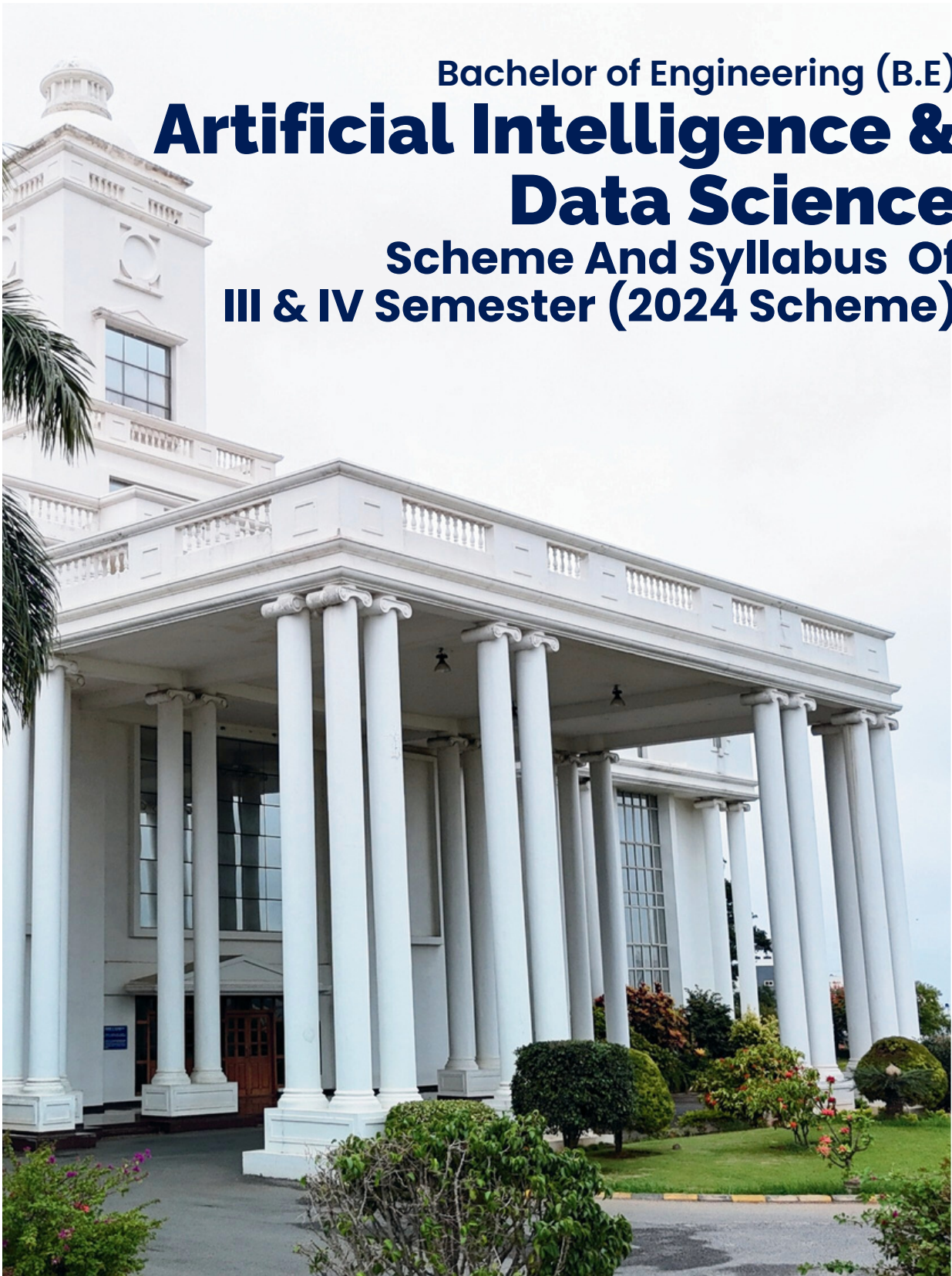


Bachelor of Engineering (B.E) **Artificial Intelligence & Data Science** Scheme And Syllabus Of III & IV Semester (2024 Scheme)



BE Programs: CSE, ISE, AI&DS, ECE, CS-AI&ML, EEE, ME, CE, AE, AI&ML

PG Programs: M.Tech (CSE), M.Tech(Structural Engg.), MBA

Ph.D Programs: VTU Affiliated Research Centers in Engineering

ACADEMIC YEAR 2025-26

DEPARTMENT VISION

To achieve high levels of quality education by utilizing cutting-edge technology, cultivating a collaborative culture, and propagating customer-focused innovations in order to benefit society as a whole.

DEPARTMENT MISSION

1. To strengthen the theoretical and practical aspects of the learning process by strong research culture in collaboration with communities to build healthy and sustainable world.
2. To Contribute towards greater association between academia and businesses to establish entrepreneurship among young minds.
3. Concentrate efforts towards application areas in health care, agriculture, transport and environment.

PROGRAM EDUCATIONAL OBJECTIVES(PEOs)

1. Ability to exhibit professional skills as Data Analysts to develop intelligent solutions for various engineering and science applications. ‘
2. Imbibe passion for life-long learning, innovation, career-growth, leadership qualities, and professional ethics.

3. Efficient team leaders, effective communicators and capable of working in multidisciplinary environment as entrepreneurs and contribute to cutting edge technologies and society.

PROGRAM SPECIFIC OUTCOMES

1. Design, develop and implement applications and system software.
2. Develop intelligent solutions using Data Science technologies to cater the societal needs.

PROGRAM OUTCOMES

PO1: Engineering Knowledge:

Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis:

Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development (WK1 to WK4).

PO3: Design/Development of Solutions:

Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs

with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required (WK5).

PO4: Conduct Investigations of Complex Problems:

Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions (WK8).

PO5: Engineering Tool Usage:

Create, select, and apply appropriate techniques, resources, and modern engineering & IT tools, including prediction, and modelling recognizing their limitations to solve complex engineering problems (WK2 and WK6).

PO6: The Engineer and The World:

Analyse and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment (WK1, WK5, and WK7).

PO7: Ethics:

Apply ethical principles and commit to professional ethics, human values, diversity, and inclusion; adhere to national & international laws (WK9).

PO8: Individual and Collaborative Teamwork:

Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication:

Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and

write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance:

Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning:

Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies, and iii) critical thinking in the broadest context of technological change.



(An Autonomous Institution, affiliated to VTU, Belagavi, recognized by Karnataka and Approved by AICTE, New Delhi.)

Global Academy of Technology

B.E. in Artificial Intelligence and Data Science

Scheme of Teaching and Examinations 2025



III SEMESTER

III SEMESTER													
Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question and Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	BMATS24301	Discrete Mathematics	TD & PSB: MAT	3	0	0	0	03	50	50	100	3
2	IPCC	BAD24302	Operating Systems	TD & PSB: AIDS	3	0	2	0	03	50	50	100	4
3	IPCC	BAD24303	Data Science with Python	TD & PSB: AIDS	3	0	2	0	03	50	50	100	4
4	PCC	BAD24304	Data Structures and its Applications	TD & PSB: AIDS	3	0	0	0	03	50	50	100	3
5	PCCL	BADL24305	Data Structures Lab	TD & PSB: AIDS	0	0	2	0	03	50	50	100	1
6	ETC/PLC	BAD24306x	ETC/PLC	TD & PSB: AIDS	3	0	0	0	03	50	50	100	3
7	UHV	BSCK24307	Social Connect and Responsibility	Any Department	1	0	0	0	01	100	---	100	1
8	AEC/ SEC	BAD24358X	Ability Enhancement Course/Skill Enhancement Course - III	TD & PSB: AIDS	1	0	0	0	01	50	50	100	1
					0	0	2	0	02				
9	MC	BNSK24359	National Service Scheme (NSS)	NSS coordinator	0	0	2	0		100	---	100	0
		BPEK24359	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK24359	Yoga	Yoga Teacher									
		BLAK24359	Liberal Arts	Prominent NGO									
Total									550	350	900	20	

PCC: Professional Core Course, **PCCL:** Professional Core Course laboratory, **UHV:** Universal Human Value Course, **MC:** Mandatory Course (Non-credit), **AEC:** Ability Enhancement Course, **SEC:** Skill Enhancement Course, **L:** Lecture, **T:** Tutorial, **P:** Practical **S= SDA:** Skill Development Activity, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation. K: This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

Dr. R. K. Ravi
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12/06/2024
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Rajarajeshwari Nagar, Bengaluru-90

Emerging Technology Course /Programming Language Course (ETC/PLC)			
BAD24306A	Data Science and Statistics	BAD24306C	Computer Organization and Architecture
BAD24306B	Fuzzy logic and Decision making	BAD24306D	Introduction to Internet of Things
Ability Enhancement Course/Skill Enhancement Course - III			
BAD24358A	Unix Shell Programming	BAD24358C	PHP Programming
BAD24358B	Data Analytics using Excel	BAD24358D	MERN


Head of the Department
 Dept. of Artificial Intelligence & Data Science
 Global Academy of Technology
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 12/06/25
Dean Academic
 Global Academy of Technology,
 Rajarajeshwarinagar, Bengaluru-98



GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka



Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 3	Course Code: BMATS24301	Contact Hrs /week: 4
Course Description: DISCRETE MATHEMATICS		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: BSC		Total no. of Hours = 40
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic algebra and number theory, Fundamental concepts of functions and relations, Introductory set theory and probability concepts from high school mathematics		

1. PREAMBLE ABOUT THE COURSE

This course provides a foundation in discrete mathematical structures that are vital to computer science, information technology, and applied mathematics. The course covers set theory, logic, counting principles, relations, functions, and probability with emphasis on reasoning, proof techniques, and combinatorial problem-solving. Through structured learning and problem-oriented approaches, students will build the mathematical foundation required for algorithm design, data structures, and theoretical computer science.

2. COURSE LEVEL OBJECTIVES

CLO1	Apply set theory and probability concepts.
CLO2	Construct and evaluate logical statements.
CLO3	Use counting principles and combinatorial techniques.
CLO4	Analyze and classify relations and functions.
CLO5	Identify and manipulate different types of functions

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Apply set theory, counting principles, and basic probability concepts to model and solve problems in computer science, including algorithm analysis and data representation.	PO1, PO2, PO5	L3	WK1, WK2, WK3, WK6	8
CO2	Construct and evaluate logical statements using truth tables, rules of inference, and quantifiers to develop valid	PO1, PO2, PO5	L3	WK1, WK2, WK3, WK6	8

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	proofs and verify program correctness.				
CO3	Solve combinatorial problems using counting techniques, permutations, combinations, and mathematical induction to support algorithm design and complexity analysis.	PO1, PO2, PO5	L2	WK1, WK2, WK3, WK6	8
CO4	Analyze relations and their properties using matrices and graphs, and interpret equivalence and partial order relations using Hasse diagrams and partitions in discrete structures.	PO1, PO2, PO5	L4	WK1, WK2, WK3, WK6.	8
CO5	Apply function theory, generating functions, and recurrence relations to model computational processes and analyze recursive algorithms.	PO1, PO2, PO5	L3	WK1, WK2, WK3, WK6	8

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Sets and Subsets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams. Probability, Axioms of probability, Conditional probability, Bayes theorem.	CO1	8
II	Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence, The Laws of Logic Logical Implication: Rules of Inference, Quantifiers, Definitions, and the Proofs of Theorems.	CO2	8
III	Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations: The Binomial Theorem, Combinations with Repetition. The Well Ordering Principle: Mathematical Induction, Recursive Definitions.	CO3	8
IV	Relations and Functions: Cartesian Products and Relations, Properties of Relations, Computer Recognition: Zero-One Matrices and Directed Graphs, Partial Orders: Hasse Diagrams, Equivalence Relations and Partitions.	CO4	8
V	Functions: Plain and One-to-One, Onto Functions. Function Composition and Inverse Functions. Generating function and first order recurrence relation.	CO5	8

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5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Discrete and Combinatorial Mathematics	Ralph P. Grimaldi	Pearson Education	5th	All modules
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44th	All modules
3	Discrete Mathematics and its Applications	Kenneth H. Rosen	McGraw Hill	6th	All modules
4	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th	All modules
	Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks	T Veerarajan	Tata Mc-Graw Hill Co	4 th	All modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

1. <https://nptel.ac.in/courses>
2. <https://swayam.gov.in/nptelonlinecourses.nptel.ac.in/>
3. <https://academicearth.org/online-college-courses/>
4. <https://elearning.vtu.ac.in/>

7. EVALUATION METHODOLOGY

- a) Continuous Internal Evaluation (CIE) = 50 marks
 - b) Semester End Examination (SEE) = 50 marks
- Total = 100 marks

CIE Framework:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50
Grand Total			100

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8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	1			1						
CO2	3	1			1						
CO3	3	1			1						
CO4	3	1			1						
CO5	3	1			1						

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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GLOBAL ACADEMY OF TECHNOLOGY

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Approved by UGC, AICTE and Govt of Karnataka



Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 3	Course Code: BAD24302	Contact Hrs /week: 3
Course Description: OPERATING SYSTEMS		No. of Credits: 4 L : T : P : S = 3:0:2:0
Course Category: IPCC		Total no. of Hours = 52
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic understanding of computer architecture and organization, Understanding of memory management and process concepts		

1. PREAMBLE ABOUT THE COURSE

This subject introduces the fundamental concepts of operating systems, including process management, memory handling, file systems, and concurrency. Students will explore real-world OS mechanisms and their roles in system performance. The lab provides hands-on practice in implementing basic OS functionalities. It builds a solid understanding of system-level software. The course lays a foundation for advanced system programming and resource management. Real-time scenarios and simulations are emphasized.

2. COURSE LEVEL OBJECTIVES

CLO1	To understand the OS services, types of OS and different computing environments.
CLO2	To understand the concept of processes, IPC and multithreading models.
CLO3	To understand scheduling algorithms to compute various scheduling criteria
CLO4	To understand methods for handling deadlock and solve memory management problems using page replacement algorithms.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Identify the operating system structures and services, and recognize the concepts of process management.	PO1,PO2,PO3,PO4, PO9,PO11,PSO1	L2	WK1, WK2, WK6	08
CO2	Demonstrate multithreaded programming and interpret	PO1,PO2,PO3,PO4, PO9,PO11,PSO1	L3	WK1, WK2, WK6	08

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	process synchronization techniques.				
CO3	Examine the optimization of resource utilization using different scheduling algorithms.	PO1,PO2,PO3,PO4, PO9,PO11,PSO1	L4	WK1, WK2, WK6	08
CO4	Distinguish the methods for handling deadlock and compare memory management strategies.	PO1,PO2,PO3,PO4, PO9,PO11,PSO1	L4	WK1, WK2, WK6	08
CO5	Contrast different techniques for management of memory & file resources.	PO1,PO2,PO3,PO4, PO9,PO11,PSO1	L4	WK1, WK2, WK6	07

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Introduction to OS: What Operating Systems Do, Computer-System Organization, Computer-System Architecture, Operating-System Operations, Resource Management, Computing Environments. Operating-System Services: User and Operating-System Interface, System Calls, Operating-System Design and Implementation, Operating-System Structure, Process Management and Threads: Processes, Process Concept	CO1	08
II	Process Management and Threads: Process Scheduling, Operations on Processes, Interprocess Communication, IPC in Shared-Memory Systems, IPC in Message-Passing Systems. Threads: Overview, Multithreading Models. Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.	CO2	08
III	CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms (First Come First Serve, Shortest Job First, Shortest Remaining Time First, Priority Scheduling, Round Robin).	CO3	08
IV	Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance (Safe State, Banker's Algorithm), Deadlock Detection, Recovery from Deadlock.	CO4	08
V	Memory Management: Main Memory management- Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory Hardware -TLB, Page Replacement Algorithms (FIFO, LRU, Optimal Page Replacement). File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection	CO5	07

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Lab Programs:

Sl. No.	Experiments
5.	Implement the fork() and exec() system call using C programming
6.	Implement the wait(), exit() and abort() system call using C programming
7.	Simulate Inter Process Communication techniques: Messages Queues, and Shared Memory using C Programming
8.	Simulate solutions to Producer – Consumer Process Synchronization Problems using C Programming
9.	Simulate the following CPU scheduling algorithm using C Programming i) FCFS ii) SJF iii) SRTF iv) Round Robin v) Priority
10.	Simulate Deadlock detection through Banker's Algorithm using C
11.	Simulate Deadlock Avoidance through Banker's Safety Algorithm
12.	Simulate Deadlock Avoidance through Banker's Resource Request Algorithm
13.	Simulate Contiguous Memory Allocation for i) First Fit ii) Best Fit iii) Worst Fit
14.	Simulate the following Page Replacement Algorithms i) FIFO ii) LRU iii) Optimal Page Replacement

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Operating System Concepts	Abraham Silberschatz, Peter B. Galvin, Greg Gagn,	Wiley	9th Edition.	All modules
2	Operating Systems	William Stallings	Pearson Education	5th Edition	All modules
3	Operating Systems	Ramez Elmasri, A Carrick, David Levine	McGrawHill		All modules
4	Modern Operating System	Andrew S. Tanenbaum	PHI		All modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

15. Operating system overview https://www.tutorialspoint.com/operating_system/os_overview.html
16. Lecture notes on Operating System <https://www.bput.ac.in/lecture-notes-download>
17. Operating System https://en.wikipedia.org/wiki/Operating_system
18. https://www.youtube.com/watch?v=vBURT97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O
19. https://www.youtube.com/watch?v=a2B69vCtjOU&list=PL3-wYxht4yCjpcfUDzTgD_ainZ2K3MUZ&index=2
20. <https://www.coursera.org/learn/os-power-user>
21. <https://www.udacity.com/course/introduction-to-operating-systems--ud923>

7. EVALUATION METHODOLOGY

- a) Continuous Internal Evaluation (CIE) = 50 marks
 - b) Semester End Examination (SEE) = 50 marks
- Total = 100 marks

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CIE Framework:**Semester End Examination (SEE):**

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the Two tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	Laboratory	20	
SEE	Semester End Examination	50	50
Grand Total			100

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	3	3	2				2			1
CO2	3	3	3	2				2			1
CO3	3	3	3	2				2			1
CO4	3	3	3	2				2			1
CO5	3	3	3	2				2			1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	3	
CO2	3	
CO3	3	
CO4	3	
CO5	3	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka



Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 3	Course Code: BAD24303	Contact Hrs /week: 3
Course Description: DATA SCIENCE WITH PYTHON		No. of Credits: 4 L : T : P : S = 3:0:2:0
Course Category: IPCC		Total no. of Hours = 52
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic programming knowledge, Familiarity with data structures (lists, arrays, dictionaries), Understanding of fundamental math concepts (algebra, statistics)		

1. PREAMBLE ABOUT THE COURSE

This subject focuses on using Python as a tool for data analysis and scientific computing. It includes libraries like NumPy, pandas, Matplotlib, and scikit-learn. The lab integrates theoretical concepts with real-world data operations. Students learn preprocessing, visualization, and model development. Emphasis is on solving analytical problems through coding. The course bridges programming and statistics for data insights.

2. COURSE LEVEL OBJECTIVES

CLO1	To build a strong foundation to understand advanced python packages for data science.
CLO2	To understand daily tasks that data scientists tackle.
CLO3	To gain skills needed to implement machine learning, AI, and predictive analytics algorithms.
CLO4	To understand the access to a wide variety of data analysis and data science libraries.
CLO5	To meet industry demand for experts with Python skills.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Identify the fundamentals of NumPy and ndarrays.	PO1,PO2,PO3,PO5,PO6 PO8,PO9,PO10, PO11,PSO1, PSO1	L2	WK5, WK6	08
CO2	Apply the essential features of Pandas to extract and manipulate relevant data.	PO1,PO2,PO3,PO5,PO6 PO8, PO9,PO10, PO11,PSO1, PSO1	L3	WK5, WK6	08

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CO3	Analyze statistical data and represent the results using appropriate graphical methods.	PO1,PO2,PO3,PO5,PO6 PO8,PO9,PO10, PO11,PSO1, PSO1	L4	WK5, WK6	08
CO4	Analyze and evaluate techniques used in data preparation and wrangling to ensure data quality and consistency.	PO1,PO2,PO3,PO5,PO6 PO8,PO9,PO10, PO11,PSO1, PSO1	L4	WK5, WK6	08
CO5	Examine real-world data to apply suitable preprocessing techniques, including for time-series data.	PO1,PO2,PO3,PO5,PO6 PO8,PO9,PO10, PO11,PSO1, PSO1	L4	WK5, WK6	07

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Basics of Numpy Arrays: NumPy Array Attributes The NumPy nd array, A Multidimensional Array Object, Creating nd arrays, Data Types for nd arrays, Arithmetic with NumPy Arrays, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Transposing Arrays and Swapping Axes, Reshaping of Arrays, Aggregations, Universal Functions: Fast Element-Wise Array Functions, Array-Oriented Programming with Arrays, Expressing Conditional Logic as Array Operations, Mathematical and Statistical Methods, Methods for Boolean Arrays, Sorting, Unique and Other Set Logic, File Input and Output with Arrays, Linear Algebra, Pseudorandom Number Generation, Example: Random Walks.	CO1	08
II	Pandas: Installing and using Pandas, Introducing Pandas Objects, Operating on data in pandas. Introduction to pandas Data Structures: Series, DataFrame, Index Objects Essential Functionality, Reindexing, Dropping Entries from an Axis, Indexing, Selection, and Filtering, Integer Indexes, Arithmetic and Data Alignment, Function Application and Mapping, Sorting and Ranking, Axis Indexes with Duplicate Labels. Combining Datasets: Concat, Append, Merge and Join. Working with Time Series	CO2	08
III	Plotting and Visualization: Figures and Subplots, Charts using plot(), pie chart, violin plot, scatter plot, histogram, bar chart, area plot, Quiver plot, Mesh grid, contour plot, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, matplotlib Configuration.	CO3	08

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	Plotting with pandas and seaborn: Three-Dimensional Plotting in Matplotlib, Python Visualization Tools for categorical Variables and Continuous Variables.		
IV	Data Cleaning and Preparation: Handling Missing Data, Filtering Out Missing Data, Filling in Missing Data, Data Transformation, Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Renaming Axis Indexes, Discretization and Binning, Detecting and Filtering Outliers, Computing Indicator/Dummy Variables. Data Wrangling: Join, Combine, and Reshape: Combining and Merging Datasets, Database-Style Data Frame Joins, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap, Reshaping and Pivoting, Reshaping with Hierarchical Indexing, Pivoting “Long” to “Wide”Format, Pivoting “Wide”to “Long”Format.	CO4	08
V	Data Preprocessing: Datasets and Partitions, Underfitting in Machine Learning, Overfitting in Machine Learning, Cross-Validation, Normalization, Data Scaling, Data Integration Outliers’ removal. Time Series Data: Introduction to time series, time series in pandas, time series decomposition and resampling.	CO5	07

Lab Programs:

Sl. No.	Experiments
1	22. Write a Python program to create a one-dimensional NumPy array, a two-dimensional array, and a three-dimensional array. Print their attributes like shape, size, and data type. 23. Write a python program to find mean, median, minimum, maximum, standard deviation, cumulative sum and cumulative product for the following array elements 1,2,3,4,5,6,7,8,9,10 using Numpy array statistical methods
2	1. Write a Python program to create a 3x4 array and then reshape it into a 2x6 array. Also, demonstrate the transpose of the original array 2. Given a 3x3 matrix, extract: The first row The last column The middle element
3	3. Write a python program for indexing, selection and filtering in pandas series and data frames. 4. Write a python program to create pandas data frame from list of list
4	5. Create a DataFrame with student names and their scores in 3 subjects. Access data using .loc[] and .iloc[]. 6. Create a Pandas DataFrame and sort it by column values and index labels.
5	Write a Python program to: 7. Concatenate two DataFrames. 8. Append one DataFrame to another. 9. Merge two DataFrames based on a common column. 10. Perform a left join between two DataFrames

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6	11. Write a program to create bar graph for the given data: data = {'AUDI':23, 'BMW':17, 'FORD':35, 'TESLA':29, 'JAGUAR':12, 'MERCEDES':41} 12. Write a program to create area plot on the given data: x = range (1,6); y1=[1,4,6,8,9]; y2=[2,2,7,10,12]; y3=[3.5,0,1.4,6,1]												
7	Merge two DataFrames based on a common column using merge(). Perform different types of joins: 13. Inner Join 14. Outer Join 15. Left Join 16. Right Join												
8	17. Write a program to demonstrate discretization and binning 18. Convert a long-format DataFrame to wide format												
9	Create a Pandas DataFrame with some missing (NaN) values. Use different techniques to handle missing data: 19. Drop rows with missing values. 20. Drop columns with missing values. 21. Fill missing values with the column mean/median.												
10	Write a python program to sort the following data according to descending order of name <table><tr><td>Name</td><td>Age</td><td>Designation</td></tr><tr><td>Sanjeev</td><td>37</td><td>Manager</td></tr><tr><td>Keshav</td><td>42</td><td>Clerk</td></tr><tr><td>Rahul</td><td>38</td><td>Accountant</td></tr></table>	Name	Age	Designation	Sanjeev	37	Manager	Keshav	42	Clerk	Rahul	38	Accountant
Name	Age	Designation											
Sanjeev	37	Manager											
Keshav	42	Clerk											
Rahul	38	Accountant											

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Python Data Science handbook	Jake Vander Plas	O'Reilly		All Modules
2	Python for Data Analysis	Wes McKinney	O'Reilly.	2nd Edition	All Modules
3	Data Analytics using Python	Bharti Motwani	Wiley		All Modules
4	Introduction to Python Programming	Gowrishankar S, Veena A	CRC Press/Taylor & Francis	1st Edition	All Modules
5	Hands-On Machine Learning with Scikit	Aurelien Geron	O'Reilly Media	2nd Edition	All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

22. Automate The Boring Stuff with Python <https://automatetheboringstuff.com/>
23. Python 3 Tutorial https://www.tutorialspoint.com/python3/python_tutorial.pdf
24. Python 3 for Absolute Beginners <http://index.of.es/Python/Python%203%20for%20Absolute%20Beginners.pdf>
25. <https://www.coursera.org/learn/python-for-applied-data-science-ai>
26. <https://www.edx.org/course/python-basics-for-data-science>
27. <https://cognitiveclass.ai/courses/python-for-data-science>

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7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

CIE Framework:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	Laboratory	20	
SEE	Semester End Examination	50	50
Grand Total			100

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	3	3		2	1		2	2	2	2
CO2	3	3	3		2	1		2	2	2	2
CO3	3	3	3		2	1		2	2	2	2
CO4	3	3	3		2	1		2	2	2	2
CO5	3	3	3		2	1		2	2	2	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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GLOBAL ACADEMY OF TECHNOLOGY

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 3	Course Code: BAD24304	Contact Hrs /week: 3
Course Description: DATA STRUCTURES AND ITS APPLICATIONS		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PCC		Total no. of Hours = 39
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic knowledge of programming concepts, understanding of fundamental algorithms (sorting, searching).		

1. PREAMBLE ABOUT THE COURSE

This course covers essential data structures like arrays, stacks, queues, linked lists, trees, and graphs. It emphasizes algorithm efficiency and real-time applications. Topics focus on memory management and abstract data types. The subject develops skills in problem solving and logic building. Real-world cases like scheduling and pathfinding are discussed. It strengthens the foundation for algorithm design.

2. COURSE LEVEL OBJECTIVES

CLO1	Understand the fundamental concepts of data structures and their importance in algorithm design and problem-solving.
CLO2	Implement various linear data structures such as arrays, linked lists, stacks, and queues for efficient data manipulation.
CLO3	Ability to analyze Binary search trees, Balanced binary search trees.
CLO4	Analyze, evaluate and choose appropriate data structure and algorithmic technique to solve real-world problems

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Apply the concepts of Stacks to solve a problem.	PO1,PO2,PO3,PO4,PO5 PO8,PO11,PSO1, PSO2	L2	WK1, WK2, WK4	8
CO2	Demonstrate the implementation and application of queue data structures, including their	PO1,PO2,PO3,PO4,PO5 PO8,PO11,PSO1, PSO2	L2	WK1, WK2, WK4	8

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	variations, to solve real-world problems				
CO3	Investigate the various types of lists and their application in real world.	PO1,PO2,PO3,PO4,PO5 PO8,PO11,PSO1, PSO2	L2	WK1, WK2, WK4	8
CO4	Analyze and implement binary tree structures to optimize searching, traversal, and hierarchical data representation.	PO1,PO2,PO3,PO4,PO5 PO8,PO11,PSO1, PSO2	L2	WK1, WK2, WK4	8
CO5	Design and develop efficient algorithms using advanced data structures like hash tables, heaps, and balanced trees.	PO1,PO2,PO3,PO4,PO5 PO8,PO11,PSO1, PSO2	L2	WK1, WK2, WK4	7

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Introduction: Introduction to Data Structures, Types of Data Structures, Linear & non-linear Data Structures Stacks: Stack definitions & concepts, Representing stacks in C, Operations on stacks, Applications of Stacks: Infix to Postfix, Infix to Prefix, Postfix expression evaluation Recursion: Introduction to Recursion, Factorial function, Binary search, Towers of Hanoi problem, GCD of two numbers, Tail End recursion.	CO1	08
II	Queues: Representation of queue and its operations operations, circular queues. Priority Queue Dynamic Memory allocation: malloc(), calloc(), free(), realloc() Linked Lists: Definition and terminology, Singly Linked List (SLL), Various operations on SLL: insertion, deletion and display, Multiplication of two polynomial using SLL, Header Node	CO2	08
III	Circular Singly Linked List (CSLL): Definition, Various operations on CSLL: insertion, deletion and display, Application: Addition of long positive integers. Doubly Linked List (DLL) Definition, Various operations on DLL: insertion, deletion and display, Applications: Sparse matrix Trees: Definition, Terminology, Binary Trees (BT), Binary Search Trees (BST): Insertion, Deletion, and Traversals: Preorder, Postorder and Inorder.	CO3	08
IV	Expression Trees (ET): Definition and Construction of Expression Tree Threaded Binary Tree: Types and application. Heap: Definition, Construction, Applications of Heap: Priority Queue	CO4	08

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V	Balanced tree: AVL trees, B tree, B+ tree, Splay tree. Hashing: Open Hashing, Closed Hashing, Collision and Collision Resolution Strategies.	CO5	07
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5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Data Structures using C and C++	Yedidyah Langsam Moshe J. Augenstein and Aaron M. Tenenbaum	PHI/Pearson.	2 nd Edition, 2009	All Modules
2	Data Structures and Algorithm Analysis in C++,.	Mark Allen Weiss	Addison-Wesley, ISBN-13:	4th Revised Edition, 2013,	All Modules
3	Data Structures Using C	ReemaThareja	Oxford Higher Education	1 st Edition, 2011	All Modules
4	Fundamentals of Data Structures,	Ellis Horowitz, SartajSahni	Illustrated Edition, Computer Science Press.		All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE

28. <https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html>
29. <https://ds2-iiith.vlabs.ac.in/List%20of%20experiments.html>
30. <https://archive.nptel.ac.in/courses/106/102/106102064/>
31. <https://www.youtube.com/watch?v=OAc2t3eE6eQ>

7. EVALUATION METHODOLOGY

- a) Continuous Internal Evaluation (CIE) = 50 marks
 - b) Semester End Examination (SEE) = 50 marks
- Total = 100 marks

CIE Framework:

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

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Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50
Grand Total			100

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	3	3	1	2			1			2
CO2	3	3	3	1	2			1			2
CO3	3	3	3	1	2			1			2
CO4	3	3	3	1	2			1			2
CO5	3	3	3	1	2			1			2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1
CO5	2	1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 3	Course Code: BADL24305	Contact Hrs /week: 2
Course Description: DATA STRUCTURES LABORATORY		No. of Credits:1 L : T : P : S = 0:0:2:0
Course Category: Lab		Total no. of Hours = 13
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Understanding of algorithm basics, Familiarity with a programming language (e.g., C, Java, or Python)		

1. PREAMBLE ABOUT THE COURSE

This lab enables students to implement fundamental data structures practically. Exercises include operations on arrays, linked lists, stacks, queues, trees, and graphs. Students gain hands-on coding experience in C/C++. The lab enhances logical thinking and debugging skills. Emphasis is on optimizing data handling techniques. It complements the theoretical concepts for better understanding.

2. COURSE LEVEL OBJECTIVES

CLO1	Understand the fundamental concepts of data structures and their importance in algorithm design and problem-solving.
CLO2	Implement various linear data structures such as arrays, linked lists, stacks, and queues for efficient data manipulation.
CLO3	Ability to analyze Binary search trees, Balanced binary search trees.
CLO4	Analyze, evaluate and choose appropriate data structure and algorithmic technique to solve real-world problems

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Apply the concepts of Stacks to solve a problem.	PO1,PO2,PO3,PO4,PO5 PO8,PO11,PSO1, PSO2	L3	WK2, WK6	3
CO2	Demonstrate the implementation and application of queue data structures,	PO1,PO2,PO3,PO4,PO5 PO8,PO11,PSO1, PSO2	L3	WK2, WK6	3

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	including their variations, to solve real-world problems				
CO3	Investigate the various types of lists and their application in real world.	PO1,PO2,PO3,PO4,PO5 PO8,PO11,PSO1, PSO2	L5	WK2, WK6	3
CO4	Analyze and implement binary tree structures to optimize searching, traversal, and hierarchical data representation.	PO1,PO2,PO3,PO4,PO5 PO8,PO11,PSO1, PSO2	L5	WK2, WK6	2
CO5	Design and develop efficient algorithms using advanced data structures like hash tables, heaps, and balanced trees.	PO1,PO2,PO3,PO4,PO5 PO8,PO11,PSO1, PSO2	L5	WK2, WK6	2

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Sl. No.	Experiments/Programs
1	Develop a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate Overflow and Underflow situations on Stack d. Display the status of Stack f. Exit Support the program with appropriate functions for each of the above operations
2	Develop a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands
3	Develop a Program in C to evaluate of Suffix expression with single digit operands and operators: +, -, *, /, % and ^.
4	Develop recursive program in C to 32. To Find GCD of 2 numbers 33. To Solve the Tower of Hanoi Problem
5	Develop a menu driven Program in C for the following operations on QUEUE of Characters (Array Implementation of QUEUE with maximum size MAX) a. Enqueue an Element on to Queue

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	b. Dequeue an Element from Queue c. Demonstrate Overflow and Underflow situations on Queue d. Display the status of Queue f. Exit Support the program with appropriate functions for each of the above operations
6	Implement a program to multiply two polynomials using singly linked list.
7	Design a doubly linked list to represent sparse matrix. Each node in the list can have the row and column index of the matrix element and the value of the element. Print the complete matrix as the output.
8	Write a C program to create Binary Tree and to traverse the tree using In-order, Preorder and Post order (recursively).
9	Write a C program to implement priority queue using Heap.
10	Write a C program to implement Hashing using Linear probing. Implement insertion, deletion, search and display.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Data Structures using C and C++	Yedidyah Langsam Moshe J. Augenstein and Aaron M. Tenenbaum	2 nd Edition, 2009	PHI/Pearson.	All Modules
2	Data Structures and Algorithm Analysis in C++,.	Mark Allen Weiss	Addison-Wesley, ISBN-13:	4th Revised Edition, 2013,	All Modules
3	Data Structures Using C	ReemaThareja	Oxford Higher Education	1 st Edition, 2011	All Modules
4	Fundamentals of Data Structures,	Ellis Horowitz, SartajSahni	Illustrated Edition, Computer Science Press.		All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE

34. <https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html>
35. <https://ds2-iiith.vlabs.ac.in/List%20of%20experiments.html>

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36. <https://archive.nptel.ac.in/courses/106/102/106102064/>

37. <https://www.youtube.com/watch?v=OAc2t3eE6eQ>

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

CIE Framework:

ASSESSMENT AND EVALUATION PATTERN		
	CIE	SEE
WEIGHTAGE	50%	50%
Record	10	50
Test	20	
Experiential Learning	20	NIL
Total Marks for the Course	50	50

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	3	3	1	2			1			2
CO2	3	3	3	1	2			1			2
CO3	3	3	3	1	2			1			2
CO4	3	3	3	1	2			1			2
CO5	3	3	3	1	2			1			2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1
CO5	2	1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 3	Course Code: BAD24306A	Contact Hrs /week: 3
Course Description: DATA SCIENCE AND STATISTICS		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: ETC/PLC		Total no. of Hours = 39
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic knowledge of programming (preferably Python or R), Understanding of mathematics (algebra, probability, and calculus)		

1. PREAMBLE ABOUT THE COURSE

This subject combines statistical principles with modern data science tools. It covers descriptive and inferential statistics, hypothesis testing, and data visualization. Practical labs apply concepts using Python and statistical software. Students gain skills in exploratory data analysis and model validation. It builds a strong analytical mindset for data-driven decisions. Real-world datasets and case studies are explored.

2. COURSE LEVEL OBJECTIVES

CLO1	To understand the problems solvable with data science
CLO2	Ability to solve problems from a statistical perspective.
CLO3	To build the skills to create data analytical pipelines
CLO4	To bring the familiarity with the data science ecosystem and the various tools needed to continue developing as a data scientist.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Identify key data science principles, classify data types, and summarize pre-processing techniques.	PO1,PO2,PO3, PO5, PO8,PO10,PO11,PSO,PSO2	L2	WK3, WK4	8

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CO2	Apply advanced data mining concepts to extract meaningful information from data.	PO1,PO2,PO3,PO5, PO8,PO10,PO11,PSO,PSO2	L3	WK3, WK4	8
CO3	Analyze descriptive statistics by interpreting measures of central tendency, dispersion, and data visualization techniques.	PO1,PO2,PO3,PO5, PO8,PO10,PO11,PSO,PSO2	L4	WK3, WK4	8
CO4	Interpret and utilize probability distributions and statistical inference methods.	PO1,PO2,PO3,PO5, PO8,PO10,PO11,PSO,PSO2	L4	WK3, WK4	8
CO5	Demonstrate and interpret hypothesis testing using statistical methods	PO1,PO2,PO3,PO5, PO8,PO10,PO11,PSO,PSO2	L4	WK3, WK4	7

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Introduction to Data Science: Evolution of Data Science, Data Science Roles, Lifecycle of Data Science, Representation of Data Science as a Venn Diagram, Technologies revolving around Data Science. Types of Data: Structured and Unstructured Data, Quantitative and Qualitative Data, Four Levels of data (Nominal, Ordinal, Interval, Ratio Level). Data Pre-processing: Asking interesting question, obtaining of data, Exploration of data, Modelling of data, Communication and visualization.	CO1	08
II	Data Mining: What is Data Mining? Types of Data Mining, Challenges of implementation in Data Mining, Advantages and Disadvantages, Applications of Data Mining. Overview of Basic Data Mining Tasks: Classification, Regression, Time Series Analysis, Prediction, Clustering, Sequence Discovery.	CO2	08
III	Basics of Statistics: Introduction to Statistics, Terminologies in Statistics, Measures of center, variance and relative standing, Normalization of data using the z-score, Empirical rule, Categories in Statistics (Descriptive and Inferential Statistics). Descriptive Statistics: Data Objects and Attribute, Basic Statistical Description of Data (Measuring the Central Tendency	CO3	08

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	of Data, Measuring the Dispersion of Data, Graphical Displays), Data Visualization Techniques, Measuring Data Similarity and Dissimilarity.		
IV	Inferential Statistics: Overview of Probability Distributions (Bernoulli, Binomial, Poisson, Chi-square, t-tail), Joint distribution of the Sample Mean and Sample Variance, Confidence Intervals, Bayesian Analysis of samples from Normal Distribution, Fisher Estimator, Central Limit Theorem.	CO4	08
V	Hypothesis Testing: Testing simple hypotheses, Uniform tests, Two-sided alternatives, tTest, F-Distribution, Bayes Test Procedures, Case studies based on Hypothesis Testing.	CO5	07

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Principles of Data Science	Sinan Ozdemir, Sunil Kakade,	Packt Publishing Limited	2nd Edition	All Modules
2	Probability and Statistics	Morris H Degroot, Mark J Schervish	Pearson	4th Edition	All Modules
3	Data Mining Concepts and Techniques	Jiawei Han and Micheline Kamber, Morgan Kaufmann		3rd Edition	All Modules
4	Machine Learning: A probabilistic perspective	Murphy, Kevin P	MIT Press		All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

38. Learn Data Science: Open content for self-directed learning in Data Science: <http://learnds.com/>
39. Foundations of Data Science: <https://www.cs.cornell.edu/jeh/book.pdf>
40. Introduction to Mathematical Thinking: <https://www.coursera.org/learn/mathematical-thinking>
41. IBM Data Science Professional Certificate: <https://www.coursera.org/professional-certificates/ibm-datascience>

7. EVALUATION METHODOLOGY

- a) Continuous Internal Evaluation (CIE) = 50 marks
 - b) Semester End Examination (SEE) = 50 marks
- Total = 100 marks

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CIE Framework:**Semester End Examination (SEE):**

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

Continuous Internal Evaluation (CIE):

Two tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50
Grand Total			100

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	3	3		2			2		2	2
CO2	3	3	3		2			2		2	2
CO3	3	3	3		2			2		2	2
CO4	3	3	3		2			2		2	2
CO5	3	3	3		2			2		2	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	3
CO2	2	3
CO3	2	3
CO4	2	3
CO5	2	3

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 3	Course Code: BAD24306B	Contact Hrs /week: 3
Course Description: FUZZY LOGIC AND DECISION MAKING		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: ETC/PLC		Total no. of Hours = 39
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic knowledge of mathematics (sets, relations, and logic), Understanding of classical/probabilistic logic and reasoning.		

1. PREAMBLE ABOUT THE COURSE

This subject introduces fuzzy sets, logic systems, and approximate reasoning. It explores decision-making under uncertainty and vagueness. Applications in control systems, AI, and expert systems are covered. The focus is on modeling real-life ambiguity in data. It enhances understanding of soft computing techniques. Theoretical grounding is provided for intelligent system design.

2. COURSE LEVEL OBJECTIVES

CLO1	Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
CLO2	Provide an emphasis on the differences and similarities between fuzzy sets and classical sets theories.
CLO3	Explain the concepts of fuzzy logic and decision systems.
CLO4	Enable students to Solve problems that are appropriately solved by fuzzy logic

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Outline the fundamental principles of fuzzy sets and fuzzy logic.	PO1,PO2,PO3, PO5, PO6,PO8,PO11,PSO1,PSO2	L2	WK4, WK5	08
CO2	Employ basic fuzzy inference and approximate reasoning concepts.	PO1,PO2,PO3, PO5, PO6,PO8,PO11,PSO1,PSO2	L3	WK4, WK5	08
CO3	Analyze and examine fuzzy classification	PO1,PO2,PO3, PO5, PO6,PO8,PO11,PSO1,PSO2	L4	WK4, WK5	08

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	algorithms on real data.				
CO4	Examine and test the basic fuzzy system modeling methods.	PO1,PO2,PO3, PO5, PO6,PO8,PO11,PSO1,PSO2	L4	WK4, WK5	08
CO5	Analyze principles of fuzzy decision techniques to solve real-world problems.	PO1,PO2,PO3, PO5, PO6,PO8,PO11,PSO1,PSO2	L4	WK4, WK5	07

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets: Classical Sets, Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions, Fuzzy Sets, Fuzzy Set Operations, Properties of Fuzzy Sets, Alternative Fuzzy Set Operations, Fuzzy Arithmetic.	CO1	08
II	Classical Relations and Fuzzy Relations: Cartesian Product, Crisp Relations, Cardinality of Crisp Relations, Operations on Crisp Relations, Properties of Crisp Relations, Composition, Fuzzy Relations, Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition, Tolerance and Equivalence Relations, Crisp Equivalence Relation, Crisp Tolerance Relation, Fuzzy Tolerance and Equivalence Relations, Value Assignments, Cosine Amplitude, Max–Min Method.	CO2	08
III	Properties of Membership Functions, Fuzzification, and Defuzzification: Features of the Membership Function, Various Forms, Fuzzification, Defuzzification to Crisp Sets, λ -Cuts for Fuzzy Relations, Defuzzification to Scalars. Development of Membership Functions: Membership Value Assignments, Intuition, Inference, Inductive Reasoning	CO3	08
IV	Fuzzy Classification: Classification by Equivalence Relations, Cluster Analysis, Cluster Validity, c-Means Clustering, Hard c-Means (HCM), Fuzzy c-Means (FCM), Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering	CO4	08
V	Decision-Making with Fuzzy Information and Applications of FS: Fuzzy Synthetic Evaluation, Fuzzy Ordering, Nontransitive Ranking Preference and Consensus, Multi objective Decision Making, Fuzzy Bayesian Decision Method, Decision Making Under Fuzzy States and Fuzzy Actions. Applications of Fuzzy Systems: Fuzzy TOPSIS, Fuzzy AHP (Geometric and Mean method).	CO5	07

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5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Fuzzy Sets and Fuzzy Logic with Engineering Applications	Timothy J. Ross	Wiley	4th Edition	All Modules
2	Principles of Soft Computing	S. N Sivanandam, S.N Deepa	Wiley	3rd Edition	All Modules
3	Neuro-Fuzzy and Soft Computing	J.S. R. Jang, C.-T. Sun, and E. Mizutani	Prentice Hall.		All Modules
4	Fuzzy sets Fuzzy logic	Klir, G. J and Yuan B.B	Prentice Hall of India Pvt. Ltd., New Delhi.		All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

42. Fuzzy Sets by Lotfi A. Zadeh

43. <https://www.udemy.com/course/fuzzy-logic/>

44. <https://www.udemy.com/course/intro-to-fuzzy-logic-and-artificial-intelligence/>

45. https://onlinecourses.nptel.ac.in/noc20_ge09/preview

46. <https://www.coursera.org/lecture/children-literacy/fuzzy-logical-model-of-perception-ZT8ZJ>

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

CIE Framework:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

Continuous Internal Evaluation (CIE):

Two tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50
Grand Total			100

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	2	3		3	2		2			2
CO2	3	2	3		3	2		2			2
CO3	3	2	3		3	2		2			2
CO4	3	2	3		3	2		2			2
CO5	3	3	3		3	2		2			2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BAD24306C	Contact Hrs /week: 3
Course Description: COMPUTER ORGANISATION AND ARCHITECTURE		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: ETC/PLC		Total no. of Hours = 39
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic understanding of digital electronics (logic gates, circuits), Knowledge of basic computer fundamentals (CPU, memory, input/output devices)		

1. PREAMBLE ABOUT THE COURSE

This subject explores CPU architecture, memory hierarchy, instruction cycles, and control units. Students learn how computers execute instructions at the hardware level. Emphasis is on internal data flow and design principles. Concepts like pipelining and addressing modes are introduced. It builds a base for systems and embedded programming. Performance metrics are analyzed.

2. COURSE LEVEL OBJECTIVES

CLO1	To understand basic structure of computer and instructions.
CLO2	To know input/output communications with processor.
CLO3	To analyse different memories.
CLO4	To understand basic arithmetic operations used in ALU design.
CLO5	To know the complete working of processing unit.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Understand the basic structure of computers, functional units, instruction sequencing, and arithmetic operations.	PO1,PO2,PO3,PO4, PO6,PO8,PO11,PS01	L2	WK2, WK4	8
CO2	Apply assembly programming, addressing modes, and basic I/O operations including interrupts and DMA.	PO1,PO2,PO3,PO4, PO6,PO8,PO11,PS01	L3	WK2, WK4	8

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CO3	Analyze the fundamental concepts of memory systems, including RAM, ROM, memory hierarchy, and virtual memory.	PO1,PO2,PO3,PO4, PO6,PO8,PO11,PS01	L4	WK2, WK4	8
CO4	Examine and implement efficient arithmetic operations such as fast addition, multiplication, and floating-point computations	PO1,PO2,PO3,PO4, PO6,PO8,PO11,PS01	L4	WK2, WK4	8
CO5	Analyze the Basic Processing Unit, instruction execution, bus organization, and control unit design.	PO1,PO2,PO3,PO4, PO6,PO8,PO11,PS01	L4	WK2, WK4	7

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Basic structure of computers and instructions: Functional Units, Basic operational concepts, Performance, Number representation and arithmetic Operations, Number representation and arithmetic Operations, Character representation, Memory locations and addresses, Memory Operations, Instruction and instruction sequencing.	CO1	8
II	Assembly languages and input/output operations: Addressing modes, Assembly Languages, basic I/O Operations, Accessing I/O Devices, Interrupts, Direct Memory Access, Buses.	CO2	8
III	Memory Systems: Basic concepts, semiconductor RAM Memories, ROM Memories, Memory hierarchy, memory mappings and virtual memory.	CO3	8
IV	Arithmetic Operations: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Signed Numbers, Fast Multiplication: Bit-Pair Recoding of Multipliers, Carry-Save Addition of Summands, Integer Division, Floating Point Numbers and Operations: Implementing Floating-Point Operations.	CO4	8
V	Basic Processing Unit: Some Fundamental Concepts, Execution of complete Instruction, Multiple bus organization, Hardwired Control and Microprogrammed control.	CO5	7

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5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Computer Organization	Carl Hamacher, Zvonko Vranesic, Safwat Zaky	McGraw-Hill	6th Edition	All Modules
2	Computer Organization and Design	David A. Patterson, John L. Hennessy	The Hardware / Software Interface ARM Edition	4th Edition	All Modules
3	Computer Organization & Architecture	William Stallings	PHI	7th Edition	All Modules
4	Computer Systems Design and Architecture	Vincent P. Heuring & Harry F. Jordan	John Willey & Sons	2nd Edition	All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

47. <https://os.ecci.ucr.ac.cr/ci0114/material/Stallings/Computer-Organization-Architecture-11th.pdf>
48. https://engineering.futureuniversity.com/BOOKS%20FOR%20IT/%5BMostafa_Abd-El-Barr_Hesham_El-Rewini%5D_Fundamenta%28BookZZ.org%29.pdf
49. <https://unidel.edu.ng/focelibrary/books/Computer%20Organisation%20and%20Architecture%20by%20Smruti%20Ranjan%20Sarangi%20%28z-lib.org%29.pdf>

7. EVALUATION METHODOLOGY

- a) Continuous Internal Evaluation (CIE) = 50 marks
 - b) Semester End Examination (SEE) = 50 marks
- Total = 100 marks

CIE Framework:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Two tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50

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Grand Total	100
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8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	3	3	2				2			1
CO2	3	3	3	2				2			1
CO3	3	3	3	2				2			1
CO4	3	3	3	2				2			1
CO5	3	3	3	2				2			1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	3	
CO2	3	
CO3	3	
CO4	3	
CO5	3	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 3	Course Code: BAD24306D	Contact Hrs /week: 3
Course Description: INTRODUCTION TO INTERNET OF THINGS		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: ETC/PLC		Total no. of Hours = 39
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic knowledge of electronics and sensors, Exposure to microcontrollers (e.g., Arduino, Raspberry Pi)		

1. PREAMBLE ABOUT THE COURSE

This subject introduces IoT architecture, protocols, sensors, and communication models. It covers device integration and cloud connectivity. Applications in smart cities, healthcare, and industry are discussed. Students learn about data acquisition, security, and IoT standards. Emphasis is on real-world deployments and emerging trends. The course builds a foundation for intelligent connected systems.

2. COURSE LEVEL OBJECTIVES

CLO1	Understand about the fundamentals of Internet of Things and its building blocks along with their characteristics
CLO2	Understand the recent application domains of IoT in everyday life.
CLO3	Gain insights about the current trends of Associated IOT technologies and IOT Analytics
CLO4	Understand the applications of IoT in various domains

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Identify network types, layered models, components and the evolution of IoT.	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO11, PSO1, PSO2	L2	WK5, WK6, WK8	08
CO2	Apply knowledge of sensor and actuator types, characteristics, and considerations to design IoT sensing and actuation systems	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO11, PSO1, PSO2	L3	WK5, WK6, WK8	08

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CO3	Analyze IoT processing topologies and device design considerations to optimize processing and offloading strategies.	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO11, PSO1, PSO2	L3	WK5, WK6, WK8	08
CO4	Apply cloud computing concepts, including virtualization, cloud models, and Sensor-Cloud, and interpret agricultural IoT case studies.	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO11, PSO1, PSO2	L3	WK5, WK6, WK8	08
CO5	Analyze case studies of vehicular and healthcare IoT, and examine emerging trends and the role of IoT analytics.	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO11, PSO1, PSO2	L4	WK5, WK6, WK8	07

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Basics of Networking: Introduction, Network Types, layered network models. Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components	CO1	08
II	IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.	CO2	08
III	IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.	CO3	08
IV	Associated IoT Technologies Cloud Computing: Introduction, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor-Cloud: Sensors-as-a-Service. IoT Case Studies Agricultural IoT – Introduction and Case Studies	CO4	08
V	IoT Case Studies and Future Trends Vehicular IoT: Introduction Healthcare IoT – Introduction, Case Studies IoT Analytics – Introduction	CO5	07

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5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Introduction to IoT	Sudip Misra, Anandarup Mukherjee, Arijit Roy	Cambridge University Press		All Modules
2	Introduction to Industrial Internet of Things and Industry	S. Misra, C. Roy, and A. Mukherjee	CRC	3rd Edition	All Modules
3	Internet of Things (A Hands-on-Approach)	Vijay Madisetti and Arshdeep Bahga		1st Edition	All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE

50. <https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/>

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

CIE Framework:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50
Grand Total			100

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
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COs ↓											
CO1	3	3	3		2			2	2	2	2
CO2	3	3	3		2			2	2	2	2
CO3	3	3	3		2			2	2	2	2
CO4	3	3	3		2			2	2	2	2
CO5	3	3	3		2			2	2	2	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → COs ↓	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: Science & Humanities		
Semester: III	Course Code: BSCK24307	Contact Hrs /week:2
Course Description: Social Connect & Responsibility		No. of Credits:01 L : T : P : S = 0:0:2:0
Course Category: UHV		Total no. of Hours = 15
CIE: 100 Marks	SEE:	Exam Hours:

1. PREAMBLE ABOUT THE COURSE

The *Social Connect & Responsibility* course aims to nurture social awareness, civic responsibility, and environmental sensitivity among students. Through activities like tree plantation, heritage walks, organic farming, and community engagement, students gain hands-on experience in understanding societal needs and contributing to sustainable solutions. The course fosters empathy, teamwork, and leadership, encouraging students to connect classroom learning with real-world impact.

2. COURSE LEVEL OBJECTIVES

CLO1	Provide a formal platform for students to communicate and connect to the surrounding.
CLO2	Create a responsible connection with the society.
CLO3	Understand the community in general in which they work.
CLO4	Identify the needs and problems of the community and involve them in problem – solving.
CLO5	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CLO6	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description
CO1	Communicate and connect to the surrounding.
CO2	Create a responsible connection with the society.
CO3	Involve in the community in general in which they work.

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CO4	Notice the needs and problems of the community and involve them in problem – solving.
CO5	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CO6	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description
I	Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.
II	Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives, Visit, case study, report, outcomes.
III	Organic farming and waste management: Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes.
IV	Water conservation: Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.
V	Food walk: City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 3	Course Code: BAD24358A	Contact Hrs /week: 2
Course Description: UNIX SHELL PROGRAMMING		No. of Credits: 1 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 13
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 02
Course Pre-requisites: Basic knowledge of operating systems and command-line interfaces, Familiarity with file system structure and basic commands in UNIX		

1. PREAMBLE ABOUT THE COURSE

This course teaches Unix/Linux environment and shell scripting. Topics include file handling, filters, process control, and shell customization. Lab sessions provide practical experience in writing bash scripts. Students automate tasks and manage system operations. The course sharpens system-level programming skills. It bridges OS concepts with command-line operations.

2. COURSE LEVEL OBJECTIVES

CLO1	Learn the fundamentals of UNIX architecture, commands, shell scripting, and server management.
CLO2	Gain knowledge of file system operations, file management commands, compression techniques, and file permissions in Unix/Linux environments.
CLO3	Understand file linking concepts and process control mechanisms, including process attributes, states, and job management in Unix/Linux.
CLO4	Learn the fundamentals of shell scripting, including shell interpretation, variables, commands, execution methods, and script automation.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Apply basic UNIX commands to interact with the system and demonstrate understanding of its	PO1,PO2,PO3,PO4, PO8,PO9 PO10,PO11,PSO1	L3	WK6, WK8	6

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	features and architecture.				
CO2	Apply UNIX file handling and permission commands to manage files and control access in a multi-user environment.	PO1,PO2,PO3,PO4, PO8,PO9 PO10,PO11,PSO1	L3	WK6, WK8	4
CO3	Develop shell scripts by applying knowledge of UNIX commands to automate tasks and solve basic problems.	PO1,PO2,PO3,PO4, PO8,PO9 PO10,PO11,PSO1	L3	WK6, WK8	3

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Sl No.	Module Description	Mapped COs	No. of Hours
1	Topics: UNIX architecture, kernel & shell, Types of shells (Bourne, C, Korn, Bash), Basic UNIX commands: ls, pwd, cd, touch, echo To practice on UNIX commands: man, echo, passwd, uname, who, date, cal, banner, tty, pwd, cd, ls, cat, touch, clear, more, wc.	1,2	2
2	Topics: To practice UNIX commands on Vi Editor. Writing a shell script.	1,2	1
3	Topics: File handling in UNIX: mkdir, rmdir, cat, cp, mv, Lab Program: a) Write a shell script to display the current working directory, list all files and display current date and time. b) Write a shell script to create a directory, create a file in it and copy the file to another directory.	1,2	1
4	Topics: File types and permissions, chmod, chown, chgrp, umask, File viewing commands: cat, more, less, head, tail Lab Program: a) Write a shell script that accepts two file names as arguments, checks if the permissions for these files are identical and if the permission are identical, output common permission and otherwise output each file name followed by its permissions.	1,2,3	1

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	b) Shell script to count the number of files and directories in a given path.		
5	Topics: Variables and quoting, Read, command-line arguments \$0, \$1, etc Lab Program: a) Shell script to accept a name from user and greet them with a message. b) Shell script to add two numbers passed as command-line arguments	1,2,3	1
6	Topics: if, if-else, if-elif-else, test and [] expressions Lab Program: a) Shell script to check if a number is even or odd. b) Shell script to check whether a file exists and is readable/writable/executable.	1,2,3	1
7	Topics: While, until, for loops, break, continue Lab Program: a) Shell script to print the multiplication table of a given number. b) Shell script to find factorial of a number using a while loop.	1,2,3	1
8	Topics: Case statement, Menu-driven programs Lab Program: a) Shell script to perform basic arithmetic operations using case. b) Shell script for a menu-driven program to list files, view current directory, and exit.	1,2,3	1
9	Topics: String manipulation: length, substring, comparison, File input/output redirection Lab Program: a) Shell script to check whether a string is a palindrome. b) Shell script to count number of lines, words, and characters in a file.	1,2,3	1
10	Topics: String manipulation: length, substring, comparison, File input/output redirection Lab Program: a) Shell script to check whether a string is a palindrome. b) Shell script to count number of lines, words, and characters in a file.	1,2,3	1
11	Topics: grep, cut, sort, uniq, tr, Using pipes () and redirection Lab Program: a) Shell script to extract usernames from /etc/passwd using grep.	1,2,3	1

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	b) Shell script to remove duplicate lines from a file using sort and uniq.		
12	Topics: Shell scripts a) Write a shell script that accept one or more filenames as argument and convert all of them to uppercase, provided they exist in current directory. b) Write a shell script that displays all the links to a file specified as the first argument to the script. The second argument, which is optional, can be used to specify in which the search is to begin. If this second argument is not present, the search is to begin in current working directory. In either case, the starting directory as well as all its subdirectories at all levels must be searched. The script need not include any error checking.	1,2,3	1

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	UNIX Concepts and Applications	Sumitabha Das	Tata McGraw Hill	4 th Edition	All Modules
2	UNIX & Shell Programming	M.G.Venkatesh Murthy	Pearson Education.	Second Impression	All Modules
3	Linux Command Line and Shell Scripting Bible	Richard Blum, Christine Bresnahan	Wiley,2014	2 nd	All Modules
4	The Complete Reference UNIX	Kenneth Rosen, Douglas Host, Rachel Klee, James Farber, Richard Rosinski	Tata McGRAW-HILL Edition	Second Edition, 6th Reprint	All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE

51. <https://www.youtube.com/watch?v=ffYUfAqEamY>
52. <https://www.youtube.com/watch?v=Q05NZiYFcD0>
53. <https://www.youtube.com/watch?v=8GdT53KDIyY>
54. <https://www.youtube.com/watch?app=desktop&v=3Pga3y7rCgo>

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55. <https://nptel.ac.in/courses/117106113>
 56. <https://infyspringboard.onwingspan.com/>

7. EVALUATION METHODOLOGY

- a) Continuous Internal Evaluation (CIE) = 50 marks
 b) Semester End Examination (SEE) = 50 marks
 Total = 100 marks

ASSESSMENT AND EVALUATION PATTERN		
	CIE	SEE
WEIGHTAGE	50%	50%
Record	25	50
Test	25	
Total Marks for the Course	50	50

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	1	2		2						2
CO2	3	1	2		2						2
CO3	3	1	2		2						2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	1
CO2	2	1
CO3	2	1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka



Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 3	Course Code: BAD24358B	Contact Hrs /week: 2
Course Description: DATA ANALYTICS USING EXCEL		No. of Credits:1 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 13
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 02
Course Pre-requisites: Fundamentals of Microsoft Excel, Mathematics/Statistics Fundamentals		

1. PREAMBLE ABOUT THE COURSE

This course introduces data analysis through Excel tools and functions. It includes pivot tables, charts, statistical formulas, and dashboards. Lab exercises emphasize practical data interpretation and decision-making. Students learn to transform raw data into actionable insights. The course is suitable for business and non-programming backgrounds. Emphasis is on user-friendly analytics

2. COURSE LEVEL OBJECTIVES

CLO1	To Apply analysis techniques to datasets in Excel
CLO2	Learn how to use Pivot Tables and Pivot Charts to streamline your workflow in Excel
CLO3	Understand and identify the principles of data analysis
CLO4	Become adept at using Excel functions and techniques for analysis
CLO5	Build presentation ready dashboards in Excel

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Use advanced functions and productivity tools to assist in developing worksheets.	PO1,PO2,PO3,PO5,PO8 PO9,PO11,PSO1, PSO2	L2	WK2, WK4, WK6	3
CO2	Understand how to import data and format data for data analysis	PO1,PO2,PO3,PO5,PO8 PO9,PO11,PSO1, PSO2	L3	WK2, WK4, WK6	3

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CO3	Implement data lists using Outline and PivotTable features.	PO1,PO2,PO3,PO5,PO8 PO9,PO11,PSO1, PSO2	L4	WK2, WK4, WK6	3
CO4	Analyze data consolidation techniques to compile and report results across multiple worksheets	PO1,PO2,PO3,PO5,PO8 PO9,PO11,PSO1, PSO2	L4	WK2, WK4, WK6	2
CO5	Implement Macros and Autofilter to solve the given real world scenario.	PO1,PO2,PO3,PO5,PO8 PO9,PO11,PSO1, PSO2	L4	WK2, WK4, WK6	2

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Sl. No.	EXPERIMENTS
57.	Getting Started with Excel: Creation of spread sheets, Insertion of rows and columns, Drag & Fill, use of Aggregate functions.
58.	Working with Data: Importing data, Data Entry & Manipulation, Sorting & Filtering.
59.	Working with Data: Data Validation, Pivot Tables & Pivot Charts.
60.	Data Analysis Process: Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs. Data Analysis Process:
61.	Cleaning Data with Text Functions: use of UPPER and LOWER, TRIM function, Concatenate.
62.	Cleaning Data Containing Date and Time Values: use of DATEVALUE function, DATEADD and DATEDIF, TIMEVALUE functions.
63.	Conditional Formatting: formatting, parsing, and highlighting data in spreadsheets during data analysis.
64.	Working with Multiple Sheets: work with multiple sheets within a workbook is crucial for organizing and managing data, perform complex calculations and create comprehensive reports.
65.	Create worksheet with following fields: Empno, Ename, Basic Pay(BP), Travelling Allowance(TA), Dearness Allowance(DA), House Rent Allowance(HRA), Income Tax(IT), Provident Fund(PF), Net Pay(NP). Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
66.	Create worksheet on Inventory Management: Sheet should contain Product code, Product name, Product type, MRP, Cost after % of discount, Date of purchase. Use appropriate formulas to calculate the above scenario. Analyze the data using appropriate chart and report the data.

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67.	Create worksheet on Sales analysis of Merchandise Store: data consisting of Order ID, Customer ID, Gender, age, date of order, month, online platform, Category of product, size, quantity, amount, shipping city and other details. Use of formula to segregate different categories and perform a comparative study using pivot tables and different sort of charts.
68.	Generation of report & presentation using Auto filter & macro.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Data Analysis with Microsoft Excel	Berk Carey &	Cengage Learning,	Third Edition.	All Modules
2	Microsoft Excel 2019: Data Analysis And Business Modeling	Wayne L. Winston	PHI		All Modules

6. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

ASSESSMENT AND EVALUATION PATTERN		
	CIE	SEE
WEIGHTAGE	50%	50%
Record	10	50
Test	20	
Experiential Learning	20	NIL
Total Marks for the Course	50	50

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7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	2	3	2		2			1	2		2
CO2	2	3	2		2			1	2		2
CO3	2	3	2		2			1	2		2
CO4	2	3	2		2			1	2		2
CO5	2	3	2		2			1	2		2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	3
CO2	2	3
CO3	2	3
CO4	2	3
CO5	2	3

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 3	Course Code: BAD24358C	Contact Hrs /week: 2
Course Description: PHP PROGRAMMING		No. of Credits: 1 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 13
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 02
Course Pre-requisites: Basic understanding of HTML and CSS, Knowledge of web browsers and how websites work		

1. PREAMBLE ABOUT THE COURSE

This subject introduces server-side scripting with PHP and MySQL integration. It covers form handling, sessions, cookies, and dynamic content creation. Lab work involves building basic web applications. Students learn about secure coding and web interaction. It supports backend development fundamentals. Real-world applications like CMS and e-commerce are explored

2. COURSE LEVEL OBJECTIVES

CLO1	To introduce the PHP syntax, elements, and control structures
CLO2	To make use of PHP Functions and File handling
CLO3	To illustrate the concept of PHP arrays and OOPs

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Recognize basic concepts of PHP to develop web program	PO1,PO2,PO3,PO4,PO5,PO8 PO9,PO11,PSO1, PSO2	L2	WK3	3
CO2	Implement programs in PHP involving control structures	PO1,PO2,PO3,PO4,PO5,PO8 PO9,PO11,PSO1, PSO2	L3	WK3	3
CO3	Implement programs to handle structured	PO1,PO2,PO3,PO4,PO5,PO8 PO9,PO11,PSO1, PSO2	L3	WK3	3

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	data (object) and data items (array)				
CO4	Execute programs to access and manipulate contents of files	PO1,PO2,PO3,PO4,PO5,PO8 PO9,PO11,PSO1, PSO2	L3	WK3	2
CO5	Demonstrate super-global arrays and regular expressions to solve real world problems.	PO1,PO2,PO3,PO4,PO5,PO8 PO9,PO11,PSO1, PSO2	L3	WK3	2

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Sl. No.	EXPERIMENTS
69.	a. Develop a PHP program to calculate areas of Triangle and Rectangle. b. Develop a PHP program to calculate Compound Interest
70.	Demonstrating the various forms to concatenate multiple strings Develop program(s) to demonstrate concatenation of strings: (i) Strings represented with literals (single quote or double quote) (ii) Strings as variables (iii) Multiple strings represented with literals (single quote or double quote) and variables (iv) Strings and string variables containing single quotes as part string contents (v) Strings containing HTML segments having elements with attributes
71.	a. Develop a PHP Program(s) to check given number is: (i) Odd or even (ii) Divisible by a given number (N) (iii) Square of another number b. Develop a PHP Program to compute the roots of a quadratic equation by accepting the coefficients. Print the appropriate messages.
72.	a. Develop a PHP program to find the square root of a number by using the newton's algorithm. b. Develop a PHP program to generate Floyd's triangle.
73.	a. Develop a PHP application that reads a list of numbers and calculates mean and standard deviation. b. Develop a PHP application that reads scores between 0 and 100 (possibly including both 0 and 100) and creates a histogram array whose elements contain the number of scores between 0 and 9, 10 and 19, etc. The last "box" in the histogram should include scores between 90 and 100. Use a function to generate the histogram.

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74.	a. Develop PHP program to demonstrate the date() with different parameter options. b. Develop a PHP program to generate the Fibonacci series using a recursive function.
75.	Develop a PHP program to accept the file and perform the following 76. Print the first N lines of a file 77. Update/Add the content of a file
78.	Develop a PHP program to read the content of the file and print the frequency of occurrence of the word accepted by the user in the file
79.	Develop a PHP program to filter the elements of an array with key names. Sample Input Data: 1st array: ('c1' => 'Red', 'c2' => 'Green', 'c3' => 'White', 'c4' => 'Black') 2nd array: ('c2', 'c4') Output: Array ([c1] => Red [c3] => White)
80.	Develop a PHP program that illustrates the concept of classes and objects by reading and printing employee data, including Emp_Name, Emp_ID, Emp_Dept, Emp_Salary, and Emp_DOJ.
81.	a. Develop a PHP program to count the occurrences of Aadhaar numbers present in a text. b. Develop a PHP program to find the occurrences of a given pattern and replace them with a text.
82.	Develop a PHP program to read the contents of a HTML form and display the contents on a browser.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Programming in HTML and PHP	Devid R brooks	Springer International Publishing		All Modules

6. EVALUATION METHODOLOGY

- a) Continuous Internal Evaluation (CIE) = 50 marks
- b) Semester End Examination (SEE) = 50 marks
- Total = 100 marks

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ASSESSMENT AND EVALUATION PATTERN		
	CIE	SEE
WEIGHTAGE	50%	50%
Record	10	50
Test	20	
Experiential Learning	20	NIL
Total Marks for the Course	50	50

7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	2	2	2	3	2			2	2		2
CO2	2	2	2	3	2			2	2		2
CO3	2	2	2	3	2			2	2		2
CO4	2	2	2	3	2			2	2		2
CO5	2	2	2	3	2			2	2		2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1
CO5	2	1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 3	Course Code: BAD24358D	Contact Hrs /week: 2
Course Description: MERN		No. of Credits: 1 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 13
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 02
Course Pre-requisites: Basic knowledge of HTML, CSS, and JavaScript, Understanding of client-server architecture		

1. PREAMBLE ABOUT THE COURSE

This subject covers the full-stack JavaScript development using MongoDB, Express, React, and Node.js. Students learn to build scalable web applications from frontend to backend. Labs focus on real-time projects and component-based development. Emphasis is on REST APIs, routing, and database interaction. It prepares students for full-stack roles. Industry-standard frameworks and tools are used.

2. COURSE LEVEL OBJECTIVES

CLO1	Understand and apply critical web development languages and tools to create dynamic and responsive web application
CLO2	To build server-side applications using Node.js and Express
CLO3	Develop user interfaces with React.js,
CLO4	Manage data using MongoDB, and integrate these technologies to create full stack apps

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Apply the fundamentals of MongoDB, such as data modelling, CRUD operations, and basic queries to	PO1,PO2,PO3,PO5,PO6,PO8 PO9,PO11,PSO1, PSO2	L3	WK4, WK5, WK6	3

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	solve given problem.				
CO2	Implement constructs of Express.js, including routing, software and constructing RESTful APIs to solve real world problems.	PO1,PO2,PO3,PO5,PO6,PO8 PO9,PO11,PSO1, PSO2	L3	WK4, WK5, WK6	3
CO3	Sketch scalable and efficient RESTful APIs using NodeJS.	PO1,PO2,PO3,PO5,PO6,PO8 PO9,PO11,PSO1, PSO2	L3	WK4, WK5, WK6	3
CO4	Examine applications using React, including components, state, props, and JSX syntax.	PO1,PO2,PO3,PO5,PO6,PO8 PO9,PO11,PSO1, PSO2	L4	WK4, WK5, WK6	2
CO5	Interpret the APIs and routing.	PO1,PO2,PO3,PO5,PO6,PO8 PO9,PO11,PSO1, PSO2	L3	WK4, WK5, WK6	2

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Sl. No.	EXPERIMENTS
83.	Using MongoDB, create a collection called transactions in database usermanaged (drop if it already exists) and bulk load the data from a json file, transactions.json b. Upsert the record from the new file called transactions_upsert.json in Mongoddb.
84.	Query MongoDB with Conditions: [Create appropriate collection with necessary documents to answer the query] a. Find any record where Name is Somu b. Find any record where total payment amount (Payment.Total) is 600. c. Find any record where price (Transaction.price) is between 300 to 500. d. Calculate the total transaction amount by adding up Payment.Total in all records.
85.	a. Write a program to check request header for cookies. b. Write node.js program to print a car object property, delete the second property and get length of the object.

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86.	a. Read the data of a student containing usn, name, sem, year_of_admission from node js and store it in the mongodb b. For a partial name given in node js, search all the names from mongodb student documents created in Question(a)
87.	Implement all CRUD operations on a File System using Node JS
88.	Develop the application that sends fruit name and price data from client side to Node.js server using Ajax
89.	Develop an authentication mechanism with email_id and password using HTML and Express JS (POST method)
90.	Develop two routes: find_prime_100 and find_cube_100 which prints prime numbers less than 100 and cubes less than 100 using Express JS routing mechanism
91.	Develop a React code to build a simple search filter functionality to display a filtered list based on the search query entered by the user.
92.	Develop a React code to collect data from rest API.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node	Vasan Subramanian	PHI	1st Edition	All Modules
2	MERN Quick Start Guide	Eddy Wilson Iriarte Koroliova	Packt Publishing		All Modules

6. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

ASSESSMENT AND EVALUATION PATTERN		
	CIE	SEE
WEIGHTAGE	50%	50%
Record	10	50
Test	20	
Experiential Learning	20	NIL
Total Marks for the Course	50	50

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7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2		1	1		2	2		2
CO2	2	2	2		1	1		2	2		2
CO3	2	2	2		1	1		2	2		2
CO4	2	2	2		1	1		2	2		2
CO5	2	2	2		1	1		2	2		2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → COs ↓	PSO1	PSO2
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1
CO5	2	1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: Science and Humanities		
Semester: 3 to 6	Course Code: BNSK24359/459/559/659	Contact Hrs /week: 1
Course Description: National Service Scheme (NSS)		No. of Credits: 0 L : T : P : S = 0:0:2:0
Course Category: MC		Total no. of Hours = 24
CIE: 100 Marks		

COURSE LEVEL OBJECTIVES

CLO1	Understand the community in general in which they work.
CLO2	Identify the needs and problems of the community and involve them in problem – solving
CLO3	Develop among themselves a sense of social & civic responsibility & utilize their knowled in finding practical solutions to individual and community problems.
CLO4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
CLO5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description
CO1	Understand the importance of his / her responsibilities towards society.
CO2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4	Implement government or self-driven projects effectively in the field.
CO5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

SYLLABUS

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Module No.	Module Description
I	National Service Scheme (NSS) – Contents 1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues. 4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education. 7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs. (minimum 5 programs). 10. Social connect and responsibilities. 11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Publisher
1	NSS Course Manual	Published by NSS Cell, VTU Belagavi
2	Government of Karnataka, NSS cell, activities reports and its manual.	
3	Government of India, NSS cell, Activities reports and its manual.	

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Department: Science and Humanities		
Semester: 3 to 6	Course Code: BPEK24359/459/559/659	Contact Hrs /week: 2
Course Description: PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I		No. of Credits: 0 L : T : P : S = 0:0:2:0
Course Category: MC		Total no. of Hours = 24
CIE: 100 Marks		

1. SYLLABUS

Module No.	Module Description	No. of Hours
I	A. Lifestyle B. Health & Wellness C. Pre-Fitness test.	4
II	A. Warming up (Free Hand exercises) B. Strength – Push-up / Pull-ups C. Speed – 30 Mtr Dash	4
III	1. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. 2. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.	16

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Department: Science and Humanities		
Semester: 3 to 6	Course Code:BYOK24359/459/559/659	Contact Hrs /week: 02
Course Description: YOGA		No. of Credits: 0 L : T : P : S = 0:0:2:0
Course Category: MC		Total no. of Hours = 24
CIE: 100		

1. SYLLABUS

Course Title	Content
Introduction of Yoga, Aim and Objectives of yoga, Prayer	Yoga, its meaning, definitions. Different schools of yoga, importance of prayer
Brief introduction of yogic practices for common man	Yogic practices for common man to promote positive health.
Rules and regulations	Rules to be followed during yogic practices by practitioner.
Misconceptions of yoga	Yoga its misconceptions
Suryanamaskara	Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar 12 count, 2 rounds.
Different types of Asanas Sitting 1. Padmasana 2. Vajrasana Standing 1. Vrikshana 2. Trikonasana Prone line 1. Bhujangasana 2. Shalabhasana Supine line 1. utthitadvipadasana 2. Ardhalasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits.

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Department: Science and Humanities		
Semester: 3 to 6	Course Code: BMUK359/459/559/659	Contact Hrs /week: 2
Course Description: MUSIC		No. of Credits: 0 L : T : P : S = 0:0:2:0
Course Category: MC		Total no. of Hours = 24
CIE: 100 Marks		

1. COURSE LEVEL OBJECTIVES

1. Identify the major traditions of Indian music, both through notations and aurally.
2. Analyse the compositions with respect to musical and lyrical content.
3. Demonstrate an ability to use music technology appropriately in a variety of setting.

2. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description
CO1	Discus the Indian system of music and relate it to other genres (Cognitive Do main)
CO2	Experience the emotions of composer and develop empathy (Affective Domain)
CO3	Respond to queries on various patterns in a composition (Psycho Motor Domain)

3. SYLLABUS

Module No.	Module Description	No. of Hours
I	Preamble: Contents of the curriculum intend to promote music as language to develop on analytical, Creative, and intuitive Understanding. For this the student through study and direct participation in improvisation. Origin of the Indian Music: Evolution of the Indian music system, Understanding of Shruthi, Nada, Swara. Laya, Raga, Tala, Mela.	3
II	Compositions: Introduction to the types of composition in Carnatic Music Swarajathi, Varna, Krithi, and Thillana, Notation System.	3
III	Composers: Biography and Contributions of Purandaradasa, Thyagaraja.	3

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IV	Music Instruments: Classification and construction of string instruments, percussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instruments.	3
V	Abhyasa Gana: Singing the swara exercises (Sarale Varase Only), Botation writing for Sarale Varase and Suladi Saptha Tala (Only in Mayamalavagowla Raga), Singing 4 Geethe in Malahari, and one jathi Swara, One Krithi in a Mela raga.	4

4. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

Sl. No.	Name of the Book	Author(s)	Publisher	Edition
1	Theory of Music	Vidushi Vasantha Madhavi	Prism Publication	2007
2	Karnataka Sangeetha Dharpana	T Sachidevi and T Sharadha (Thirumalai Sisters)	Shreenivaas Prakaashana	Vol, 1 2018
3	Classical Music of India: A Practical Gulge	Lakshminarayana Subramaniam, Viji Subramaniam	Tranqueber	2018
4	History of South Indian (Carnatic) Music	R Rangaramanuja Ayyangar	Vipanci Charitable Trust,	Third edition 2019
5	The Story of Indian Music and Its Instruments: A Study of the Present and a Record of the Past	Ethel Rosenthal	Pilgrims Publishing	2007

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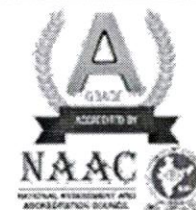


Global Academy of Technology

(An Autonomous Institution, affiliated to VTU, Belagavi, recognized by Karnataka and Approved by AICTE, New Delhi.)

B.E. in Artificial Intelligence and Data Science

Scheme of Teaching and Examinations 2025



IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	BSC	BMATS24401	Probability and Graph Theory	TD & PSB: MAT	3	0	0	0	03	50	50	100	3
2	IPCC	BAD24402	Machine Learning - 1	TD & PSB: AIDS	3	0	2	0	03	50	50	100	4
3	PCC	BAD24403	Design and Analysis of Algorithms	TD & PSB: AIDS	3	0	0	0	03	50	50	100	3
4	PCC	BAD24404	Computer Networks	TD & PSB: AIDS	3	0	0	0	03	50	50	100	3
5	PCCL	BADL24405	Algorithms Laboratory	TD & PSB: AIDS	0	0	2	0	03	50	50	100	1
6	ETC/PLC	BAD24406X	ETC/PLC	TD & PSB: AIDS	3	0	0	0	03	50	50	100	3
7	AEC/ SEC	BAD24457X	Ability Enhancement Course/Skill Enhancement Course- IV	TD & PSB: AIDS	1	0	0	0	01	50	50	100	1
					0	0	2	0	02				
8	BSC	BBOK24407	Biology For Engineers	TD & PSB: BT, CHE	1	0	0	0	01	50	50	100	1
9	UHV	BUHK24408	Universal human values course	Any Department	1	0	0	0	01	50	50	100	1
10	MC	BNSK24459	National Service Scheme (NSS)	NSS coordinator	0	0	2	0		100	---	100	0
		BPEK24459	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK24459	Yoga	Yoga Teacher									
		BLAK24459	Liberal Arts	Prominent NGO									
Total									550	450	1000	20	

PCC: Professional Core Course, **PCCL:** Professional Core Course laboratory, **UHV:** Universal Human Value Course, **MC:** Mandatory Course (Non-credit), **AEC:** Ability Enhancement Course, **SEC:** Skill Enhancement Course, **L:** Lecture, **T:** Tutorial, **P:** Practical **S= SDA:** Skill Development Activity, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation, **K:** This letter in the course code indicates common to all the stream of engineering.

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Bengaluru - 560 093

R. Raju
12/06/25
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Rajarajeshwari Nagar, Bengaluru-93

Emerging Technology Course /Programming Language Course (ETC/PLC)			
BAD24406A	Image Processing	BAD24406C	Object Oriented Programming with C++
BAD24406B	Introduction to Data Mining	BAD24406D	Object Oriented Programming with Java
Ability Enhancement Course / Skill Enhancement Course – IV			
BAD24457A	Data Analytics with R	BAD24457C	Optimization Technique
BAD24457B	Project Management with GIT	BAD24457D	Mastering Data Visualization


Head of the Department
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Dean Academic
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 Rajarajeshwarinagar, Bengaluru-98



GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka



Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BMATS24401	Contact Hrs /week: 4
Course Description: PROBABILITY AND GRAPH THEORY		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: BSC		Total no. of Hours = 40
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: A fundamental understanding of calculus and linear algebra, Basic knowledge of set theory and matrix operations, Introductory familiarity with probability concepts and high school-level statistics.		

1. PREAMBLE ABOUT THE COURSE

This course is designed to equip students with essential tools from **statistics, probability theory, stochastic processes, and graph theory** that form the backbone of data analysis, decision-making, and computational modelling in engineering and scientific domains. The course begins with foundational techniques in data fitting and correlation, progresses through theoretical and applied probability models, and extends to stochastic behaviour analysis and hypothesis testing. The final module introduces students to key concepts in graph theory, enabling them to model complex structures like networks, circuits, and hierarchical data. By integrating classical mathematical techniques with modern applications, this course aims to prepare students to apply these tools in engineering contexts, research problems, and real-world systems modelling.

2. COURSE LEVEL OBJECTIVES

CLO1	Apply statistical techniques such as least squares fitting, correlation, and regression to analyze and interpret data.
CLO2	Evaluate probability models involving discrete and continuous random variables for a variety of engineering and scientific applications.
CLO3	Analyze joint and conditional distributions, and understand the behaviour of stochastic processes and Markov chains.
CLO4	Conduct statistical hypothesis testing using sampling theory and various test statistics (t, chi-square, F) to make informed decisions.
CLO5	Construct and examine graphs and trees, including Euler and Hamiltonian paths, and use these tools in problems involving sorting, coding, and network structures.

3. COURSE OUTCOMES (COs) & COMPETENCIES

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After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Analyze and interpret data using statistical techniques such as curve fitting, correlation, regression, and error estimation to support decision-making in computing and data science.	PO1, PO2, PO5	L4	WK1, WK2, WK3, WK6	8
CO2	Apply discrete and continuous probability distributions to model uncertainty in computer systems and support probabilistic algorithm design	PO1, PO2, PO5	L3	WK1, WK2, WK3, WK6	8
CO3	Evaluate joint, marginal, and conditional distributions, and model dynamic systems using stochastic processes and Markov chains in algorithmic contexts.	PO1, PO2, PO5	L3	WK1, WK2, WK3, WK6	8
CO4	Perform hypothesis testing using sampling distributions and statistical tests (t , χ^2 , F) to draw conclusions from sample data in experimental and research applications.	PO1, PO2, PO5	L4	WK1, WK2, WK3, WK6.	8
CO5	Apply graph theory concepts including Euler and Hamiltonian paths, planar graphs, and tree structures to design and analyze efficient algorithms and data structures..	PO1, PO2, PO5	L3	WK1, WK2, WK3, WK6	8

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Statistics: Introduction, Principles of least squares, fitting of a straight line, second degree parabola, . Karl Pearson's coefficient of correlation, Regression analysis standard error of estimate, rank correlation	CO1	8
II	Random variable, Discrete and continuous random variables, Probability distributions: Binomial, Poisson, exponential, uniform and Normal distributions.	CO2	8
III	Joint distributions, Marginal and conditional distributions, Covariance, Correlation. Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability.	CO3	8

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IV	Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, student's t-distribution, chi-square distribution as a test of goodness of fit, F- test.	CO4	8
V	Graphs, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits. Planar Graphs, Hamiltonian paths and Cycles. Trees, Rooted Trees, Trees and Sorting, Weighted Trees and Prefix Codes.	CO5	8

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44 th	All modules
2	Higher Engineering Mathematics	B.V. Ramana	Tata McGraw-Hill		All modules
3	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th	All modules
4	A Textbook of Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publications	6 th	All modules
	Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks	T Veerarajan	Tata Mc-Graw Hill Co	4 th	All modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

1. <https://nptel.ac.in/courses>
2. <https://swayam.gov.in/nptelonlinecourses.nptel.ac.in/>
3. <https://academicearth.org/online-college-courses/>
4. <https://elearning.vtu.ac.in/>

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

CIE Framework:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

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Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50
Grand Total			100

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	1			1						
CO2	3	1			1						
CO3	3	1			1						
CO4	3	1			1						
CO5	3	1			1						

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BAD24402	Contact Hrs /week: 3
Course Description: MACHINE LEARNING - 1		No. of Credits: 4 L : T : P : S = 3:0:2:0
Course Category: IPCC		Total no. of Hours = 52
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Strong background in statistics (probability distributions, hypothesis testing, regression), Basic knowledge of linear algebra and calculus.		

1. PREAMBLE ABOUT THE COURSE

This subject bridges statistics and machine learning, covering regression, classification, and clustering. Labs involve model implementation using Python tools. Topics include performance metrics and validation techniques. Emphasis is on building interpretable models and handling real-world datasets. Students gain practical ML experience with statistical reasoning. It lays the groundwork for advanced AI applications

2. COURSE LEVEL OBJECTIVES

CLO1	Examine the data for various features, properties, characteristics and assessment of the problem they represent.
CLO2	Learn methods to transform raw data into a form that is ready for application of algorithms.
CLO3	Become conversant with types of Machine Learning Algorithms, their applicability and Inductive Bias.
CLO4	Familiarize with techniques for Dimensionality Reduction and Computational Efficiency.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Understand the data pre-processing techniques used in the data science.	PO1,PO2,PO3,PO4, PO5, PO6, PO9, PO11, PSO1,PSO2	L2	WK4, WK5	8
CO2	Exploring various techniques to handle missing and noisy data.	PO1,PO2,PO3,PO4, PO5, PO6, PO9, PO11, PSO1,PSO2	L2	WK4, WK5	8

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CO3	Apply supervised learning techniques on real-world data using regression algorithms and demonstrate their implementation and outcomes	PO1,PO2,PO3,PO4, PO5, PO6, PO9, PO11, PSO1,PSO2	L3	WK4, WK5	8
CO4	Apply supervised learning techniques on real-world data using classification algorithms and demonstrate their implementation and effectiveness	PO1,PO2,PO3,PO4, PO5, PO6, PO9, PO11, PSO1,PSO2	L3	WK4, WK5	8
CO5	Implement machine learning models to classify data in real-world applications and analyze their performance using appropriate evaluation metrics.	PO1,PO2,PO3,PO4, PO5, PO6, PO9, PO11, PSO1,PSO2	L3	WK4, WK5	7

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Introduction to Machine Learning: Basic steps of ML, Perspectives and Issues, Designing learning systems, Concepts of hypotheses. Datasets and Partitions, Data Pre-processing and Scaling: Different Preprocessing techniques, Data Integration, Outlier removal, artifact removal, Applying Data Transformations, Scaling Training and Test Data the Same Way, Data Normalization, Data Transformation techniques.	CO1	8
II	Dealing With Missing Values: Assumptions and Missing Data Mechanisms, Simple approaches to missing Data, Dealing with Noisy Data: Identifying Noise, Types of Noise Data, Noise filtering at data level. Data Reduction: Curse of Dimensionality, PCA, LDA, Data sampling, Binning	CO2	8
III	Feature Engineering: Feature Extraction, Feature Ranking, Best Features, Feature Selection	CO3	8
IV	Introduction to Supervised learning - Regression Algorithms: Linear Regression, Polynomial Regression, Lasso, Ridge and Elastic nets Regression, Regularization methods, Categorical Variables in Regression, Loss functions, Risk functions. Use Case: Relationship between Buying Intention and Awareness of Electric Vehicles, Application of Technology Acceptance Model in Cloud Computing, Impact of Social Networking Websites on Quality of Recruitment, Transportation optimization, Applications in Smart phones.	CO4	8

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V	Supervised Learning: Classification Algorithms: Supervised Machine Learning Algorithms: Sample Datasets, logistic regression, k-Nearest Neighbors (Regression and Classification) Linear Models: Naive Bayes, Decision Trees. Use Case: Prediction of Customer buying Intension due to Digital Marketing, Measuring Acceptability of a New Product, Predicting phishing websites, loan categorization, Diagnosis and Treatment of Diseases, Security applications	CO5	7
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Lab Programs:

Sl. No.	Lab Programs
5.	Write a program to implement different data imputations in Machine Learning using Python.
6.	Write a program to implement to implement different feature scaling techniques using python
7.	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets
8.	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
9.	For the iris dataset, Implement Logistic Regression and Linear Regression. Plot the following graphs: Accuracy and Loss values per iteration.
10.	Implement ID3 decision tree algorithm using Python
11.	For the diabetics dataset implement Random Forest classifier.
12.	Extract features and perform text classification from unstructured text using Python
13.	Write a program to implement Word2Vec and produce the word embedding using Python.
14.	For the given dataset, develop the recommendation system using PCA.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Data preprocessing in Data Mining	Salvador García, JuliánLuengo Francisco Herrera	Springer		All Modules
2	Introduction to Machine Learning with Python	Sarah Guido, Andreas C. Müller	O' Reilly	1 st Edition 2017	All Modules
3	Bharti Motwani, _Data Analytics using Python		Wiley		All Modules
4	Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms	John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy,	The MIT Press, 2015		All Modules

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5	Introduction to Machine Learning	Ethem Alpaydin	PHI Learning	2nd Edition, 2019	All Modules
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6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

1. Building Machine Learning Systems with Python <http://totoharyanto.staff.ipb.ac.id/files/2012/10/Building-Machine-Learning-Systems-with-Python-RichertCoelho.pdf>
2. Foundations of Machine Learning <https://cs.nyu.edu/~mohri/mlbook/>
3. Understanding Machine Learning: From Theory to Algorithms
<https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine-learning-theoryalgorithms.pdf>
4. <https://www.coursera.org/learn/machine-learning>
5. https://www.udemy.com/course/what-is-machine-learning/?ranMID=39197&ranEAID=JVFxdTr9V80&ranSiteID=JVFxdTr9V80-cIV9JiZ_AJo5kC9cS9TbrQ&LSNPUBID=JVFxdTr9V80&utm_source=aff-campaign&utm_medium=udemyads

7. EVALUATION METHODOLOGY

- a) Continuous Internal Evaluation (CIE) = 50 marks
 - b) Semester End Examination (SEE) = 50 marks
- Total = 100 marks

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	Laboratory	20	
SEE	Semester End Examination	50	50
Grand Total			100

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8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	2	3	3	3	2			2		3
CO2	3	2	3	3	3	2			2		3
CO3	3	2	3	3	3	2			2		3
CO4	3	2	3	3	3	2			2		3
CO5	3	2	3	3	3	2			2		3

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	3
CO2	2	3
CO3	2	3
CO4	2	3
CO5	2	3

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BAD24403	Contact Hrs /week: 3
Course Description: DESIGN AND ANALYSIS OF ALGORITHMS		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PCC		Total no. of Hours = 39
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Strong understanding of data structures (arrays, linked lists, trees, graphs), Knowledge of basic mathematics (discrete mathematics, combinatorics, probability)		

1. PREAMBLE ABOUT THE COURSE

This course focuses on algorithmic techniques like divide-and-conquer, dynamic programming, and greedy methods. Time and space complexity analysis is a key topic. It teaches optimization and efficient problem-solving. Real-world case studies like sorting and searching are discussed. Students enhance logic-building and mathematical rigor. The course is core to computer science foundations.

2. COURSE LEVEL OBJECTIVES

CLO1	To learn mathematical background for analysis of algorithm
CLO2	Analyze the asymptotic performance of algorithms.
CLO3	To understand the concept of designing an algorithm.
CLO4	Synthesize efficient algorithms in common engineering design situations.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Understand the fundamental concepts of algorithms, explore asymptotic notations and apply brute force technique	PO1,PO2,PO3,PO4, PO5, PO8, PO11,PSO1	L2	WK2, WK4	08
CO2	Apply Divide-and-Conquer and Decrease-and-Conquer techniques to design efficient algorithmic solutions for given problems.	PO1,PO2,PO3,PO4, PO5, PO8, PO11,PSO1	L3	WK2, WK4	08

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CO3	Analyze problems to select and apply Dynamic Programming and Transform-and-Conquer techniques for optimizing solutions and enhancing algorithmic efficiency.	PO1,PO2,PO3,PO4, PO5, PO8, PO11,PSO1	L4	WK2, WK4	08
CO4	Evaluate and design efficient solutions for optimization problems using the Greedy Technique, assessing their effectiveness and applicability	PO1,PO2,PO3,PO4, PO5, PO8, PO11,PSO1	L5	WK2, WK4	08
CO5	Evaluate the effectiveness of Backtracking and Branch and Bound techniques in solving complex combinatorial and optimization problems, and justify their appropriate use.	PO1,PO2,PO3,PO4, PO5, PO8, PO11,PSO1	L5	WK2, WK4	07

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Introduction: Notion of algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithmic Efficiency: Analysis frame work, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms. Brute Force: Selection Sort and Bubble Sort.	CO1	08
II	Divide and Conquer: Merge sort, Quicksort, Multiplication of long integers, Strassen's Matrix multiplication, Max-Min Problem Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Applications of DFS and BFS.	CO2	08
III	Transform and Conquer: Presorting, Heapsort, Problem reduction. Space and Time Tradeoffs: Sorting by Counting, Naive String Matching, Input Enhancement in String Matching: Horspool's and Boyer-Moore algorithm.	CO3	08
IV	Dynamic Programming: Computing a Binomial Coefficient, Warshall's and Floyd's Algorithms, The Knapsack Problem and Memory Functions. Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and codes.	CO4	08
V	Backtracking : N-Queen's Problem, Sum of Subset Problem. Branch-and-Bound: Travelling Sales Person problem, 0/1 Knapsack problem	CO5	07

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	NP and NP-Complete Problems : Basic concepts, nondeterministic algorithms, P, NP, NP-Complete, and NP-Hard classes		
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5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	Pearson Education	3 rd Edition	All Modules
2	Introduction to Algorithms	Cormen T.H., Leiserson C.E., Rivest R.L., Stein C.	PHI	3 rd Edition	All Modules
3	Computer Algorithms	Horowitz E., Sahani S., Rajasekharan S	Galgotia Publications	2 nd Edition	All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE

1. <http://www.facweb.iitkgp.ac.in/~sourav/daa.html>
2. <https://freevidelectures.com/course/2281/design-and-analysis-of-algorithms>
3. <https://www.youtube.com/watch?v=4R8dJCSfyKU&list=PLtg1mdkLERgnS8XNGU4irXk7dRuj61Z>
4. <https://nptel.ac.in/courses/106101060/>
5. <https://www.coursera.org/specializations/algorithms>

7. EVALUATION METHODOLOGY

- a) Continuous Internal Evaluation (CIE) = 50 marks
 - b) Semester End Examination (SEE) = 50 marks
- Total = 100 marks

CIE Framework:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

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Typical Evaluation pattern for courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50
Grand Total			100

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	3	3	2	2			1			2
CO2	3	3	3	2	2			1			2
CO3	3	3	3	2	2			1			2
CO4	3	3	3	2	2			1			2
CO5	3	3	3	2	2			1			2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	
CO2	2	
CO3	2	
CO4	3	
CO5	2	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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GLOBAL ACADEMY OF TECHNOLOGY

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BAD24404	Contact Hrs /week: 3
Course Description: COMPUTER NETWORKS		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PCC		Total no. of Hours = 39
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Foundation in computer basics, including operating systems, and basic network concepts		

1. PREAMBLE ABOUT THE COURSE

Sequence of bits or symbols transmitted at the beginning of a message or packet to signal the start of a communication frame. Its primary purpose is to synchronize the sender and receiver's clocks, ensuring that both are operating at the same timing for accurate data transmission. The preamble prepares the receiver for the incoming data and may include a known pattern to help detect errors early. It typically ends with a Start Frame Delimiter (SFD), indicating the beginning of the actual data. This mechanism is essential in protocols like Ethernet and Wi-Fi, where it helps establish proper communication, reduces errors, and improves overall efficiency.

2. COURSE LEVEL OBJECTIVES

CLO1	Comprehend the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data
CLO2	Explain with the basics of data communication and various types of computer networks
CLO3	Demonstrate Medium Access Control protocols for reliable and noisy channels.
CLO4	Expose wireless and wired LANs.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Understand the fundamental components of data communication systems.	PO1,PO2,PO3,PO4, PO5, PO6, PO9, PO11, PSO1,PSO2	L2	WK2, WK4	08
CO2	Apply digital-to-digital and analog-to-digital conversion techniques, including line coding and PCM, to design	PO1,PO2,PO3,PO4, PO5, PO6, PO9, PO11, PSO1,PSO2	L3	WK2, WK4	08

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	basic communication system models.				
CO3	Apply error detection and correction techniques such as block coding, cyclic codes, and checksum to ensure reliable data communication.	PO1,PO2,PO3,PO4, PO5, PO6, PO9, PO11, PSO1,PSO2	L3	WK2, WK4	08
CO4	Apply media access control methods and perform IPv4 addressing and subnetting using classful and CIDR techniques in network configurations	PO1,PO2,PO3,PO4, PO5, PO6, PO9, PO11, PSO1,PSO2	L3	WK2, WK4	08
CO5	Demonstrate the application of wired and wireless LAN technologies, such as Ethernet standards and IEEE 802.11, in designing and configuring local area networks	PO1,PO2,PO3,PO4, PO5, PO6, PO9, PO11, PSO1,PSO2	L3	WK2, WK4	07

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer-1: Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance.	CO1	08
II	Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding). Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes, Analog Transmission: Digital to analog conversion.	CO2	08
III	Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Framing.	CO3	08
IV	Media Access control: Random Access, Controlled Access and Channelization, IPv4 Addressing and subnetting: Classful and CIDR addressing.	CO4	08
V	Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, Wireless LANs: Introduction, IEEE 802.11 Project and Bluetooth.	CO5	07

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5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Data Communications and Networking ,	Behrouz A. Forouzan	Tata McGraw-Hill, 2013.	5th Edition	All Modules
2	Communication Networks - Fundamental Concepts and Key architectures	Alberto Leon-Garcia and Indra Widjaja	Tata McGraw-Hill, 2004	2nd Edition	All Modules
3	Computer Networks – A Systems Approach	Larry L. Peterson and Bruce S. Davie	Elsevier, 2007	4th Edition	All Modules
4	Computer and Communication Networks	Nader F. Mir	Pearson Education, 2007.		All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE

15. <https://archive.nptel.ac.in/courses/106/105/106105082/>
16. https://onlinecourses.nptel.ac.in/noc22_ee61/preview
17. <http://kcl.digimat.in/nptel/courses/video/106105082/L34.html>
18. <https://www.youtube.com/playlist?list=PLUfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN>

7. EVALUATION METHODOLOGY

- a) Continuous Internal Evaluation (CIE) = 50 marks
 - b) Semester End Examination (SEE) = 50 marks
- Total = 100 marks

CIE Framework:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

Typical Evaluation pattern for courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50
Grand Total			100

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8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	2	3	3	3	2			2		3
CO2	3	2	3	3	3	2			2		3
CO3	3	2	3	3	3	2			2		3
CO4	3	2	3	3	3	2			2		3
CO5	3	2	3	3	3	2			2		3

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BADL24405	Contact Hrs /week: 2
Course Description: ALGORITHMS LABORATORY		No. of Credits: 1 L : T : P : S = 0:0:2:0
Course Category: PCCL		Total no. of Hours = 13
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Strong understanding of programming concepts (preferably in C, C++, Java, or Python), Familiarity with data structures (arrays, stacks, queues, linked lists, trees)		

1. PREAMBLE ABOUT THE COURSE

This lab provides practical implementation of various algorithmic techniques. Students apply sorting, searching, graph, and optimization algorithms. Programming in C/C++ is emphasized. It develops logic and debugging skills. Real-world problem solving through code is practiced. It complements the DAA theory course.

2. COURSE LEVEL OBJECTIVES

CLO1	Applying brute-force and divide-and-conquer paradigms
CLO2	Investigating design techniques for graph traversal.
CLO3	Demonstrate the greedy technique, dynamic programming paradigm to solve problems
CLO4	Illustrate the Backtracking algorithm design paradigms

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Apply brute-force and divide-and-conquer paradigms to solve computational problems effectively.	PO1,PO2,PO3, PO4,PO5, PO8, PO11,PSO1	L3	WK2, WK4	4
CO2	Analyze and investigate various design techniques used for efficient graph traversal.	PO1,PO2,PO3, PO4,PO5, PO8, PO11,PSO1	L5	WK2, WK4	3
CO3	Demonstrate the application of greedy technique and dynamic programming	PO1,PO2,PO3, PO4,PO5, PO8, PO11,PSO1	L5	WK2, WK4	3

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	paradigms to solve computational problems effectively.				
CO4	Illustrate the use of Backtracking algorithm design paradigm to solve complex computational problems.	PO1,PO2,PO3, PO4,PO5, PO8, PO11,PSO1	L3-L5	WK2, WK4	3

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Sl. No.	Experiments/Programs
1	Sort a given set of n integer elements using bubble Sort method and compute its time complexity.
2	Sort a given set of n integer elements using Merge Sort method and compute its time complexity.
3	Sort a given set of n integer elements using Quick Sort method and compute its time complexity.
4	Write a program to check whether a given unweighted graph is connected or not using BFS method.
5	Demonstrate how to obtain the Topological ordering of vertices in a given digraph using DFS
6	Sort a given set of n integer elements using Heap Sort method and compute its time complexity.
7	Write a program to implement Horspool's String matching algorithm.
8	Implement 0/1 Knapsack problem using Dynamic Programming Memory Functions technique.
9	Find Minimum Cost Spanning Tree for a given weighted graph using Prims algorithm.
10	Implement Single Source Shortest Path algorithm
11	Write a Program to solve the sum of Subset problem using Back Tracking.
12	Demonstrate the working of back tracking approach for solving N-Queen's problem.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	Pearson Education	3 rd Edition	All Modules
2	Introduction to Algorithms	Cormen T.H., Leiserson C.E., Rivest R.L., Stein C	PHI	3rd Edition, 2010	All Modules
3	Computer Algorithms	Horowitz E., Sahani S., Rajasekharan S.,	Galgotia Publications	2 nd Edition, 2006	All Modules

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6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

19. <https://nptel.ac.in/courses/106/106/106106136/>

20. <https://nptel.ac.in/courses/106/106/106106094/>

7. EVALUATION METHODOLOGY

ASSESSMENT AND EVALUATION PATTERN		
	CIE	SEE
WEIGHTAGE	50%	50%
Record	10	50
Test	20	
Experiential Learning	20	NIL
Total Marks for the Course	50	50

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	3	3	1	3			2			2
CO2	3	3	3	1	3			2			2
CO3	3	3	3	1	3			2			2
CO4	3	3	3	1	3			2			2
CO5	3	3	3	1	3			2			2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BAD24406A	Contact Hrs /week: 3
Course Description: IMAGE PROCESSING		No. of Credits: 3 L : T : P : S = 3:0:0:0
Course Category: ETC/PLC		Total no. of Hours = 39
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic knowledge of mathematics (linear algebra, matrices, calculus, probability), Understanding of digital signal processing fundamentals		

1. PREAMBLE ABOUT THE COURSE

This subject introduces digital image fundamentals, transformations, filtering, and segmentation. Labs involve implementing enhancement and recognition techniques. Applications in medical imaging and surveillance are discussed. Tools like OpenCV are used for practical exposure. Students learn to process, analyze, and interpret images. It bridges signal processing and computer vision.

2. COURSE LEVEL OBJECTIVES

CLO1	To develop insight into the fundamental concepts of Digital image processing.
CLO2	To evaluate the techniques followed in image enhancements.
CLO3	To illustrate the techniques involved in image compression algorithms.
CLO4	To illustrate the techniques involved in image segmentation algorithms.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Understand the core principles and foundational concepts of Digital Image Processing	PO1,PO2,PO3,PO4, PO6,PO9,PO10,PO11, PS01,PSO2	L2	WK5, WK6	08
CO2	Understand the fundamental transformation algorithms involved in the formation of digital images	PO1,PO2,PO3,PO4, PO6,PO9,PO10,PO11, PS01,PSO2	L2	WK5, WK6	08

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CO3	Demonstrate the ability to differentiate between image enhancement and image compression techniques by applying fundamental concepts.	PO1,PO2,PO3,PO4, PO6,PO9,PO10,PO11, PS01,PSO2	L3	WK5, WK6	08
CO4	Apply image segmentation techniques to develop a comprehensive understanding of their principles and applications.	PO1,PO2,PO3,PO4, PO6,PO9,PO10,PO11, PS01,PSO2	L3	WK5, WK6	08
CO5	Apply image enhancement, compression, and segmentation algorithms in practical scenarios.	PO1,PO2,PO3,PO4, PO6,PO9,PO10,PO11, PS01,PSO2	L3	WK5, WK6	07

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Introduction, Fundamental steps in image processing, Components of an Image Processing System, Digital Image Fundamentals, Elements of visual perception, Image model, Sampling and quantization, Relationship between pixels	CO1	08
II	Image Formation: Introduction, Geometric Model, Photometric Model. Digitalization: Introduction, Sampling, Quantization, Digital Image, Elements of Digital Geometry.	CO2	08
III	Image Enhancement: Enhancement by point processing, Sample intensity transformation, Histogram processing, Image subtraction, Image averaging, Spatial filtering, Smoothing filters, Sharpening filters, Frequency domain: Low-Pass, High-Pass, Homomorphic filtering.	CO3	08
IV	Image Compression: Coding redundancy, Inter-pixel redundancy, Fidelity criteria, Image compression models, Error-free compression, Variable length coding, Bit-plane coding, Loss-less predicative coding, Lossy compression, Image compression standards, Fractal Compression, Real-Time image transmission, JPEG and MPEG.	CO4	08
V	Image Segmentation: Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region oriented segmentation, Use of motion in segmentation, Spatial techniques, Frequency domain techniques, Spatial Operations and Transformations Spatially dependent transform template and convolution, Window operations, 2- Dimensional geometric transformations.	CO5	07

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5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Digital Image Processing	R. Gonzalez and R. E. Wood	Prentice Hall of India	4 th Edition	All Modules
2	Digital Image Processing and Analysis	B. Chanda and D. Dutta Majumder	Prentice Hall of India	2 nd Edition	All Modules
3	Introductory Computer Vision and Image Procession	Andrian Low	McGrawHill		All Modules
4	Pattern Recognition- Statistical, Structural and neural approach	Robert Schalkoff	John Willey & Sons	4 th Edition	All Modules
5	Digital Image Processing	W.K. Pratt	McGraw Hill		All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE

1. Principles of Digital Image Processing, Wilhelm Burger [http://omercetin.com.tr/DERS/IP/Kitap/2.Principles%20of%20digital%20image%20processing.p df](http://omercetin.com.tr/DERS/IP/Kitap/2.Principles%20of%20digital%20image%20processing.pdf)
2. Image Processing, Analysis and Machine Vision, Milan Sonka <https://kgut.ac.ir/useruploads/1550563201478ety.pdf>
3. Introductory Digital Image Processing, John R Jensen <https://media.oaipdf.com/pdf/f11c7ea9-28a4-42c8-8854-21a2f96a6338.pdf>

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

CIE Framework:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50
Grand Total			100

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8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	3	2	2		2			2	2	2
CO2	3	3	2	2		2			2	2	2
CO3	3	3	2	2		2			2	2	2
CO4	3	3	2	2		2			2	2	2
CO5	3	3	2	2		2			2	2	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	3	1
CO2	3	1
CO3	3	1
CO4	3	1
CO5	3	1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BAD24406B	Contact Hrs /week: 3
Course Description: INTRODUCTION TO DATA MINING		No. of Credits: L : T : P : S = 3:0:0:0
Course Category: ETC/PLC		Total no. of Hours = 39
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic programming skills (preferably in Python, R, or Java), Understanding of data structures and algorithms, Basic knowledge of statistics and probability		

1. PREAMBLE ABOUT THE COURSE

This course explores techniques for extracting meaningful patterns from large datasets. It includes classification, clustering, association rules, and anomaly detection. Students learn about data pre-processing and model evaluation. Emphasis is on knowledge discovery and practical insights. It builds skills relevant to business intelligence and analytics. Real-time applications and case studies are emphasized

2. COURSE LEVEL OBJECTIVES

CLO1	To learn about data mining Concepts
CLO2	To study the different data mining techniques
CLO3	Study large item sets and basic algorithms for association rule mining
CLO4	Learn about similarity and distance measures, outlier detection

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Understand and explain the fundamental concepts and methodologies of data mining.	PO1, PO2, PO3, PO5, PO8, PO9, PO11, PSO1, PSO2	L2	WK4, WK5	08
CO2	Apply statistical and machine learning techniques to interpret and analyze data mining results.	PO1, PO2, PO3, PO5, PO8, PO9, PO11, PSO1, PSO2	L3	WK4, WK5	08

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CO3	Analyze and apply classification, clustering, and association rule mining techniques through hands-on experience.	PO1, PO2, PO3, PO5, PO8, PO9, PO11, PSO1, PSO2	L4	WK4, WK5	08
CO4	Analyze real-world problems and apply appropriate data mining techniques to extract meaningful insights.	PO1, PO2, PO3, PO5, PO8, PO9, PO11, PSO1, PSO2	L4	WK4, WK5	08
CO5	Examine and investigate advanced topics in data mining to enhance subject mastery..	PO1, PO2, PO3, PO5, PO8, PO9, PO11, PSO1, PSO2	L4	WK4, WK5	07

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Basic Data Mining Tasks: Data Mining Versus Knowledge Discovery in Data Bases Data Mining Issues, Data Mining Matrices, Social Implications of Data Mining, Data Mining from Data Base Perspective	CO1	08
II	Data Mining Techniques: A Statistical Perspective on data mining, Similarity Measures, Decision Trees, Neural Networks, Genetic Algorithms.	CO2	08
III	Classification: Introduction, Statistical, Based Algorithms, Distance Based Algorithms Decision.	CO3	08
IV	Clustering Tree: Based Algorithms, Neural Network Based Algorithms, Rule Based Algorithms, Combining Techniques: Introduction, Similarity and Distance Measures Outliers, Hierarchical Algorithms. Partitioned Algorithms.	CO4	08
V	Association Rules: Introduction, Large Item Sets, Basic Algorithms, Parallel & Distributed Algorithms, Comparing Approaches, Incremental Rules, Advanced Association Rules Techniques, Measuring the Quality of Rules.	CO5	07

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5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Data Mining Concepts & Techniques	Jiawei Han & Micheline Kamber	The Morgan Kaufmann Series in Data Management Systems	3rd Edition.	All Modules
2	Data Mining and Introductory and Advanced Topics	Margaret H. Dunham	Pearson Education 2003	3rd Edition	All Modules
3	Data Mining: Concepts and Techniques,	Jiawei Han, Micheline Kamber, Jian Pei		3rd Edition,	All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

21. <https://www.geeksforgeeks.org/data-mining/>
22. https://onlinecourses.nptel.ac.in/noc21_cs06/preview
23. <https://nptel.ac.in/courses/106105174/>

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

CIE Framework:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50
Grand Total			100

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8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	3	3		2			2	2		2
CO2	3	3	3		2			2	2		2
CO3	3	3	3		2			2	2		2
CO4	3	3	3		2			2	2		2
CO5	3	3	3		2			2	2		2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BAD24406C	Contact Hrs /week: 3
Course Description: Object Oriented Programming with C++		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: ETC/PLC		Total no. of Hours = 39
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic understanding of programming concepts (variables, loops, functions), Knowledge of basic data structures (arrays, structures, pointers)		

1. PREAMBLE ABOUT THE COURSE

This course introduces OOP concepts like classes, inheritance, and polymorphism in C++. Lab sessions involve real-time problem solving and application building. Emphasis is on encapsulation and modular code design. Students gain skills in writing reusable, maintainable code. It prepares them for software development roles. Object-oriented thinking is developed.

2. COURSE LEVEL OBJECTIVES

CLO1	Understanding about object oriented programming and Gain knowledge about the capability to store information together in an object.
CLO2	Understand the capability of a class to rely upon another class and functions.
CLO3	Understand about constructors which are special type of functions.
CLO4	Create and process data in files using file I/O functions
CLO5	Use the generic programming features of C++ including Exception handling

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Understand the principles of object-oriented programming and the concept of encapsulating related information within objects.	PO1,PO2,PO3, PO5,PO9,PO11,PS01	L2	WK3, WK4	08
CO2	Apply the concept of class dependencies by demonstrating how one	PO1,PO2,PO3, PO5,PO9,PO11,PS01	L3	WK3, WK4	08

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	class relies on another class and its functions.				
CO3	Interpret usage of constructors as specialized functions within object-oriented programming..	PO1,PO2,PO3, PO5,PO9,PO11,PS01	L3	WK3, WK4	08
CO4	Apply file I/O functions to perform creation, reading, and modification of data within files.	PO1,PO2,PO3, PO5,PO9,PO11,PS01	L3	WK3, WK4	08
CO5	Demonstrate generic programming features of C++, including exception handling, to develop reliable and efficient programs.	PO1,PO2,PO3, PO5,PO9,PO11,PS01	L3	WK3, WK4	07

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Introduction to Object Oriented Programming: Computer programming background- C++ overview. First C++ Program - Basic C++ syntax, Object Oriented Programming: What is an object, Classes, methods and messages, abstraction and encapsulation, inheritance, abstract classes, polymorphism.	CO1	08
II	Functions in C++: Tokens – Keywords – Identifiers and constants – Operators in C++ – Scope resolution operator – Expressions and their types – Special assignment expressions – Function prototyping – Call by reference – Return by reference – Inline functions -Default arguments – Function overloading.	CO2	08
III	Inheritance & Polymorphism: Derived class Constructors, destructors-Types of InheritanceDefining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance.	CO3	08
IV	I/O Streams: C++ Class Hierarchy- File Stream-Text File Handling- Binary File Handling during file operations.	CO4	08
V	Exception Handling: Introduction to Exception - Benefits of Exception handling- Try and catch blockThrow statement- Pre-defined exceptions in C++	CO5	07

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5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Programming with ANSI C++	Bhushan Trivedi	Oxford Press	4 th Edition	All Modules
2	Object Oriented Programming in C++	Robert Lafore (Author), Waite Group (Author)	SAMS publication.	4th edition	All Modules
3	C++ Primer	Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo		5th Edition	All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

24. Basics of C++ - <https://www.youtube.com/watch?v=BCIS40yzssA>
25. Functions of C++ - <https://www.youtube.com/watch?v=p8ehAjZWjPw>
26. https://www.w3schools.com/cpp/cpp_intro.asp
27. <https://www.edx.org/course/introduction-to-c-2>

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

CIE Framework:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50
Grand Total			100

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8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	3	3		3				1		2
CO2	3	3	3		3				1		2
CO3	3	3	3		3				1		2
CO4	3	3	3		3				1		2
CO5	3	3	3		3				1		2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka



Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BAD24406D	Contact Hrs /week: 3
Course Description: OBJECT ORIENTED PROGRAMMING WITH JAVA		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: ETC/PLC		Total no. of Hours = 39
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Familiarity with procedural programming (any language like C, C++), Knowledge of basic data structures (arrays, strings)		

1. PREAMBLE ABOUT THE COURSE

These subject covers core Java concepts like objects, interfaces, exceptions, and collections. Labs focus on GUI development, file handling, and threading. Students learn to build platform-independent applications. The course emphasizes industry practices and design patterns. It bridges frontend and backend development. OOP concepts are reinforced with Java's robust framework.

2. COURSE LEVEL OBJECTIVES

CLO1	Introduces Object Oriented Programming concepts. Learn fundamental features of Java Programming
CLO2	Setup Java JDK environment to create, debug and run Java Programs To understand in detail about classes, and inheritance.
CLO3	Learn Object Oriented concepts using Java programs.
CLO4	Apply the concepts of multiprogramming to develop Java programs
CLO5	To gain knowledge on: packages, multithreaded programming and exceptions and develop robust java programs.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Understand core Java programming concepts and the process of developing, debugging, and executing programs using modern development tools.	PO1,PO2,PO3,PO5, PO9,PO11,PS01	L2	WK3, WK4	08

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CO2	Apply object-oriented programming concepts in Java to develop functional programs.	PO1,PO2,PO3,PO5, PO9,PO11,PS01	L3	WK3, WK4	08
CO3	Analyze and implement reusable Java programs by effectively utilizing interfaces and packages.	PO1,PO2,PO3,PO5, PO9,PO11,PS01	L4	WK3, WK4	08
CO4	Analyze and apply packages and exception handling to improve Java program structure and reliability.	PO1,PO2,PO3,PO5, PO9,PO11,PS01	L4	WK3, WK4	08
CO5	Demonstrate the creation of threads and implementation of thread synchronization in Java programs.	PO1,PO2,PO3,PO5, PO9,PO11,PS01	L4	WK3, WK4	07

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	An Overview of OOP with Java: Object-Oriented Programming (Two Paradigms, Abstraction, The Three OOP Principles), Using Blocks of Code, Lexical Issues (Whitespace, Identifiers, Literals, Comments, Separators, The Java Keywords), Member functions and data, objects and functions, The Java Buzzwords. Data types, variables and Arrays: The primitive types, a closer look at Literals, Variables, Type conversion and casting, Automatic type promotion in Expressions, Arrays. Operators: Arithmetic operators, The Bitwise operators, Relational operators, Boolean Logical operators, Assignment operator, The? operator, Operator precedence Control Statements: Java's selection statements, iteration statements, Jump statements	CO1	08
II	Introducing Classes: Classes fundamentals; Declaring objects; Introducing methods, Constructors, Destructors, this keyword, garbage collection Methods and Classes: Overloading Methods, Argument Passing, Returning Objects, Recursion, Access Control, understanding static, Introducing final, Inner Classes.	CO2	08
III	Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch (run-time polymorphism), Using Abstract Classes, Using final with Inheritance. Interfaces: Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods.	CO3	08
IV	Packages: Packages, Packages and Member Access, Importing Packages. Exceptions: Exception-Handling Fundamentals, Exception Types, Uncaught	CO4	08

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	Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses.		
V	Multithreaded Programming: The Java Thread Model, The Main Thread, creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Interthread Communication.	CO5	07

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Java: A beginner's guide	Herbert Schildt	McGraw-Hill Education	11th Edition	All Modules
2	Programming with Java	E Balagurusamy		7th Edition	All Modules
3	Head First Java	Kathy Sierra & Bert Bates	Oreilly	2nd Edition	All Modules
4	Effective java	Joshua Bloch	John Wiley & Sons	3 rd Edition	All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

28. <https://java-programming.mooc.fi/part-1>
29. <https://education.oracle.com/java-se-programming-i-mooc>
30. https://onlinecourses.nptel.ac.in/noc22_cs47

7. EVALUATION METHODOLOGY

- a) Continuous Internal Evaluation (CIE) = 50 marks
 - b) Semester End Examination (SEE) = 50 marks
- Total = 100 marks

CIE Framework:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

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Typical Evaluation pattern for integrated courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50
Grand Total			100

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	3	3		3				1		2
CO2	3	3	3		3				1		2
CO3	3	3	3		3				1		2
CO4	3	3	3		3				1		2
CO5	3	3	3		3				1		2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BAD24457A	Contact Hrs /week: 2
Course Description: DATA ANALYTICS WITH R		No. of Credits:1 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 13
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 02
Course Pre-requisites: Knowledge of data structures like vectors, matrices, and data frames, Familiarity with statistics and data interpretation		

1. PREAMBLE ABOUT THE COURSE

This subject teaches statistical analysis and data visualization using R. Labs include data cleaning, modeling, and graphical representation. Topics like linear models and clustering are explored. Students apply statistical techniques to real-world datasets. Emphasis is on scripting and reproducible research. It supports roles in data science and analytics.

2. COURSE LEVEL OBJECTIVES

CLO1	To Gain the knowledge of R Programming Concepts
CLO2	To Explain the concepts of Data Visualization
CLO3	To Explain the concept of Statistics in R.
CLO4	To Work with R charts and Graphs

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Understand the fundamental data structures of R Programming including vectors, lists, matrices and data frames.	PO1,PO2,PO3,PO4,PO5, PO9,PO11,PSO1, PSO2	L2	WK2, WK4, WK6	3
CO2	Demonstrate the use of arrays, lists, data frames string and date functions in R to solve practical data related tasks.	PO1,PO2,PO3,PO4,PO5, PO9,PO11,PSO1, PSO2	L3	WK2, WK4, WK6	3

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CO3	Analyze the key components of Data Preparation and examine their impact using real world examples.	PO1,PO2,PO3,PO4,PO5, PO9,PO11,PSO1, PSO2	L5	WK2, WK4, WK6	3
CO4	Apply the Graphical Packages in R to create effective visual representations of data for meaningful interpretations.	PO1,PO2,PO3,PO4,PO5, PO9,PO11,PSO1, PSO2	L5	WK2, WK4, WK6	2
CO5	Apply various Statistical Analysis Techniques to examine data and extract meaningful insights.	PO1,PO2,PO3,PO4,PO5, PO9,PO11,PSO1, PSO2	L5	WK2, WK4, WK6	2

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Sl. No.	EXPERIMENTS
31.	Demonstrate the steps for installation of R and R Studio. Perform the following: a) Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type. b) Demonstrate Arithmetic and Logical Operations with simple examples. c) Demonstrate generation of sequences and creation of vectors. d) Demonstrate Creation of Matrices e) Demonstrate the Creation of Matrices from Vectors using Binding Function. f) Demonstrate element extraction from vectors, matrices and arrays
32.	Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics: a. Profit for each month. b. Profit after tax for each month (Tax Rate is 30%). c. Profit margin for each month equals to profit after tax divided by revenue. d. Good Months – where the profit after tax was greater than the mean for the year. e. Bad Months – where the profit after tax was less than the mean for the year. f. The best month – where the profit after tax was max for the year. g. The worst month – where the profit after tax was min for the year. Note: 33. All Results need to be presented as vectors b 34. Results for Dollar values need to be calculated with \$0.01 precision, but need to be presented in Units of \$1000 (i.e 1k) with no decimal points 35. Results for the profit margin ratio need to be presented in units of % with no decimal point. 36. It is okay for tax to be negative for any given month (deferred tax asset) e. Generate CSV file for the data

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37.	Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction d) multiplication																		
38.	Develop a program to find the factorial of given number using recursive function calls																		
39.	Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes																		
40.	The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to: a) Find the Pearson and Spearman correlation coefficients. Are they similar? b) Plot the data using the plot command. c) Plot the logarithm (log) of each variable and see if that makes a difference																		
41.	Develop R program to create a Data Frame with following details and do the following operations <table><tr><th>itemCode</th><th>itemCategory</th><th>itemPrice</th></tr><tr><td>1001</td><td>Electronics</td><td>700</td></tr><tr><td>1002</td><td>Desktop Supplies</td><td>300</td></tr><tr><td>1003</td><td>Office Supplies</td><td>350</td></tr><tr><td>1004</td><td>USB</td><td>400</td></tr><tr><td>1005</td><td>CD Drive</td><td>800</td></tr></table> a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350. b) Subset the Data frame and display only the items where the category is either “Office Supplies” or “Desktop Supplies” c) Create another Data Frame called “item-details” with three different fields itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames	itemCode	itemCategory	itemPrice	1001	Electronics	700	1002	Desktop Supplies	300	1003	Office Supplies	350	1004	USB	400	1005	CD Drive	800
itemCode	itemCategory	itemPrice																	
1001	Electronics	700																	
1002	Desktop Supplies	300																	
1003	Office Supplies	350																	
1004	USB	400																	
1005	CD Drive	800																	
42.	Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements. a) Assigning names, using the air quality data set. b) Change colors of the Histogram c) Remove Axis and Add labels to Histogram d) Change Axis limits of a Histogram e) Add Density curve to the histogram																		
43.	Design a data frame in R for storing about 20 employee details. Create a CSV file named “input.csv” that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis. a) Find the total number rows & columns b) Find the maximum salary c) Retrieve the details of the employee with maximum salary d) Retrieve all the employees working in the IT Department. e) Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file “output.csv”																		
44.	Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors Develop R program, to solve the following: a) What is the total number of observations and variables in the dataset?																		

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	b) Find the car with the largest hp and the least hp using suitable functions c) Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness? d) What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations. e) Which pair of variables has the highest Pearson correlation?
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5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	R Programming: An Approach to Data Analytics	G. Sudhamathy and C. Jothi Venkateswaran	MJP Publishers 2019	Third Edition.	All Modules
2	An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics	W. N. Venables, D.M. Smith and the R Development Core Team			All Modules

6. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

ASSESSMENT AND EVALUATION PATTERN		
	CIE	SEE
WEIGHTAGE	50%	50%
Record	10	50
Test	20	
Experiential Learning	20	NIL
Total Marks for the Course	50	50

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7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	3	3	3	3				1		1
CO2	3	3	3	3	3				1		1
CO3	3	3	3	3	3				1		1
CO4	3	3	3	3	3				1		1
CO5	3	3	3	3	3				1		1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	3
CO2	2	3
CO3	2	3
CO4	2	3
CO5	2	3

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Approved by UGC, AICTE and Govt of Karnataka



Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BAD24457B	Contact Hrs /week: 2
Course Description: PROJECT MANAGEMENT WITH GIT		No. of Credits: 1 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 13
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 02
Course Pre-requisites: Familiarity with command-line interface (CLI) operations, Knowledge of version control concepts (commits, branches, merges)		

1. PREAMBLE ABOUT THE COURSE

This course introduces software project planning, version control, and agile practices. Git tools and workflows are emphasized in the lab. Students learn collaborative development, branching, and issue tracking. Emphasis is on real-world software team environments. It prepares for industry-level code management. Documentation and reporting skills are also developed.

2. COURSE LEVEL OBJECTIVES

CLO1	To familiar with basic command of Git
CLO2	To create and manage branches
CLO3	To understand how to collaborate and work with Remote Repositories
CLO4	To familiar with version controlling commands

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Demonstrate how to execute basic Git commands to manage and track changes in a repository.	PO1,PO2,PO3,PO4,PO5, PO8,PO11,PSO1, PSO2	L3	WK4, WK6, WK8	3
CO2	Evaluate and manage Git branches by selecting appropriate branching strategies and justifying their use for effective collaboration and version control.	PO1,PO2,PO3,PO4,PO5, PO8,PO11,PSO1, PSO2	L5	WK4, WK6, WK8	3

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CO3	Apply Git commands to Collaborate with others by managing remote repositories.	PO1,PO2,PO3,PO4,PO5, PO8,PO11,PSO1, PSO2	L5	WK4, WK6, WK8	3
CO4	Apply Git commands to create and manage Git Tags, handle releases and perform advanced git operations.	PO1,PO2,PO3,PO4,PO5, PO8,PO11,PSO1, PSO2	L5	WK4, WK6, WK8	2
CO5	Analyze the Git commit history to identify necessary modifications and apply appropriate commands to rewrite or reorganize the history for clarity and accuracy	PO1,PO2,PO3,PO4,PO5, PO8,PO11,PSO1, PSO2	L5	WK4, WK6, WK8	2

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Sl. No.	EXPERIMENTS
45.	Setting Up and Basic Commands Initialize a new Git repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message.
46.	Creating and Managing Branches Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."
47.	Creating and Managing Branches Write the commands to stash your changes, switch branches, and then apply the stashed changes.
48.	Collaboration and Remote Repositories Clone a remote Git repository to your local machine.
49.	Collaboration and Remote Repositories Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch.
50.	Collaboration and Remote Repositories Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.
51.	Git Tags and Releases Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.
52.	Advanced Git Operations Write the command to cherry-pick a range of commits from "source-branch" to the current branch.
53.	Analysing and Changing Git History Given a commit ID, how would you use Git to view the details of that specific commit,including the author, date, and commit message?
54.	Analysing and Changing Git History Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31."

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5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Version Control with Git	Prem Kumar Ponuthurai, Jon Loeliger	O'Reilly Media, Inc	Third Edition.	All Modules
2	Pro Git book	Scott Chacon and Ben Straub	Apress		All Modules

6. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

ASSESSMENT AND EVALUATION PATTERN		
	CIE	SEE
WEIGHTAGE	50%	50%
Record	10	50
Test	20	
Experiential Learning	20	NIL
Total Marks for the Course	50	50

7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	3	3			1			1
CO2	3	3	3	3	3			1			1
CO3	3	3	3	3	3			1			1
CO4	3	3	3	3	3			1			1
CO5	3	3	3	3	3			1			1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓	PSO1	PSO2
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1
CO5	2	1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BAD24457C	Contact Hrs /week: 2
Course Description: OPTIMIZATION TECHNIQUE		No. of Credits:1 L : T : P : S = 1:0:0:0
Course Category: AEC		Total no. of Hours = 13
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 02
Course Pre-requisites: Basic knowledge of mathematics (linear algebra, calculus, and probability), Understanding of problem-solving and logical reasoning skills.		

1. PREAMBLE ABOUT THE COURSE

This subject focuses on linear, nonlinear, and dynamic optimization methods. Students learn to model and solve real-life decision problems. Topics include simplex method, duality, and LPP. Applications in engineering, logistics, and finance are explored. Emphasis is on algorithmic thinking. The course develops analytical and mathematical skills.

2. COURSE LEVEL OBJECTIVES

CLO1	Appreciate the importance of linear algebra in computer science and allied engineering science.
CLO2	Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
CLO3	Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Apply the concepts of vector calculus to solve the given problem	PO1,PO2,PO3,PO4,PO5, PO7,PO11,PSO1, PSO2	L3	PO1, PO2, PO4	03
CO2	Apply the concepts of partial differentiation in machine learning and deep neural networks.	PO1,PO2,PO3,PO4,PO5, PO7,PO11,PSO1, PSO2	L4	PO1, PO2, PO4	03
CO3	Analyze the convex optimization algorithms and their importance in	PO1,PO2,PO3,PO4,PO5, PO7,PO11,PSO1, PSO2	L4	PO1, PO2, PO4	03

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	computer science & engineering.				
CO4	Apply the optimization algorithms to solve the problem.	PO1,PO2,PO3,PO4,PO5, PO7,PO11,PSO1, PSO2	L4	PO1, PO2, PO4	02
CO5	Analyze the advanced optimization algorithms for machine learning.	PO1,PO2,PO3,PO4,PO5, PO7,PO11,PSO1, PSO2	L4	PO1, PO2, PO4	02

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	VECTOR CALCULUS: Functions of several variables, Differentiation and partial differentials, gradients of vector-valued functions, gradients of matrices, useful identities for computing gradients, linearization and multivariate Taylor series.	CO1	08
II	APPLICATIONS OF VECTOR CALCULUS: Back propagation and automatic differentiation, gradients in a deep network, The Gradient of Quadratic Cost, Descending the Gradient of Cost, The Gradient of Mean Squared Error.	CO2	08
III	Convex Optimization-1: Local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, Optimization using gradient descent, Sequential search 3point search and Fibonacci search.	CO3	08
IV	Convex Optimization-2: Unconstrained optimization -Method of steepest ascent/descent,NR method, Gradient descent, Mini batch gradient descent, Stochastic gradient descent.	CO4	08
V	Advanced Optimization: Momentum-based gradient descent methods: Adagrad, RMSprop and Adam Non-Convex Optimization: Convergence to Critical Points, Saddle Point methods.	CO5	07

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Mathematics for Machine learning	Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong	Cambridge University Press.		All Modules
2	Convex Optimization: Algorithms and Complexity, Foundations and Trends in Optimization	S. Bubeck, 2015			All Modules

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6. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE. The CIE would also include assignment evaluation for 10 marks.

Typical Evaluation pattern for courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	Assignment	10	
SEE	Semester End Examination	50	50
Grand Total			100

7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	2	2	3	2	2		2				2
CO2	2	2	3	2	2		2				2
CO3	2	2	3	2	3		2				2
CO4	2	2	3	3	3		2				2
CO5	2	2	3	3	3		2				2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1		1
CO2		1
CO3		1
CO4		1
CO5		1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
Semester: 4	Course Code: BAD24457D	Contact Hrs /week: 2
Course Description: MASTERING DATA VISUALIZATION		No. of Credits: 1 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 13
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 02
Course Pre-requisites: Basic understanding of data analysis and statistics, Knowledge of data types, charts, and visual elements		

1. PREAMBLE ABOUT THE COURSE

This subject explores tools like Tableau, Power BI, and D3.js for visual storytelling. Labs involve creating dashboards and interactive charts. Students learn to communicate insights effectively. Real datasets are used for hands-on visualization. Emphasis is on clarity, aesthetics, and audience engagement. It bridges data analysis and business communication.

2. COURSE LEVEL OBJECTIVES

CLO1	Learn to create and customize various types of plots
CLO2	Gain proficiency in reading and processing datasets
CLO3	Understand how to apply styling properties like line styles, markers, legends, annotations, and color palettes
CLO4	Develop the ability to compare data distributions, highlight key trends, and analyse.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Design and create effective data visualizations using Python.	PO1,PO2,PO3,PO4,PO5, PO11,PSO1, PSO2	L3	WK5, WK6	4
CO2	Apply data transformations such as Joins, filtering, sorting, aggregation etc., for visualization using industry-standard software tools	PO1,PO2,PO3,PO4,PO5, PO11,PSO1, PSO2	L3	WK5, WK6	4

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CO3	Identify opportunities for application of data visualization in various domains and p communicate the results for documentation and interpretation	PO1,PO2,PO3,PO4,PO5, PO11,PSO1, PSO2	L3	WK5, WK6	5
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Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Sl. No.	EXPERIMENTS
55.	Using the sales_data.csv, create the visualization report for the following using Matplotlib: Get total profit of all months and show line plot with the following Style properties Generated line plot must include following Style properties: – 56. Line Style dotted and Line-color should be green 57. Show annotation 58. Add a square marker. 59. Add ticks for both X and Y axis
60.	Using the sales_data.csv, create the visualization report for the following using Matplotlib: Get total profit of all months and show line plot with the following Style properties Generated line plot must include following Style properties: – 61. Line Style dashed and Line-color should be green 62. Show legend at the lower right location Add ticks for both X and Y axis 63. Line width should be 2
64.	Using the sales_data.csv, create the visualization report for the following using Matplotlib: 1. Calculate total sale data for last year for each product and show it using a Pie chart · Print the total sale inside each part · Explode the highest sale · Set the start angle=60 2. Read face cream and facewash product sales data and show it using the horizontal bar chart
65.	Write a Python programming for the following: 3. to display a horizontal bar chart of the sale of book. Use different color for each bar. Sample data: Programming languages: Fict, Tech, Moti, Business, Nutri, Dev Sale: 5.2,19.6, 8.7, 8, 7.7, 3.7 a. Add ticks for both axis b. Show legend at the upper right corner 4. Write a Python program to create a stacked bar plot. Note: Use bottom to stack the women bars on top of the men bars. Sample Data: Means (men) = (22, 30, 35, 35, 26) Means (women) = (25, 32, 30, 35, 29) 5. Add labels and ticks 6. Use annotation
66.	Write a Python programming for the following:

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	7. To create a pie chart with a title of the pass percentage of subjects. Sample data: Subjects: DSC, OOP, OPS, COA, MAT, Java Pass percentage (%): 40, 25.6, 8.8, 30, 7.7, 60.7 - Print percentage inside the chart - Use explode property 8. Using the sales_data.csv, read the total profit of each month and show it using the histogram to see the most common profit ranges
67.	Using the dataset planets.csv, create the visualization report for the following using Seaborn: Get the distance covered year-wise and show scatter plot with the following properties - Add “mass” as additional features - Use different markers - Control the range of marker areas with sizes
68.	Using the dataset planets.csv, create the visualization report for the following using Seaborn: - Get the distance covered year-wise and show scatter plot with the following properties - Add “mass” and “method” as additional features - Change the default color palette - Display the complete legend - Read the distance for each method and show it using the bar chart.
69.	Using the dataset titanic.csv, create the visualization report for the following using Seaborn: - Demonstrate the use of “displot” - Plot the distribution using Kernel density estimation. - Use lineplot for any two suitable features - Generate scatter plot with different color palette
70.	Using the dataset titanic.csv, create the visualization report for the following using Seaborn: - Demonstrate the subplots (2x1) on scatter plots - Demonstrate the use of violin plot - Get different line plots for survival of passengers class wise. - Create visualization for strip plot without jitter
71.	Using the dataset titanic.csv, create the visualization report for the following using Seaborn: - Create a visualization using categorical plot and re-order the axis contents - Demonstrate the use of violin plot - Demonstrate the subplots (1x3) on line plots - Generate scatter plot with different color palette

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Python Data Science Handbook	Jake Vander Plas	O'Reilly 2017.	Second Edition	All Modules
2	Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems	Sossama Embarak	Apress 2018		All Modules

6. EVALUATION METHODOLOGY

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- a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

ASSESSMENT AND EVALUATION PATTERN		
	CIE	SEE
WEIGHTAGE	50%	50%
Record	10	50
Test	20	
Experiential Learning	20	NIL
Total Marks for the Course	50	50

7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	2	2	3	2	2						2
CO2	2	2	3	2	2						2
CO3	2	2	3	2	3						2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	3
CO2	2	3
CO3	2	3

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: Science and Humanities		
Semester: 4	Course Code: BBOK24407	Contact Hrs /week: 2
Course Description: BIOLOGY FOR ENGINEERS		No. of Credits: 1 L : T : P : S = 1:0:0:0
Course Category: BSC		Total no. of Hours = 15
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 01
Course Pre-requisites: Foundation in computer basics, including operating systems, and basic network concepts		

1. PREAMBLE ABOUT THE COURSE

Biology for Engineers bridges life sciences with engineering principles. It empowers students to apply biological concepts to innovate in technology and healthcare. Understanding biological systems enhances sustainable design and bio-inspired solutions. This course fosters interdisciplinary thinking for real-world problem-solving.

2. COURSE LEVEL OBJECTIVES

CLO1	To familiarize the students with the basic biological concepts and their engineering applications.
CLO2	To enable the students with an understanding of biodesign principles to create novel devices and structures.
CLO3	To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
CLO4	To motivate the students to develop interdisciplinary vision of biological engineering.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Elucidate the basic biological concepts via relevant industrial applications and case studies.	PO1,PO2, PO7, PSO1,PSO2	L3	WK1, WK3, WK3	5
CO2	Evaluate the principles of design and development, for exploring novel bioengineering projects.	PO1,PO2, PO7, PSO1,PSO2	L3	WK1, WK3, WK3	5

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CO3	Understand and apply biological concepts and emerging technologies such as tissue engineering, bioprinting, biosensing, and AI for solving real-world engineering problems.	PO1,PO2, PO7, PSO1,PSO2	L3	WK1, WK3, WK3	5
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Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Cell Basic Unit of Life Introduction. Structure and functions of a cell. Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules: Properties and functions of enzymes, vitamins and hormones.	CO1	5
II	Adaptation of Anatomical Principles for Bioengineering Design Brain as a CPU system. Eye as a Camera system. Heart as a pump system. Lungs as purification system. Kidney as a filtration system.	CO2	5
III	Trends In Bioengineering: Muscular and Skeletal Systems as scaffolds, scaffolds and tissue engineering, Bioprinting techniques and materials. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Bioconcrete. Bioremediation. Biomining.	CO3	5

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Biology for Engineers	Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K.,	Tata McGraw-Hill, New Delhi, 2012		All Modules
2	Human Physiology	Stuart Fox, Krista Rompolski	McGraw-Hill eBook	16th Edition, 2022	All Modules

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3	Biology for Engineers	Arthur T. Johnson	CRC Press, Taylor and Francis, 2011		All Modules
4	Biology for Engineers	Sohini Singh and Tanu Allen,	Vayu Education of India, New Delhi, 2014		All Modules
	Biomimetics: Nature-Based Innovation	Yoseph Bar-Cohen	2012, CRC Press	1st edition	All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

72. <https://nptel.ac.in/courses/121106008>
73. <https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists>
74. <https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009>
75. <https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006>
76. <https://www.coursera.org/courses?query=biology>
77. https://onlinecourses.nptel.ac.in/noc19_ge31/preview
78. <https://www.classcentral.com/subject/biology>
79. <https://www.futurelearn.com/courses/biology-basic-concepts>

7. EVALUATION METHODOLOGY

- a) Continuous Internal Evaluation (CIE) = 50 marks
 - b) Semester End Examination (SEE) = 50 marks
- Total = 100 marks

CIE Framework:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be **proportionately reduced to 50**. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module**.

Continuous Internal Evaluation (CIE):

Two Tests are to be conducted for 30 marks each. The average of the two tests are taken for computation of CIE and Assignment carries 20 marks.

Typical Evaluation pattern for courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	Assignment	20	
SEE	Semester End Examination	50	50
Grand Total			100

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8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	3	2					3				
CO2	3	2					3				
CO3	3	2					3				

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

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Department: Science and Humanities		
Semester: 4	Course Code: BUHK408	Contact Hrs /week: 01
Course Description: Universal Human Values (UHV)		No. of Credits:01 L : T : P : S = 1:0:0:0
Course Category: UHV		Total no. of Hours = 15
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 02

1. COURSE LEVEL OBJECTIVES

CLO1	To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
CLO2	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
CLO3	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
CLO4	This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

2. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description
CO1	They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO2	They would have better critical ability.
CO3	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO4	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

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3. SYLLABUS

Module No.	Module Description	No. of Hours
I	Introduction to Value Education Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations	3
II	Harmony in the Human Being Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health	3
III	Harmony in the Family and Society Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	3
IV	Harmony in the Nature/Existence Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence	3
V	Implications of the Holistic Understanding – a Look at Professional Ethics Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	3

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition
1	The Textbook A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1	2nd Revised Edition
2	The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G		

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3	Jeevan Vidya: Ek Parichaya	A Nagaraj, Jeevan Vidya Prakashan Amar kantik		1999
4	Human Values New	A.N. Tripathi,	Age Intl. Publishers, New Delhi	2004
5	The Story of My Experiments with Truth	Mohandas Karamchand Gandhi		

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Department: Science and Humanities		
Semester: 3 to 6	Course Code: BNSK24359/459/559/659	Contact Hrs /week: 1
Course Description: National Service Scheme (NSS)		No. of Credits: 0 L : T : P : S = 0:0:2:0
Course Category: MC		Total no. of Hours = 24
CIE: 100 Marks		

COURSE LEVEL OBJECTIVES

CLO1	Understand the community in general in which they work.
CLO2	Identify the needs and problems of the community and involve them in problem – solving
CLO3	Develop among themselves a sense of social & civic responsibility & utilize their knowled in finding practical solutions to individual and community problems.
CLO4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
CLO5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description
CO1	Understand the importance of his / her responsibilities towards society.
CO2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4	Implement government or self-driven projects effectively in the field.
CO5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

SYLLABUS

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Module No.	Module Description
I	National Service Scheme (NSS) – Contents 1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues. 4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education. 7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs. (minimum 5 programs). 10. Social connect and responsibilities. 11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Publisher
1	NSS Course Manual	Published by NSS Cell, VTU Belagavi
2	Government of Karnataka, NSS cell, activities reports and its manual.	
3	Government of India, NSS cell, Activities reports and its manual.	

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Department: Science and Humanities		
Semester: 3 to 6	Course Code: BPEK24359/459/559/659	Contact Hrs /week: 2
Course Description: PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I		No. of Credits: 0 L : T : P : S = 0:0:2:0
Course Category: MC		Total no. of Hours = 24
CIE: 100 Marks		

1. SYLLABUS

Module No.	Module Description	No. of Hours
I	A. Lifestyle B. Health & Wellness C. Pre-Fitness test.	4
II	A. Warming up (Free Hand exercises) B. Strength – Push-up / Pull-ups C. Speed – 30 Mtr Dash	4
III	1. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. 2. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.	16

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Department: Science and Humanities		
Semester: 3 to 6	Course Code: BYOK24359/459/559/659	Contact Hrs /week: 02
Course Description: YOGA		No. of Credits: 0 L : T : P : S = 0:0:2:0
Course Category: MC		Total no. of Hours = 24
CIE: 100		

1. SYLLABUS

Course Title	Content
Introduction of Yoga, Aim and Objectives of yoga, Prayer	Yoga, its meaning, definitions. Different schools of yoga, importance of prayer
Brief introduction of yogic practices for common man	Yogic practices for common man to promote positive health.
Rules and regulations	Rules to be followed during yogic practices by practitioner.
Misconceptions of yoga	Yoga its misconceptions
Suryanamaskara	Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar 12 count, 2 rounds.
Different types of Asanas Sitting 1. Padmasana 2. Vajrasana Standing 1. Vrikshana 2. Trikonasana Prone line 1. Bhujangasana 2. Shalabhasana Supine line 1. utthitadvipadasana 2. Ardhalasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits.

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GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka



Department: Science and Humanities		
Semester: 3 to 6	Course Code: BMUK359/459/559/659	Contact Hrs /week: 2
Course Description: MUSIC		No. of Credits: 0 L : T : P : S = 0:0:2:0
Course Category: MC		Total no. of Hours = 24
CIE: 100 Marks		

1. COURSE LEVEL OBJECTIVES

1. Identify the major traditions of Indian music, both through notations and aurally.
2. Analyse the compositions with respect to musical and lyrical content.
3. Demonstrate an ability to use music technology appropriately in a variety of setting.

2. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description
CO1	Discuss the Indian system of music and relate it to other genres (Cognitive Do main)
CO2	Experience the emotions of composer and develop empathy (Affective Domain)
CO3	Respond to queries on various patterns in a composition (Psycho Motor Domain)

3. SYLLABUS

Module No.	Module Description	No. of Hours
I	Preamble: Contents of the curriculum intend to promote music as language to develop on analytical, Creative, and intuitive Understanding. For this the student through study and direct participation in improvisation. Origin of the Indian Music: Evolution of the Indian music system, Understanding of Shruthi, Nada, Swara. Laya, Raga, Tala, Mela.	3
II	Compositions: Introduction to the types of composition in Carnatic Music Swarajathi, Varna, Krithi, and Thillana, Notation System.	3
III	Composers: Biography and Contributions of Purandaradasa, Thyagaraja.	3

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IV	Music Instruments: Classification and construction of string instruments, percussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instruments.	3
V	Abhyasa Gana: Singing the swara exercises (Sarale Varase Only), Botation writing for Sarale Varase and Suladi Saptha Tala (Only in Mayamalavagowla Raga), Singing 4 Geethe in Malahari, and one jathi Swara, One Krithi in a Mela raga.	4

4. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

Sl. No.	Name of the Book	Author(s)	Publisher	Edition
1	Theory of Music	Vidushi Vasantha Madhavi	Prism Publication	2007
2	Karnataka Sangeetha Dharpana	T Sachidevi and T Sharadha (Thirumalai Sisters)	Shreenivaas Prakaashana	Vol, 1 2018
3	Classical Music of India: A Practical Gulge	Lakshminarayana Subramaniam, Viji Subramaniam	Tranqueber	2018
4	History of South Indian (Carnatic) Music	R Rangaramanuja Ayyangar	Vipanci Charitable Trust,	Third edition 2019
5	The Story of Indian Music and Its Instruments: A Study of the Present and a Record of the Past	Ethel Rosenthal	Pilgrims Publishing	2007

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