Course Description:

A Python Programming laboratory typically covers the fundamentals of programming using the Python language, including data types, control flow, strings, and data structures. It aims to equip learners with the skills to write Python programs, solve computational problems, and potentially apply these skills in fields like data science, web development, or automation.

Course Objectives:

1. To understand the setup and configuration of Java web development environment using Java Development Kit, Apache Tomcat, and an IDE, and deploy basic servlet applications.
2. To develop dynamic web applications using Servlets, and demonstrate handling of client requests using GET and POST methods.
3. To design interactive web applications with form validation, session management, and user authentication mechanisms.
4. To build dynamic web pages using JSP, Expression Language (EL), and JSTL, and compare them with servlet-based implementations.
5. To implement the MVC (Model-View-Controller) architecture using JavaBeans, Servlets, and JSP for structured web application development..

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Install and configure the Java web development environment using Java Development Kit and Apache Tomcat, and deploy basic servlet applications.
CO2	Develop dynamic web applications using Servlets to handle client requests and responses using GET and POST methods.
CO3	Design web applications with form handling, session tracking, and user authentication mechanisms.
CO4	Create dynamic web pages using JSP, Expression Language (EL), and JSTL for efficient presentation of data.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1		2				1	1		2
CO2	2	3	2	1	3				1	1		2
CO3	1	2	2	3	3		1		1	2		2
CO4	2	2	3	2	2	1	1	2	3	2	1	3

Assessment Scheme:

Two components of Continuous Assessment (CA-1, CA-2), End Semester Oral Examination (POE), have 25%, 25% and 50% weightage, respectively.

Assessment Component	Marks
CA1	25
CA2	25
POE	50

CA1 and CA2 are based on practical performance etc.

POE is based on 100% Experiments.

Course Contents

Practical No.	List of Experiments	Hours
1	Install JDK, Tomcat, and an IDE, configure the server, and deploy a simple “Hello World” servlet.	02
2	Create a servlet to display form data using GET and POST methods, demonstrate doGet() and doPost(), and print client request parameters on a web page.	02
3	Design a login form with user validation, maintain session data across multiple pages, and implement logout functionality	02
4	Develop a JSP page to accept user input, use Expression Language (EL) and JSTL tags to display dynamic data, and compare the output with a servlet-based implementation.	02
5	Implement an MVC-based student registration system using JavaBean as Model, Servlet as Controller, and JSP as View.	02
6	Connect JSP/Servlets to a MySQL database, perform CRUD operations to store and retrieve records, and implement proper exception handling and connection pooling	02
7	Create a filter for user authentication or logging, and use a servlet context listener to initialize global application settings.	02
8	Develop a RESTful web service using JAX-RS that returns JSON responses, implement GET and POST methods, and test the API using Postman or a browser.	02
9	Implement form-based authentication with role-based access control (admin/user) and restrict access to resources using web.xml or annotations.	02
10	Develop and deploy a complete Java web application integrating Servlets, JSP, JDBC, MVC, and authentication features, and test it on the Tomcat server.	02

Text Books			
Sr. No.	Title	Author	Publisher
1	Head First Servlets and JSP	Kathy Sierra, Bert Bates	O'Reilly Media
2	Java Servlet and JSP Cookbook	Bruce W. Perry	O'Reilly Media
3	Beginning Java EE 7	Antonio Goncalves	Apress

Reference Books			
1	Professional Java for Web Applications	Nicholas S. Williams	Wrox Publications
2	Murach's Java Servlets and JSP	Joel Murach, Michael Urban	Murach Publications

Title of the Course: Artificial Intelligence Laboratory Course Code: 25BCA2404L	L	T	P	Credit
	--	-	4	2

Course Prerequisite:

Basic understanding of algorithms and data structures (e.g., trees, graphs, lists). Proficiency in Python programming, including libraries like NLTK for NLP tasks

Course Description:

This course provides hands-on experience in implementing fundamental Artificial Intelligence (AI) techniques and algorithms using practical problem-solving approaches. It focuses on developing the ability to design and implement intelligent systems across various domains.

Course Objectives:

- 1 To understand and implement basic AI problem-solving techniques using search algorithms such as Breadth-First Search (BFS) and Depth-First Search (DFS).
- 2 To apply informed and optimization-based search techniques such as Hill Climbing and A* search for solving real-world problems.
- 3 To develop solutions for classical AI problems like the Water Jug problem using appropriate search strategies.
- 4 To implement adversarial search techniques such as the Minimax algorithm for decision-making in game environments.
- 5 To solve Constraint Satisfaction Problems (CSPs) using backtracking and constraint propagation techniques (e.g., 4-Queens and Magic Square problems).

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Apply Uninformed Search Algorithms and Implement Heuristic Search techniques
CO2	Analyze and Solve Constraint Satisfaction Problems
CO3	Develop Rule-Based Systems.
CO4	Implement and Evaluate Optimization Techniques
CO5	Apply and illustrate the NLP concepts

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2				1	1		2
CO2	3	3	3	3	2				1	1		2
CO3	3	3	3	2	2			2	1	1	1	2
CO4	3	3	3	3	3				1	1	1	2
CO5	3	3	2	3	3				1	2		2

Assessment Scheme:

Two components of in semester evaluation (CA1 and CA2) having 50% weightage of course contents and POE is having 50% weightage of total course contents.

Assessment Component	Marks
CA1	25
CA2	25
POE	50

CA1 and CA2 are based on practical performance etc. POE is based on 100% Experiments.

Course Contents

Practical No.	List of Experiments	Hours
1	Demonstrate basic problem-solving using Breadth-First Search on a simple grid.	02
2	Implement Depth-First Search (DFS) on a small graph.	02
3	Solve the Water Jug Problem using Breadth First Search (BFS).	02
4	Apply the A* Search algorithm to find the shortest path in a 4x4 grid	02
5	Solve the 4 – Queens Problem as a CSP backtracking problem	02
6	Use constraint propagation to solve a Magic Square puzzle	02
7	Apply optimization techniques to find the maximum value in a list. .	02
8	Represent and evaluate propositional logic expressions.	02
9	Implement a basic rule-based expert system for weather classification.	02
10	Implement a basic AI agent with simple decision-making rules	02

Text Books

Sr. No.	Title	Author	Publisher
1	Artificial Intelligence: A Modern Approach	Stuart Russell	Pearson
2	Artificial Intelligence	Elaine Rich	McGraw Hill

Reference Books			
Sr. No.	Title	Author	Publisher
1	Artificial Intelligence: Foundations of Computational Agents	M.N. Avadhanulu, A.A. Dani, P.M. Pokley.	S. Chand & Company Ltd., Delhi
2	Artificial Intelligence Using Python	Prateek Joshi	Packt