XAVIER UNIVERSITY PATNA

Digha Aashiyana Road, XTTI Campus

School of Computer Science

Programme Structure 2025-2026

Bachelor of Computer Application (AI & ML)

Contents

Introduction to the BCA (AI & ML)

Welcome to the undergraduate BCA (AI &ML) course. This course provides an engaging and dynamic look at the cutting-edge field that is transforming how we use technology and perceive the world.

The four year undergraduate Bachelor of Computer Applications (BCA) program with a specialization on Artificial Intelligence (AI) and Machine Learning (ML) aims to give students a strong foundation in computer science together with specific training in AI & ML .The program's goal is to get students ready for a future in technology, particularly in the areas of artificial intelligence and machine learning. In addition to learning how to create algorithms and applications based on AI and ML, students will also learn how to use statistical and machine learning methods to evaluate and understand data. Through projects and internships, the program offers practical training in addition to theoretical understanding. Employers strongly respect the practical skills that students will acquire while working on real-world situations. Students who successfully complete the program will have a solid background in computer science along with specialized knowledge of AI and ML. Graduates of this program can work in the technology sector as research scientists, software developers, data analysts, AI and ML engineers, and other relevant positions.

Job Opportunities

Artificial intelligence and machine learning courses are becoming more significant and relevant in a variety of industries due to the development of contemporary, high-performing technology. Artificial intelligence is a rapidly growing field. But even with its incredible advancement, there is still a critical global shortage of artificial intelligence experts. Computer scientists, data engineers, and computer vision engineers are among the occupations that are included in the category of artificial intelligence. The majority of AI specialists are employed by large companies like Fractal Analytics, LinkedIn, Tech Mahindra, Deloitte, SAP Labs, IBM, Amazon, Citrix, Verizon, Accenture, and Nvidia.

The pursuit of higher education is a crucial aspect of BCA (AI & Ml). The majority of graduates continue their studies by enrolling in advanced Master Computer Application courses. The career profiles that follow BCA (AI & Ml) are shown below; you can choose the one that interests you.

- Software Engineer
- Information Systems Manager
- Blockchain expert
- Data Engineer
- Artificial Intelligence Developer
- Robotics Engineer
- Data Scientist
- Machine Learning Engineer and many more

Message from the Dean of Computer Science

Welcome to the School of Computer Science at Xavier University, Patna! Our BCA (AI &ML) program is intended to give students the abilities and information required to succeed as professionals in the IT, AI, and machine learning domains. We provide a demanding curriculum that covers both the foundational subjects and more complex subjects including Artificial Intelligence, Machine Learning, natural language processing, Image processing, social network analysis and deep learning etc. We provide a variety of extra-curricular activities and events in addition to our academic programs to give our students a holistic education. In addition to research projects, we encourage our students to take part in coding contests and hackathons. Additionally, we give students the chance to engage with entrepreneurs and industry professionals. Additionally, our department fosters an innovative and entrepreneurial atmosphere. In addition to encouraging our students to create their own projects and ideas, we also offer them support and mentoring to help them make their ideas a reality. Additionally, we collaborate with prominent figures in the field and offer internships to our students so they can obtain practical experience.

Program Educational Objectives

Upon completion of the BCA programme

Build Core Competence in Computing

The primary goal of the BCA program is to produce graduates with strong understanding of core concepts of computer science including programming, data structures and software engineering. Besides this BCA program is also aimed at specializing students in the area of artificial intelligence and machine learning tools and techniques. By completing this program Students get equipped with the required skills to pursue diverse roles in the IT industry such as software development, data analyst, AI and ML specialist.

Foster Innovation and Creativity

Encourage innovative thinking to develop cutting-edge solutions in AI & ML, web designing & development and other advanced technologies. The program ensures that students are well-versed in modern technologies like Big Data Analytics, Artificial Intelligence and machine learning. By integrating these topics into the curriculum, we prepare students to address modern technological challenges and provide solutions across industries.

Enhance Practical and Analytical Skills

The BCA program at XUP encourages students to think critically and solve complex problems through practical and hands-on learning experiences. By working on real-world projects, case studies, and simulations, students develop strong analytical skills, critical thinking and problem-solving skills that are vital in the technology field. It enables hands-on learning to design, develop, and optimize software applications, ensuring industry readiness.

Collaboration and Communication

Effective communication and collaboration are essential in today's corporate world. The BCA program at Xavier University helps students develop strong oral and written communication skills, while also fostering teamwork through group projects, presentations, and collaborative assignments. This ensures graduates are ready to work effectively in multi-disciplinary teams.

Prepare for Diverse Career Opportunities

To ensure that students are industry-ready, the BCA program includes internships, industry visits, and guest lectures from industry experts. These activities provide students with valuable insights into the IT industry, enabling them to bridge the gap between academic learning and real-world application.

Create a Foundation for Advanced Studies

The BCA program at XUP, prepares students for further academic pursuits, such as pursuing Master of Computer Applications (MCA) or other advanced degrees in computer science and related fields. The comprehensive curriculum ensures that graduates are equipped with a solid foundation for higher studies.

Program Outcome (POs)

The Program Outcomes (POs) for the BCA in (AI & ML) program from the provided document are as follows:

PO 1: Application of Domain Knowledge: Apply the domain knowledge such as mathematics, science and software engineering fundamentals into the Computer Application related professions.

PO 2: Problem Solving & Analysis: Identify, Formulate, Analyze and Solve Complex Scenarios related to Computer Applications.

PO 3: Design/development of Activities: Conceive, Design and Develop various activities of Computer Applications**.**

PO 4: Conduct Investigations of Events: Carry out Investigation of an event and draw logical conclusions based on critical thinking and analytical reasoning.

PO 5: Modern Tool usage: Effectively apply relevant ICT Tools and digital tools to carry out Computer Application Attributes.

PO6: Apply comprehensive knowledge of computer applications and data science to solve complex data-driven problems in real-world scenarios.

Program Specific Outcomes (PSOs)

PSO1: Apply machine learning and data analytics techniques to extract insights from datasets.

PSO2: Develop AI enabled solutions for domains like healthcare, finance, and marketing.

PSO3: Design and implement AI & ML projects using programming tools and cloud platforms.

PSO4: Use advanced computational tools, cloud platforms, and Machine learning techniques for data recognition, processing, and analysis.

PSO5: Analyze data and make sound, evidence-based decisions to tackle industry challenges and drive innovation.

Course Structure

General Course Structure & Theme

Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

Course code and definition:

Course code	Definitions
B	Bachelor
CA	Computer Application
AIM	Artificial Intelligence & Machine Learning
L	Lecture
T	Tutorial
P	Practical
C	Combined
DSC	Core Course/ Discipline Specific Course
DSE	Discipline Elective / Minor/Elective
SEC	Skill Enhancement Course
AEC	Ability Enhancement Course
MDC	Multi-Disciplinary Course
VAC	Value added Course
I	Internship
O	Open Electives/Others
D	Dissertation with Research work/Project (RPD)

Course Name

Bachelor in Computer Application (AI & ML),
Bachelor Computer Application (AI & ML) Honours and
Bachelor in Computer Application ((AI & ML Honours with Research)

Course Level/Duration/System:

Undergraduate / Three or Four years/6 or 8 Semesters with multiple entry and exit. The following option will be made available to the students joining BCA Research Program:

a. **One year:** Under Graduate Certificate in Computer Application
b. **Two years**: Under Graduate Diploma in Computer Application
c. **Three years**: Bachelor in Computer Application (AI & ML)
d. **Four years**: Bachelor in Computer Application with Honors: BCA (Honours) or Bachelor in Computer Application Honors with Research: BCA (Honours with Research)

Minimum Eligibility Criteria:

Minimum eligibility criteria for opting the course in the fourth year will be as follows:

BCA (AI & ML Honours with Research): Minimum 75% marks or equivalent CGPA in BCA Degree up to Sixth Semester.

BCA (AI & ML Honours): BCA Degree

Note : The students who are eligible for BCA (Honours with Research) shall have choice to pursue either BCA (Honours) or BCA (Honours with Research).

BCA (AI &ML)

Credit Distribution

Credit Charts (Semester Wise)

Semesters	Discipline Specific Courses	Minor Course	Multi-disciplinary courses	Ability Enhancement Courses	Skill Enhancement Courses	Value added courses	Dissertation/ Research/ Intern-ship/online	Total Credits
I	5x1+4X1 =9	4x1=4	3x1=3	2x1=2	-	2x1=2	-	20
II	5x1 +3x2=11	4x1=4	3x1=3	2x1=2	3x1=3	2x1=2		25
III	5x1+3X1 =8	4x1+2x1 =6	3x1=3	2x1=2	4x1=4	2x1=2	-	25
IV	5x2+4x1 =14	-	3x1=3	2x1=2		-	2x1=2	21
Under Graduate Certificate in Computer Application								**Credit: 45**
Under Graduate Diploma in Computer Application								**Credit: 91**

Note: Course Code with category combined will contain theory marks as well as practical marks as follows:

Continuous Internal Assessment: 20 Theory + 15 Practical + 5 Attendance

End Semester Examination : 40 Theory + 20 Practical

Core /Discipline Specific Course (DSC)

Year	Semester	Course Code	Name of the course	Credit	Marks		Total
					CIA	EXTR	
1.	I	UGBCADSC101C	Problem Solving Techniques Using C Language	5C=3T+2P	40	60	100
		UGBCADSC102C	Operating System	4C= 3T+1P	40	60	100
	II	UGBCADSC203C	Computer Organization And Architecture	3T	40	60	100
		UGBCADSC204C	Object Oriented Programming Using Java	5C= 3T+2P	40	60	100

		UGBCADSC205P	Software Engineering	3	40	60	100
2.	**III**	UGBCADSC306C	Relational Database Management System	5C= 3T+2P	40	60	100
		UGBCADSC307C	Design And Analysis of Algorithm	3T	40	60	100
	IV	UGBCADSC308C	Computer Network	4T	40	60	100
		UGBCADSC309T	Data Structure	5C= 3T+2P	40	60	100
		UGBCADSC310C	Artificial Intelligence	5C= 3T+2P	40	60	100

Minor/Discipline Elective Course(DSE)

Year	Semester	Course Code	Name of the course	Credit	Marks		Total
					CIA	EXTR	
1	I	UGBCADSE101T	Mathematical Foundation to Computer Science	4	40	60	100
	II	UGBCADSE202T	Mathematical Foundation to Computer Science II	4	40	60	100
2	III	UGBCADSE303T	Probability And Statistics	4	40	60	100
		UGAIMDSE304T	Feature Engineering	2	20	30	50
	IV		----------				

Ability Enhancement Courses(AEC)

Year	Semester	Course Code	Name of the course	Credit	Marks		Total
					CIA	EXTR	
1	I		Functional English	2	20	30	50
	II		Advance Communication and Soft Skill	2	20	30	50
2	III		Hindi I	2	20	30	50

	IV		German/Korean Language/HindiII	2	20	30	50
			Soft Skills and Personality Development				

Skill Enhancement Courses (SEC)

Year	Semester	Course Code	Name of the course	Credit	Marks		Total
					CIA	EXTR	
1			Web Technology	3	40	60	100
2			Python Programming	4	40	60	100
			Digital Marketing and Social Media Management				

Multi-Disciplinary Courses (MDC)

Year	Semester	Course Code	Name of the course	Credit	Marks		Total
					CIA	EXTR	
			Indian Knowledge System	3	40	60	100
			Digital Content Creation	3	40	60	100
			Organizational Behavior	3	40	60	100
			Entrepreneurship And Innovation	3	40	60	100
			Fundamentals of Management and Entrepreneurship				
			Digital Literacy and Emerging Technology				

Value Added Courses (VAC)

Year	Semester	Course Code	Name of the course	Credit	Marks		Total
					CIA	EXTR	
			Environmental Study	2	20	30	50
			Indian Constitution	2	20	30	50
			Yoga And Wellness	2	20	30	50

			Corporate Ethics and Governance				
			Cyber Ethics and Digital Citizenship				
			Social Innovation and Community Engagement				

Internship (INT)/Project (MDP)/Other Courses (OEC)

Year	Semester	Course Code	Name of the course	Credit	Marks		Total
					CIA	EXTR	
1	I		Social Service	NA			---
2	IV		Online course on Statistical tools(NPTEL, Coursera , EDX)	2	50		50

DETAIL SYLLABUS

SEMESTER I

Semester – 1								
S.No	**Course Code**	**Course Tile**	**Course Category**	**IA Marks**	**ESE Marks**	**Total Marks**	**Credit**	**No of classes**
1	UGBCADSC101C	Problem Solving Techniques Using C Language	DSC	40	60	100	3T+2P	3+4
2	UGBCADSC102C	Operating System	DSC	40	60	100	3T+1P	3+2
3	UGBCADSE101T	Mathematical Foundation to Computer Science	DSE	40	60	100	4	4
4		Functional English	AEC	20	30	50	2	2
5		Indian Knowledge System	MDC	40	60	100	3	3
6		Environmental Study	VAC	20	30	50	2	2
			TOTAL	200	300	500	20	23

Semester 1	Problem Solving Technique using C	C	L/week	T/week
Course Code: UGBCADSC101C	Total Teaching Hours: 48	**3**	**3**	**1**

COURSE OUTCOMES

At the end of the course learners will be able to		
CO1	Design algorithms and flowcharts to solve computational problems.	Apply
CO2	Develop C programs using data types, operators, and input/output statements.	Apply
CO3	Apply decision-making and looping constructs to solve programming problems.	Apply
CO4	Implement arrays, strings, and structures for structured data handling.	Analyze
CO5	Develop modular programs using functions and recursion.	Evaluate
CO6	Apply pointer concepts and dynamic memory allocation for efficient memory management.	Analyze

Prerequisite: This is an introductory programming course and hence no prerequisites

DETAIL SYLLABUS

Unit I	**Problem Solving and Algorithm Design:** Introduction to computational problems, problem instances, generalization and special cases. Types and classification of computational problems. Analysis of problems and solution approaches. Algorithm development, correctness and efficiency. Definition and characteristics of algorithms. Standard algorithm format and pseudo-code conventions.Flowcharts: definition, standard symbols, guidelines, advantages and limitations.	**8**

Unit II	**Introduction to C Programming Fundamentals**: Introduction to programming languages and generations of programming languages. Typed versus typeless languages. History and features of C. Structure of a C program including header files and main() function. Compilation and execution process. Character set and tokens, keywords, identifiers, variables, constants and data types. Arithmetic, relational and logical operators. Expressions and type conversion. Input and output statements.Comments and good coding practices. Translation of pseudocode into C program. Incremental compilation and debugging.	**8**
Unit III	**Control Structures:** Decision making and branching using relational and logical operators. if, if-else, nested if-else, else-if ladder and switch statements. Looping constructs including while, do-while and for loops. break, continue and goto statements. Sentinel-controlled repetition.	**12**
Unit IV	**Functions, Modular Programming and Structures:** Concept and need of functions. Modular programming. Top-down and bottom-up approaches. Function declaration (prototype), Parameter passing using call by value. Pointer concepts including declaration, initialization and accessing memory locations, Call by reference, Pointer arithmetic, Arrays and pointers. Functions and pointers. Structures and pointers, Recursive functions and their applications.	**10**
Unit V	**Arrays and Strings:** Concept and characteristics of arrays. One-dimensional and two-dimensional arrays. Declaration, initialization, reading and writing array elements. Searching techniques including linear and binary search. Matrix operations including addition and multiplication. Character arrays and strings. String input/output and basic string handling functions. Introduction to structures, declaration and initialization, array of structures, enumerated data types and usage in programs.	**10**
Unit VI	**Dynamic Memory Allocation ,File Handling and Command Line Arguments**: Dynamic memory allocation using malloc(), calloc(), realloc() and free(). Introduction to file handling. File handling operations and functions. Introduction to command-line arguments using argc and argv and simple applications.	**10**

Text Books and Reference Books

Text Books	1. Venkatesh, N. Y. (2024). Practical C programming for problem solving. Khanna Book Publishing Company. 2. AICTE. (2024). Programming for problem solving (with lab manual). Khanna Book Publishing Company. 3. Deitel, H., & Deitel, P. (2015). C: How to program (9th ed.). Pearson India. Dromey, R. G. (n.d.). How to solve it by computer
Reference Books	1. Kernighan, B. W., & Ritchie, D. (2015). The C programming language (2nd ed.). Pearson. 2. Hanly, J., & Koffman, E. (2015). Problem solving and program design in C (8th ed.). Pearson.

Semester 1	Problem Solving Techniques: Lab Problems	C	P/Week
Course Code UGBCADSC101C	**Total Classes (Practical): 60**	**2**	**4**

1. Write and execute simple C programs demonstrating the use of constants, variables, and arithmetic expressions.
2. Write programs to demonstrate increment and decrement operators and data type conversion.
3. Write a program to convert temperature from Fahrenheit to Centigrade and vice versa.
4. Write programs to calculate the area and perimeter of a rectangle and the area and circumference of a circle.
5. Write a program to check whether a given year is a leap year using if-else statements.
6. Write a program to check whether a given string is a palindrome.
7. Write a program to find the greatest of three numbers using conditional operators.
8. Write a program to check whether a given character is a vowel or consonant.
9. Write a program using switch statement to display the day of the week based on a number (1–7).
10. Write a program using switch statement to calculate and display the grade of a student based on percentage marks.
11. Write a program using switch statement to determine whether a triangle is equilateral, isosceles, scalene, or right-angled.
12. Write a program to find the sum of digits of a given number.
13. Write a program to generate multiplication tables up to 10 for numbers from 1 to 5.
14. Write a program to generate Fibonacci series up to n terms.
15. Write a program to print number patterns in pyramid format from 1 to 10.
16. Write a program to extract digits of a number and check whether it is an Armstrong number.
17. Write a program to check whether a number is prime and to display its prime factors.
18. Write a program to perform statistical operations such as maximum, minimum, sum, and average on a set of numbers using a sentinel-controlled loop.
19. Write a program to read, display, and sort a list of 10 numbers using any one sorting technique.
20. Write a program to perform addition of two 3×3 matrices.
21. Write a program to perform linear search and binary search on a list of numbers.
22. Write a program to create a structure named “Library” to store details of books and display the stored data.
23. Write a program to add two distances in kilometer and meter using structures.
24. Write programs to demonstrate the use of user-defined functions including GCD calculation and factorial using recursion.
25. Write programs to demonstrate pointer concepts including printing variable addresses and finding the sum of elements of an array using pointers.

Semester 1	Operating Systems	C	L	T	P
Course Code: UGBCADSC102C	Total Teaching Hours: 50	4	3	0	2

COURSE OUTCOMES

At the end of the course learners will be able to		
CO1	Explain the fundamentals of operating systems.	Understand
CO2	Comprehend multithreaded programming, CPU scheduling, process management, process synchronization, memory, deadlocks, and storage management.	Understand
CO3	Compare the performance of CPU scheduling algorithms.	Analyze
CO4	Identify the features of I/O and file handling methods.	Analyze

DETAIL SYLLABUS

UNIT I	Definition, Evaluation of O.S, Components & Services of OS, Structure, Architecture, Types of Operating Systems, Batch Systems, Concepts of Multiprogramming and Time Sharing, Parallel, Distributed and real-time Systems. Operating system services and system calls, system programs, operating system structure, operating system generations.	10
UNIT II	Process Definition, Process States, Process State Transitions, Process Scheduling, Process Control Block, Threads, Concept of Multithreads, Benefits of Threads, Types of Threads. Scheduling Objectives, Scheduling Algorithms, CPU Scheduling (Preemptive and Non-preemptive), Performance Evaluation of Scheduling Algorithms.	15
UNIT III	Introduction, Inter-process Communication and synchronization, Race Conditions, Critical Section Problem, Mutual Exclusion, Semaphores, Monitors. System Model, Classical Problems of Synchronization – producer consumer algorithm (bounded buffer and unbounded buffer), Readers/ writers problem (i) Readers having priority, (ii) Writers having priority. Dining philosopher problem, sleeping barber problem. Deadlock and its Characterization, Deadlock Prevention, Avoidance, Banker's Algorithm, Deadlock Detection, and Recovery from Deadlocks	15

UNIT IV	Memory management concepts, Multi programming with static and dynamic partitioning, placement algorithm. Logical and Physical Address Map, Swapping, Memory Allocation, MFT, MVT, Internal and External Fragmentation, Compaction and coalescing, Paging, Segmentation. Overlays, Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing. Principles of I/O Hardware: Disk Structure, Disk space allocation methods, Contiguous and noncontiguous allocation methods, Disk Scheduling Algorithms.	10

Text Books & Reference Book

Text Books	1. Ekta Walia, Operating Systems Concepts, Khanna Publishing House, 2022 (AICTE Recommended Textbook) 2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition OR Later edition, Wiley India Private Limited, New Delhi. 3. Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.
Reference Books	1. Andrew S Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall India 2. Sumitabha Das, UNIX Concepts and Applications, 4th Edition, Tata McGraw-Hill.

Semester 1	Operating Systems Lab	Lab/Week
Course Code: UGBCADSC102C	Total Teaching Hours: 60	**2**

Part 1

1. Execute the following commands and note down the output
   a. pwd,
   b. cat command - to create new file, to display content of file/s, to send content of one file to the other while preserving and not preserving the contents of the target file,
   c. mkdir command, cd to get into and coming out of a directory.
   d. rmdir with options/switches
2. Execute LS command with different options/ switches

option	Description
ls -a	list all files including hidden file starting with '.'
ls -l	list with long format - show permissions
ls -la	list long format including hidden files
ls -lh	list long format with readable file size
ls -r	list in reverse order
ls -R	list recursively directory tree
ls -s	list file size
ls -S	sort by file size
ls -t	sort by time & date
ls -X	sort by extension name

3. Execute the following commands and note the output
   a. mv with options/switches
   b. wc with options/switches
   c. cal with options/switches
4. Execute the following commands and note the output
   a. sort with options/switches
   b. cut with options/switches
5. Execute the following commands and note the output
   a. more with options/switches
   b. less with options/switches
   c. head with options/switches
   d. tail with options/switches
6. Execute the following commands and note the output
   a. touch with options/switches
   b. cmp with options/switches
   c. comm with options/switches
   d. diff with options/switches

7. Execute the following commands and note the output
   a. ps with options/switches
   b. kill with options/switches
   c. who with options/switches
   d. whoami
8. Execute the following commands and note the output
   a. chmod with options/switches
   b. cut with options/switches
   c. grep with options/switches

9. BASIC VI COMMANDS

To create file

   a. vi filename to Create or Edit filename starting at line 1
   b. vi -r filename to recover filename that was being edited when system crashed

To Exit vi

   a. x<return> Quit vi, writing out modified file to file
   b. wq<return> Quit vi, writing out modified file to file
   c. q<return> Quit or exit vi
   d. q!<return> Quit vi even though latest changes have not been saved for this vi call

Moving the cursor

   a. j or <return>[or down-arrow] Move cursor down one line
   b. k[or up-arrow] Move cursor up one line
   c. h or<backspace>[or left-arrow] Move cursor left one line
   d. l or<space>[or right-arrow] Move cursor right one line
   e. 0(zero) Move cursor to start of current line(the one with the arrow)
   f. $ Move cursor to end of the current line
   g. W Move cursor to beginning of next word
   h. B Move cursor back to beginning of preceding word
   i. 0<return> or 1G Move cursor to first line in file
   j. n<return>or nG Move cursor to line n in file
   k. $<return>or G Move cursor to last line in file

10. Some more VI commands

A. Screen Manipulation

   a. ^f-Move forward one screen
   b. ^b-Move backward one screen
   c. ^d-Move down(forward) one half screen
   d. ^u-Move up(back)one half sreen
   e. ^l-Redraws the screen
   f. ^r-Redraws the screen, removing the deleted lines

B. Inserting or Adding text

   a. I-Insert text before cursor,until<esc>hit
   b. I-Insert text at beginning of current line,until<esc>hit
   c. a-Append text after cursor,until<esc>hit

d. A-Append text to end of current
e. line,until<esc>hit
f. o-Open and put text in a new line below
g. current line,until<esc>hit
h. O-Open and put text in a new line above
i. current line,until<esc>hit
j. u-Undo whatever you just did(a simple toggle)

C. Changing the text

a. 1.-R-Replace single character under cursor(no <esc>needed)
b. R-Replace characters,starting with current cursor position, until<esc>hit
c. w-Change the current word with new text, starting with the character under cursor,until<esc>hit
d. cNw-Change N words beginning with the character under cursor, until<esc>hit
e. c-change(replace)the characters in the current line, until<esc>hit
f. cc-change(replace)the characters in the current line, stopping when <esc>hit
g. Ncc or cNc-change(replace)the next N lines, starting with the current line, stopping when <esc>hit

Semester 1	Mathematical Foundation of Computer Science	C	L	T	P
Course Code: UGBCADSE101T	Total Teaching Hours: 60	4	4	0	0

COURSE OUTCOMES

At the end of the course learners will be able to		
CO1	Provide a basic understanding of fundamental mathematical concepts such as sets, functions, matrix algebra, and discrete mathematics	Understand
CO2	This course enables the students to use mathematical models and techniques to analyze and understand problems in computer science.	Analyze
CO3	This course demonstrates how the mathematical principles give succinct abstraction of computer science problems and help them to efficiently analyze.	Analyze
CO4	To use algebraic mathematics in computer science	Understand
CO5	Use of discrete mathematics in computer science	Analyze

Prerequisite: Knowledge of basics of mathematics

DETAIL SYLLABUS

UNIT I	Introduction to Discrete Mathematics, branches of Mathematics as a foundation to Computer Science, the skills required to solve certain type of problems Problem Solving Techniques in Computer Science – examples (selection of problems and their solutions illustrating non-formula based approach) Number Theory – introduction to prime numbers, division algorithm, theorems on divisibility, congruences and related theorems, Euler's phi function, Chinese Remainder Theorem, Fermat's theorem	**13**
UNIT II	**Counting and Recurrence Relation:** Basics of counting, Pigeonhole principle, permutations, combinations, Binomial coefficients, Binomial theorem. Multinomial coefficients Combinations with repetitions Recurrence relations, modelling recurrence relations with examples, like Fibonacci numbers, the tower of Hanoi problem. Solving linear recurrence relation with constant coefficients using characteristic equation roots method.	**17**
UNIT III	**Elementary Graph Theory:** Basic terminologies of graphs, connected and disconnected graphs, subgraph, paths and cycles, complete graphs, digraphs, weighted graphs, Euler and Hamiltonian graphs.	**15**

	Trees, properties of trees, concept of spanning tree. Planar graphs. Definitions and basic results on the topics mentioned.	
UNIT IV	**Matrix Algebra:** Types of matrices, algebra of matrices–addition, subtraction, and multiplication of matrices, determinant of a matrix, symmetric and skew-symmetric matrices, orthogonal matrix, rank of a matrix, inverse of a matrix, applications of matrices to solve system of linear equations, Eigen values and Eigen vectors, Caley-Hamilton theorem.	**15**
Text Books and Reference Books		
Text Books	1. Garg, R. (2024). Engineering mathematics. Khanna Book Publishing Company. (AICTE Recommended Textbook) Garg, R. (2023). Advanced engineering mathematics. Khanna Book Publishing Company.	
Reference Books	1. Grimaldi, R. P., & Ramana, B. V. (2007). Discrete and combinatorial mathematics: An applied introduction (5th ed.). Pearson Education. 2. Rosen, K. H., & Krithivasan, K. (2019). Discrete mathematics and its applications. McGraw Hill India. West, D. B. (2015). Introduction to graph theory (2nd ed.). Pearson Education.	

Semester 1	Functional English	C	L	T	P
Course Code:	Total Teaching Hours: 30	3	3	0	0

COURSE OUTCOMES

At the end of the course learners will be able to		
CO1	Understand and apply basic vocabulary, sentence structures, and paragraph organization.	Understand
CO2	Identify and correct grammatical errors in common usage.	Analyze
CO3	Demonstrate the ability to engage in everyday spoken conversations effectively.	Create
CO4	Develop listening comprehension skills through guided listening tasks.	Understand

Prerequisite: Basic Knowledge of English

DETAIL SYLLABUS

Unit I	**Functional Grammar and Vocabulary Building** Topics: Grammar: Subject-verb agreement, article and preposition usage, Tense, Active and Passive, Narration; Common Errors: Misplaced modifiers, pronoun errors, redundancies and Vocabulary Building: Word Formation: Root Words | Prefixes | Suffixes; Synonyms, Antonyms, and Standard Abbreviations; Business Vocabulary: Corporate Terms | Finance & Accounting | Marketing & Sales | Human Resources |Operations & Strategy Startup/Innovation; Academic Vocabulary: Research & Writing | Critical Thinking | Essay/Report Writing | Presentation | Study Skills | Quantitative Terms | General Academic Use |Pronunciation Practice: Word and sentence stress | Connected speech (linking, elision, assimilation) | Common pronunciation errors | Listening to Different English Accents: Exposure to various accents (British, American, Indian, Australian) | **Class Activity:** 1. Participants may work in pairs or small groups to identify and correct grammar errors in sentences related to subject-verb agreement, tense usage, and active/passive voice. 2. The instructor may provide root words and ask participants to form new words using prefixes and suffixes. Then, introduce business terms from areas like marketing, finance, and human resources and have participants use them in sentences.	**10**

	3. The course instructor may distribute paragraphs with common grammar errors (e.g., misplaced modifiers, redundancy, pronoun mistakes). Let the participants identify the errors and rewrite the sentences correctly.	
Unit II	**Basic Writing Skills** Sentence Construction: Basic sentence structure: Subject + Verb + Object (SVO) | Compound and complex sentences | Sentence fragments vs. run-on sentences; Paragraph Coherence: Topic sentence and supporting details | Coherence through logical flow | Unity in a paragraph: relevance of supporting idea; Punctuation: End punctuation: period, question mark, exclamation mark | Comma rules | Semicolons and colons | Quotation marks, parentheses, ellipses; Linking Devices: Coordinating conjunctions (for, and, nor, but, or, yet, so) | Subordinating conjunctions (although, because, unless, while) | Transitional phrases: in addition, however, consequently, etc	**10**
Unit III	**Reading Tips, Analysis and Practices** Comprehension strategies: skimming, scanning, inference; Reading short articles, essays, and fiction excerpts; Composition and its Types: Descriptive writing | Narrative writing | Argumentative writing | Expository writing	**10**

Text Books and Reference Books

Text Books	1. Church, P. (2010). *Added value: The life story of Indian business leaders: N. R. Narayan Murthy*. Lotus Roli.
Reference Books	1. Kumar, K. B. (2021). Effective communication skills. Khanna Book Publishing. 2. Swan, M. (2016). Practical English usage (4th ed.). Oxford University Press. 3. Zinsser, W. (2006). On writing well: The classic guide to writing nonfiction. Harper Perennial. 4. Hamp-Lyons, L., & Heasly, B. (2006). Study writing: A course in written English for academic purposes. Cambridge University Press. 5. Tiwari, A. (2021). Communication skills in English with lab manual (AICTE prescribed). Khanna Book Publishing. 6. Central Institute of English and Foreign Languages. (2006). Exercises in spoken English (Parts I–III). Oxford University Press.

Semester 1	Indian Knowledge System	C	L	T	P
Course Code:	Total Teaching Hours: 45	3	3	0	0

COURSE OUTCOMES

At the end of the course learners will be able to		
CO1	Identify and explain the origin, meaning, and scope of the Indian Knowledge System, including its ethical foundations and perspectives from major Indian and global religions.	Understanding
CO2	Analyze the diverse cultural expressions of Indian Knowledge Systems such as classical and folk arts, music, architecture, cuisine, and clothing, and their relevance to Indian identity.	Analyze
CO3	Demonstrate an understanding of traditional Indian approaches to health and wellness through Yoga and Ayurveda, and their global impact and modern relevance.	Demonstrate
CO4	Evaluate the contributions of ancient India in science, mathematics, astronomy, medicine, and education, with reference to ancient universities and scholarly traditions.	Evaluate
CO5	Critically assess contemporary initiatives for the preservation and promotion of traditional Indian knowledge and propose methods to integrate them into modern systems.	Assess

DETAIL SYLLABUS

UNIT-I: **Indian Knowledge System: Tradition and its Promotion**	**Topics:** • Indian Knowledge System: Origin Meaning and Scope • "Knowledge' in Hinduism, Buddhism, Jainism, Islam and Christianity • Yoga: Meaning and types of yoga • Initiatives to, preserve and promote traditional knowledge • Ethical foundations: Truth, Non-Violence, Karma	**10**
UNIT-II: **Cultural Dimension of Indian Knowledge System**	**Topics:** • Classical and folk-dance forms • Classical and vocal music and sangeet gharana • Painting, sculpture and architecture in ancient and mediaeval times • Sports and martial arts of India • Indian cuisine and clothes	**10**
UNIT-III: **Education and Technology in Indian**	**Topic:** • Science and Technology in Ancient India • Mathematics and Astronomy in Ancient India • Traditional knowledge of Indian medicine	**10**

Knowledge System	• Ancient universities: and their functioning India's Global Contributions: Yoga, Ayurveda, Numerals, Astronomy	
Text Books and Reference Books		
Text Books	1. Mahadevan, B., Ramasubramanian, V., & Saraswati, S. A. S. (2022). Introduction to Indian knowledge system: Concepts and applications. PHI Learning. **2.** Nitonde, R. (2023). Introduction to Indian knowledge system: A textbook for UG students as per NEP 2020. Notion Press.	

Semester 1	Environmental Study	C	L	T	P
Course Code:	Total Teaching hours: 45	**3**	**3**	**0**	**0**

COURSE OUTCOMES

At the end of the course learners will be able to		
CO1	Understand Historical Human-Environment Interactions, recognize the historical evolution of human relationships with the environment across time and regions.	Understand
CO2	Identify types, distribution, and uses of natural resources, with a focus on their status and management in India.	Analyze
CO3	Analyze resource availability and conservation, examine the factors affecting resource availability and evaluate methods for their conservation and sustainable management.	Analyze
CO4	Explain the principles, challenges, and global strategies associated with sustainable development.	Understand
CO5	Gain foundational knowledge of ecosystems, biodiversity, and the importance of conservation practices.	Analyze

DETAIL SYLLABUS

Unit I	**Humans and the Environment** Introduction to Environmental Studies: Definition, Concept & Importance; Historical significance: Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change; Environmental Ethics and emergence of environmentalism: UN Conference on Human Environment 1972; Concept of sustainable development; Rio Summit and subsequent international efforts.	**5**
Unit II	**Natural Resources and Sustainable Development** Overview and definition of natural resources; Classification of natural resources- biotic and abiotic, renewable and non-renewable; Water resources: Types of water resources- fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges; Water scarcity and stress; Soil and mineral resources: Important minerals; Mineral exploitation;	**15**

	Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation. Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources- coal, oil, natural gas, nuclear energy; Non-conventional energy sources- solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen Implications of energy use on the environment	
Unit III	**- Conservation of Biodiversity and Ecosystems** Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories; Threats to biodiversity and ecosystems:; Commercial exploitation of species; Invasive species; Fire, disasters and climate change; Major conservation policies: in-situ and ex-situ conservation approaches.	**10**
Unit IV	**Environmental Pollution, Health, and Climate Change** Understanding pollution: Definition; Point sources and non-point sources of pollution; Air pollution: Sources of air pollution; Primary and secondary pollutants; National Ambient Air Quality Standards; Water pollution: Sources of water pollution; Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life; Soil pollution and solid waste; Noise pollution; Thermal and Radioactive pollution; Understanding climate change: Importance of 1.5 °C and 2.0 °C limits to global warming; Climate change projections for the Indian sub-continent; Mitigation of climate change; Green House Gas (GHG) reduction vs. sink enhancement.	**15**

Text Books and Reference Books

Text Books	1. Adenle, A., Azadi, H., & Arbiol, J. (2015). Global assessment of technological innovation for climate change adaptation and mitigation in developing world. Journal of Environmental Management, 161(15), 261–275. 2. Ahluwalia, V. K. (2015). Environmental pollution and health. The Energy and Resources Institute (TERI). 3. Barnett, J., & O'Neill, S. (2010). Maladaptation. Global Environmental Change—Human and Policy Dimensions, 20, 211–213. 4. Bawa, K. S., Oomen, M. A., & Primack, R. (2011). Conservation biology: A primer for South Asia. Universities Press.

SEMESTER -II

Semester – 2								
S.No	**Course Code**	**Course Tile**	**Course Category**	**IA Marks**	**ESE Marks**	**Total Marks**	**Credit**	**No of classes**
1	UGBCADSC203C	Computer Organization And Architecture	DSC	40	60	100	3T	3
2	UGBCADSC204C	Object Oriented Programming Using Java	DSC	40	60	100	3T+2P	3+4
3	UGBCADSC205P	Software Engineering	DSC	40	60	100	3	3
4	UGBCADSE202T	Mathematical Foundation to Computer Science -II	DSE	40	60	100	4	4
5		Advanced Communication and Soft Skills	AEC	20	30	50	2	2
6		Web Technology	SEC	25	25	50	2	2
7		Digital Content Creation	MDC	40	60	100	3	3
8		Indian Constitution	VAC	20	30	50	2	2
			TOTAL	265	385	650	24	26

Semester II	Computer Organization And Architecture	C	L/week	T/week	P
Course Code: UGBCADSC203C	Total Teaching Hours: 60	**3**	**3**	**1**	**-**

COURSE OUTCOMES

At the end of the course learners will be able to		
CO1	To Understand the basics of Digital Electronics and Binary Number System.	Understand
CO2	To Learn the implementation of Combinational Circuit.	Create
CO3	To Learn the implementation of Sequential Circuit.	Create
CO4	To Understand the Organization of basic computers.	Understand
CO5	To Understand the concept of Parallel Processing and Memory organization	Analyze

Prerequisite: This is an introductory programming course and hence no prerequisites

DETAIL SYLLABUS

Unit I	**Digital Principles:** Definition for Digital signals, Digital logic, Digital computers, Von Neumann Architecture, Boolean Laws and Theorems, K-Map: Truth Tables to K-Map, 2, 3 and 4 variable K Map, K-Map Simplifications, Don't Care Conditions, SOP and POS. **Number Systems:** Decimal, Binary, Octal, Hexadecimal, Number System Conversions, Binary Arithmetic, Addition and subtraction of BCD, Octal Arithmetic, Hexadecimal Arithmetic, Binary Codes, Decimal Codes, Error detecting and correcting codes, ASCII, EBCDIC, Excess- 3 Code, The Gray Code.	**15**
Unit II	**Combinational Circuits:** Half Adder and Full Adder, Subtractor, Decoders, Encoder, Multiplexer, Demultiplexer **Sequential Circuits:** Flip-Flops- SR Flip- Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop. Counter Design using various Flip Flop **Register:** 4 bit register with parallel load, Shift Registers- Bidirectional shift register with parallel load Binary Counters-4 bit synchronous and Asynchronous binary counter	**15**
Unit III	Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input- Output Interrupt, Complete Computer Description, Design of Basic Computer, Design of	**12**

	Accumulator logic. Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer(RISC), RISC Vs CISC.	
Unit IV	Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input-Output Processor(IOP). Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Virtual Memory, Memory Management Hardware. Architecture of 8086 microprocessor and its various addressing mode. Instruction set architecture	**18**

Text Books and Reference Books

Text Books	1. Leach, D. P., Malvino, A. P., & Saha, G. (2011). Digital principles & applications. Tata McGraw Hill Education Private Limited. 2. Mano, M. M. (n.d.). Computer system architecture (3rd ed.). Pearson/PHI.
Reference Books	1. Stallings, W. (n.d.). Computer organization and architecture (6th ed.). Pearson/PHI. 2. Tanenbaum, A. S. (n.d.). Structured computer organization (4th ed.). PHI Pearson. 3. Subramanyam, M. V. (n.d.). Switching theory and logic design. Laxmi Publications (P) Ltd. 4. Singh, I. (n.d.). Computer organization architecture. Khanna Book Publishing.

Semester II	Object Oriented Programming Using Java	C	L	T	P
Course Code: UGBCADSC204C	Total Teaching Hours: 48	5	3	0	4

Course Outcome

At the end of the course learners will be able to		
CO1	Explore the fundamentals of java programming with object orientation.	Understand
CO2	Concept of OOPs and its implementation with java language	Understand
CO3	Exploring collection methods and various types of classes.	Analyze
CO4	Identify and analyze the situations for Exception handling.	Analyze

DETAIL SYLLABUS

UNIT I	Fundamentals of Object-Oriented Programming: Basic Concepts of OOP, Benefits and Applications of OOP. Java Evolution: Java Features, Difference between Java, C, and C++, Java and Internet, Java Environment. Overview of Java Language: Introduction to Simple Java Program, Use of Comments, Math Functions, Java Program Structure, Java Tokens and Statements, Implementing Java Program and JVM, Command Line Arguments.	12
UNIT II	Constants, Variables, and Data Types: Declaration, Giving values to variables, Symbolic Constants, Type Casting. Operators & Expressions: Arithmetic, Relational, Logical, Assignment, Increment & Decrement, Bitwise, Conditional Operators. Decision Making, Branching & Looping: Control Statements, Looping Statements, Jump in Loops, Labeled Loops.	12
UNIT III	Classes, Objects, and Methods: Defining Class, Method Declaration, Constructors, Method Overloading, Overriding Methods, Inheritance. Arrays, Strings, and Vectors: 1D & 2D Arrays, Strings, Vectors, Wrapper Classes, Enumerated Types. Inheritance: Defining, Extending Classes, Implementing Interfaces, Multiple Inheritance, and Polymorphism.	15
UNIT IV	Packages: Basics, System Packages, User-Defined Packages, Adding Class to a Package. Exception Handling: try, catch, throw, throws, finally; Nested try, Multiple catch Statements, User-Defined Exceptions.	12
Text Books & Reference Book		

Text Books	1. Balaguruswamy, E. (2023). Programming with JAVA: A primer (7th ed.). McGraw Hill Education. 2. Schildt, H. (2022). Java: The complete reference (12th ed.). McGraw-Hill Education.
Reference Books	1. Goyal, A. (2012). The essentials of JAVA. Khanna Book Publishing Company Private Limited. 2. Alam, T. (2015). Core JAVA. Khanna Book Publishing Company Private Limited. 3. Liang, Y. D. (2008). Introduction to Java programming (7th ed.). Pearson. 4. Malhotra, S., & Choudhary, S. (2014). Programming in Java (2nd ed.). Oxford University Press.

Semester II	Java Programming Lab	C	Lab /Week
Course Code: UGBCADSC204C	Total Teaching Hours: 60	2	4

Lab Exercise

UNIT I

1. Try printing the following strings, and observe the difference in output?
   a) "Xavier \t University"
   b) "Java \n Workshop"
2. Make a simple class with name First and that have main() method also but save source code as Second.java, after that run on command line and find out the name of the class file generated by the compiler and execute it.
3. Write a java program to find out simple interest and compound interest of given principal, time and rate. (input must be taken by command line arguments)
4. Write a java program to find out root of quadratic equation of given equation.(ax^2+bx+c)
5. Write a java program to find Write a program that generates and prints a random integer between 1 and 100, inclusive. **Hint:** Use `Math.random()`.
6. Write a program to read two numbers from user and print their product.
7. Write a program to print the square of a number passed through command line arguments.
8. Write a program to send the name and surname of a student through command line arguments and print a welcome message for the student.
9. Write a program to find out area of rectangle, input passed through command line arguments.
10. Write a program to find the out volume of cuboid , input passed through command line arguments.

UNIT II

1. Write a java program to reverse 3 digits number and also find out maximum digit among them. (Ex:- if number is 345 then print 543 and 5 is maximum digit).
2. Write a java program to find out multiplication of two numbers without using multiply sign(*).
3. Write a java program to generate an Arithmetic Progression (AP) series.
   (Ex: first term (a): 5, common difference (d): 3, number of terms (n): 6 then
   AP series like that 5 8 11 14 17 20)
4. Write a java program to find out factorial of given number without using multiply sign(*).
5. Write a java program to find out LCM and HCF of given two numbers.
6. Write a java program to find the largest number out of n natural numbers.
7. Write a java program to find the Fibonacci series & Factorial of a number using recursive and non recursive functions.
8. Write a java program to print all the prime number between 1 to n, where n is the range given by user.
9. Write a java program to check given number is Armstrong or not.

10. Write a java program to convert given decimal number to binary number.

UNIT III

1. Write a java program to multiply two given matrices.
2. Write a Java program for sorting a given list of names in ascending order.
3. Write a Java program that checks whether a given string is a palindrome or not . Ex:MADAM is a palindrome.
4. Write a java program to read n number of values in an array and display it in reverse order.
5. Write a Java program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from AddSub class to use the member data of the super class. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.
6. Create a JAVA class called Student with the following details as variables within it.
   a. USN, NAME, BRANCH, PHONE, PERCENTAGE
   b. Write a JAVA program to create n Student objects and print the USN, Name, Branch, Phone, and percentage of these objects with suitable headings.
7. Write a Java program that displays the number of characters, lines and words in a text.
8. Write a Java program to create a class called Shape with methods called getPerimeter() and getArea(). Create a subclass called Circle that overrides the getPerimeter() and getArea() methods to calculate the area and perimeter of a circle.
9. Write a Java program to create a class Employee with a method called calculateSalary(). Create
   a. two subclasses Manager and Programmer. In each subclass, override the calculateSalary() method to calculate and return the salary based on their specific roles.
10. Write a Java program using an interface called 'Bank' having function 'rate_of_interest()'. Implement this interface to create two separate bank classes 'SBI' and 'PNB' to print different rates of interest. Include additional member variables, constructors also in classes 'SBI' and 'PNB'.

11. Write a java program to demonstrate constructors overloading and methods overloading in one class.
12. Write a java program to print 1 to n without using loop, recursive function. Where n is the range taken from user.(as we know goto statement not implemented in java like c).
13. Write a program to input integer elements into an array of size 20 and perform the following operations: Display largest and smallest number from the array and also print its position.
14. Write a program to implement binary search in one dimensional array.
15. Create a base class Student with name and roll number as member data , create two subclasses:1>InternalMarks 2>ExternalMarks (both have 3 subjects marks)
make one main class to calculate total marks of internal+external for one student.
16. Write a program to implemented multiple inheritance in java.
17. Write a program in java for demonstrate super keyword uses.
18. Write a java program to take single character as input and also print its ASCII value.
19. Write a java program to demonstrate parseInt() method and toString() method uses.

20. Write a java program to convert an array of primitive int values into an array of Integer wrapper class objects after that print both arrays.

UNIT IV

1. Write a Java program using an interface called 'Bank' having function 'rate_of_interest()'. Implement this interface to create two separate bank classes 'SBI' and 'PNB' to print different rates of interest. Include additional member variables, constructors also in classes 'SBI' and 'PNB'.

2. Write a Java package program for the class book and then import the data from the package and display the result.

3. Write a Java program for finding the cube of a number using a package for various data types and then import it in another class and display the results.

4. Write a Java program that reads a list of integers from the user and throws an exception if any numbers are duplicates.

5. Create an exception subclass UnderAge, which prints "Under Age" along with the age value when an object of UnderAge class is printed in the catch statement. Write a class exceptionDemo in which the method test() throws UnderAge exception if the variable age passed to it as argument is less than 18. Write main() method also to show working of the program.

6. Create a package named mypack1 containing a class Message1 with a method display() that prints a "welcome to Xavier university".Write another class Message2 in different package mypack2 ,then class display() of Message1 class by using "import" keyword.

7. Write a Java program for demonstrating the divide by zero exception handling

8. Write a java program to accept two numbers from the user and perform division with Handle ArithmeticException if denominator is zero.

9. Write a java program to input 5 integers into an array. Allow the user to access any index and display its value. Handle ArrayindexOutOfBoundsException for invalid index input.

10. Create a class BankAccount with methods deposit() and withDraw().
Thrown an user define exception if:
* Withdrawal amount is greater than balance.
* Deposit amount is negative.

Semester II	Software Engineering	C	L	T	P
Course Code: UGBCADSC205T	Total Teaching Hours: 46	**3**	**3**	**0**	**0**

Course Outcome

At the end of the course learners will be able to		
CO1	Explain the fundamental concepts of software engineering and software development processes.	Understand
CO2	Analyze software requirements and risk management strategies.	Analyze
CO3	Apply software design and testing strategies for quality assurance.	Apply
CO4	Evaluate quality management, release management, and product sustenance.	Evaluate

DETAIL SYLLABUS

UNIT I	The evolving role of software, changing nature of software, layered technology, a process framework, Process models: The waterfall model, incremental process models, evolutionary process models, the unified process. Agile software development: Agility Principles, Agile methods, Plan-driven and agile development, Extreme programming, Scrum, A Tool Set for the Agile Process.	10
UNIT II	Software Requirements Engineering: Functional and non-functional requirements, software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management. Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan. Project planning- Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques.	12
UNIT III	Design: Design process and design quality, design concepts, the design model, software architecture, data design, architectural design, Basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams. Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging. Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.	12

UNIT IV	Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability. Release Management: Release planning, development and build plans, release strategies, risk management, and post-deployment monitoring. Product sustenance: Maintenance, updates, End of life, migration strategies.	12
Text Books & Reference Book		
Text Books	1. Pressman, R. S. (2014). Software engineering: A practitioner's approach (7th ed.). McGraw Hill. 2. Sommerville, I. (2015). Software engineering (10th ed.). Pearson.	
Reference Books	1. Jalote, P. (2005). An integrated approach to software engineering (3rd ed.). Springer. 2. Mall, R. (2018). Fundamentals of software engineering (5th ed.). PHI Learning.	

Semester II	Mathematics Foundation to Computer Science – II	C	L	T	P
Course Code UGBCADSE202T	Total Teaching Hours: 60	4	4	0	0

Course Outcome

At the end of the course learners will be able to		
CO1	Understand correct lines of argument and proof techniques.	Understand
CO2	Apply mathematical techniques that form the foundation for computational methods, including numerical methods and optimization.	Apply
CO3	Analyze and utilize problem-solving strategies to tackle theoretical and practical challenges in computer science.	Analyze

DETAIL SYLLABUS

UNIT I	**Logic and Methods of Proofs**: Propositions, logical operations (basic connectives), compound statements, construction of truth tables, quantifiers, conditional statements, tautology, contradiction, contingency, logical equivalence. **Methods of Proofs**: Rules of inference for propositional logic, modus ponens, modus tollens, syllogism, proof by contradiction, Mathematical Induction.	12
UNIT II	**Set, Relation and Function:** Set, Set Operations, Properties of Set operations, Subset, Venn Diagrams, Cartesian Products. Relations on a Set, Properties of Relations, Representing Relations using matrices and digraphs, Types of Relations, Equivalence Relation, Equivalence relation and partition on set, Closures of Relations, Warshall's algorithm. Functions, properties of functions (domain, range), composition of functions, surjective (onto), injective (one-to-one) and bijective functions, inverse of functions. **Algebraic Structures**: Semi-group, Monoid, Group, Subgroup, Cyclic group.	17
UNIT III	**Numerical Methods**: Concept and importance of errors in numerical methods. **Solution of Algebraic and Transcendental Equations**: Bisection method, Newton-Raphson method. **Numerical Interpolation**: Newton's Forward and Backward interpolation formulas, Lagrange's formula. **Numerical Integration**: Trapezoidal rule, Simpson's 1/3 rule. *(Only formula and problem-solving for all topics)*	13

UNIT IV	**Optimization Techniques**: **Linear Programming**: Introduction, LP formulation, graphical method for solving LPs with two variables, special cases in graphical methods, Simplex method, Duality. **Transportation Problem**: Definition, Linear form, North-west corner method, Least cost method, Vogel's approximation method for finding feasible solution, MODI method for finding optimum solution.	18

Text Books & Reference Book

Text Books	1. Kolman, B., Busby, R., & Ross, S. (2015). Discrete mathematical structures (6th ed.). Pearson Education. 2. Sastry, S. S. (2022). Introductory methods of numerical analysis (5th ed.). PHL. 3. Taha, H. A. (2003). Operations research: An introduction (8th ed.). Pearson Prentice Hall. 4. Singh, S. B. (2023). Discrete structures. Khanna Book Publishing. (AICTE Recommended Textbook)
Reference Books	1. Rosen, K. H., & Krithivasan, K. (2019). *Discrete mathematics and its applications*. McGraw Hill India. 2. Chakravorty, J. G., & Ghosh, P. R. (2017). *Linear programming and game theory*. Moulik Library. 3. Sharma, J. K. (2007). *Operations research: Theory and applications* (4th ed.). Macmillan Publishers.
Web Resources	1. https://nptel.ac.in/courses/111107127 2.https://www.math.iitb.ac.in/~siva/si50716/SI507lecturenotes.pdf

Semester II	Advanced Communication and Soft Skills	C	L	T	P
Course Code:	Total Teaching Hours: 30	2	2	0	0

Course Outcome

At the end of the course learners will be able to		
CO1	Analyze and interpret academic and professional texts	Analyze
CO2	Compose structured written communication	Create
CO3	Engage effectively in oral and coherent written communication.	Apply

DETAIL SYLLABUS

UNIT I	**Advanced Writing** Topics: Communication for Employment (Written) | Articles | Essay | Paragraph Writing | Composition and Composition Types | Summary | Report Writing | E-Mails | Circular and Memos | Reports of Survey | Professional Brochure Writing | Writing a Proposal | Letter Writing – Formal & Informal | Report Writing – Official and Business Reports | Cover Letter | Resume | CV | Job Application and Follow-up Letter | Business Letters and Its Types effective| Business emails | Proposals **Class Activity**: (Any One) 1. The Course Teacher may give participants a case (e.g., "Decline in customer satisfaction at a Shopping Malls "). Participants' Groups can generate and circulate google forms to gather data and survey results. With the help of the datasets, the participants would draft an official business report including: Executive summary Findings (with charts or bullet points) and Recommendations. 2. The participants can be asked to prepare a tailored resume and cover letter for a specific job. In class, they exchange drafts with a peer and use a guided rubric to critique: Relevance and clarity of content Format and structure Tone and professionalism. The Course teacher can give participants different business scenarios (e.g., replying to a customer complaint, requesting leave, responding to a promotion announcement, negotiating a deadline). Each student or pair must write a short, professionally formatted email.	9
UNIT II	**Effective Reading and Critical Analysis** **Topics:** Effective Reading: Techniques of Critical Reading | Extensive and Intensive Reading | Comprehension | Case Study: Analysing	9

	complex business cases or media cases, identifying problems, and proposing solutions. **Selected Reading:** (Any One) 1. "Machine Learning" (Pages-61 page -69) in John Joseph Adams Machine Learning: New and Collected Stories 2. "June 2001: Reality TV" (An excerpt from Rushdie, Salman: *Step Across This Line*) 3. Industry-specific texts and resources suggested and recommended by the Course Teacher **Class Activity:** (Any One) 1. Pick a character (e.g., from "Who Moved My Cheese?" or the ML story) and ask students to perform a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis of their choices in the story. 2. Provide a brief media/business case (or let students select from recent events). Assign roles (reporter, CEO, stakeholder, analyst). Each group must analyse the problem, identify biases (if media), and propose actionable solutions. 3. Use a layered passage from "Machine Learning" or Rushdie's essay. Ask students to: a) Infer what's implied but not said. b) Highlight ambiguity or irony. c) Predict author intent or outcome.	
UNIT III	**Industry-Specific Communication and Soft Skills** **Industry-Specific Communication** **Topics:** Communication as a Medium of Transference | Process of Communication | General business language and industry-specific language | Functions of Effective Communication | Effective Communication and its Function | Theories of Communication and Communication Models | Types of Communication | Miscommunication and Barriers in Communication | Principles of Communication | Organizational Communication and Its Types/ Hierarchical vs. flat organizational communication | Verbal Communication: Intrapersonal Communication | Interpersonal Communication | Small Group Communication | Public Speaking or Mass Communication | Nonverbal Communication: Paralanguage | Kinesics | Haptic | Proxemics | Sign and Symbols | Body Language and Behavior | Appearance | Posture | Gesture | Eye Contact | Artifacts | Voice Modulation | Types of Corporate Communication | Internal vs. External **Soft Skills** **Topics:** Soft Skills | Emotional Intelligence at Workplace | Professional Etiquette | Interpersonal Skills | Time Management and Prioritization | Adaptability	12

	Note: The course Instructor need to talk on the following aspects of Professional skills while discussing this unit: 1. Emotional Intelligence (self-control, empathy, social awareness) 2. Professional Etiquette (tone, behaviour, dressing, punctuality) 3. Interpersonal Skills (teamwork, conflict resolution) 4. Time Management & Prioritization 5. Adaptability (handling change and ambiguity) **Class Activity:** The course Instructor may assign students to small groups representing different departments in a company (e.g., Marketing, HR, IT). S/he may present a scenario (e.g., launching a product or resolving a customer complaint). Each group prepares and performs a role-play simulating, using industry-specific language, voice modulation, eye contact, gestures, and other nonverbal cues.	

Text Books & Reference Book

Text Books	1. Carnegie, D. (2010). How to win friends and influence people. Simon & Schuster. 2. Chaturvedi, P. D., & Chaturvedi, M. (n.d.). Business communication. Pearson Education. 3. Cialdini, R. B. (2006). Influence: The psychology of persuasion (Rev. ed.). Harper Business. 4. Covey, S. R. (2004). The 7 habits of highly effective people: Powerful lessons in personal change. Free Press. 5. Goleman, D. (2006). Emotional intelligence: Why it can matter more than IQ (10th anniversary ed.). Bantam Books. 6. Levinson, J. C., & Perry, J. (2005). Guerrilla etiquette: Advance praise for the new rules of business etiquette. Houghton Mifflin. 7. Robbins, S. P., & Judge, T. A. (2019). Organizational behaviour (18th ed.). Pearson. 8. Stein, S. J., & Book, H. E. (2011). The EQ edge: Emotional intelligence and your success (3rd ed.). Wiley. 9. Strunk, W., Jr., & White, E. B. (2000). The elements of style (4th ed.). Longman. 10. Suri, G. K., & Suri, R. K. (2017). Soft skills. S. Chand Publishing. **11.** Tracy, B. (2007). Eat that frog! 21 great ways to stop procrastinating and get more done in less time. Berrett-Koehler Publishers.

Semester II	Web Technology	C	L	T	P
Course Code:	Total Teaching Hours: 30	**3**	**2**	**0**	**0**

Course Outcome

At the end of the course learners will be able to		
CO1	Understand the concepts and architecture of the World Wide Web, markup languages, and Cascading Style Sheets.	Understand
CO2	Apply event handling and data validation techniques in web applications.	Apply
CO3	Implement embedded dynamic scripting on the client and server sides using JavaScript, AJAX, and XML.	Implement
CO4	Develop interactive and responsive web applications using modern web technologies.	Create

Prerequisites:

- Proficiency in at least one programming language (Python, Java, or C++).
- Understanding of programming concepts such as loops, conditionals, functions, and data structures.
- Familiarity with object-oriented programming (OOP) principles including classes, objects, inheritance, and polymorphism.

DETAIL SYLLABUS

UNIT I	**Introduction to Web Technologies:** Introduction to HTML, history of HTML, objective, basic structures of HTML, header tags, body tags, paragraph tags. **HTML Elements:** Tags for FORM creation, table, form, textarea, select, img, iframe, fieldset, anchor, lists, div tag, navbar design. **CSS & Bootstrap:** Introduction to CSS, types, selectors, responsiveness, introduction to Bootstrap, downloads/linking, using Bootstrap classes, understanding the Grid System. **Web Hosting & Protocols:** Introduction to WWW, protocols, applications, development tools, web browsers, DNS, web hosting providers, setting up Windows/Linux/Unix web servers, cloud hosting, types of web hosting.	15
UNIT II	**JavaScript Fundamentals:** Introduction to JavaScript, functions, events, Document Object Model (DOM) traversing. **JavaScript Data Handling:** Output system (Alert, Input box, Console), variables, arrays, date and string handling.	15

	JavaScript & CSS Manipulation: Form validation (required validator, length validator, pattern validator), advanced JavaScript, combining HTML, CSS, and JavaScript events. **AJAX & XML:** Introduction to AJAX, purpose, advantages, disadvantages, AJAX-based web applications, alternatives. **XML & JSON:** XML key concepts, DTD, schemas, XSL, XSLT, transforming XML using XSLT, introduction to XHTML. JSON: Keys and values, types of values, arrays, objects, transforming JSON data.	

Text Books & Reference Book

Text Books	1. *Lemay, L. (2016). Mastering HTML, CSS & JavaScript web publishing. BPB Publications.* 2. *Powell, T. A. (2017). The complete reference HTML & CSS (5th ed.).*
Reference Books	1. *Moreto, S. (2016). Bootstrap 4 by example.* 2. *Alam, T. (2011). Web technologies. Khanna Book Publishing.*
Web Resources	1. JavaTpoint. (n.d.). Web technology. https://www.javatpoint.com 2. W3Schools. (n.d.). HTML, CSS, JavaScript tutorials. https://www.w3schools.com 3. GeeksforGeeks. (n.d.). Web technology. https://www.geeksforgeeks.org

Web Technology: LAB Problem

PART A

1. Create an HTML page containing:
   - A title in the <head> section
   - A main heading <h1>
   - A paragraph <p>
   - Two sub-headings <h2>

   Use proper HTML structure.
2. Create a class timetable using the table tag.
3. Design a Student Registration Form
   - Create a form containing the following fields:
   - Name (text)
   - Email (email)
   - Gender (radio)
   - Course (select)
   - Address (textarea)
   - Submit
   - Resetbuttons

   Use <form>, <input>, <select>, <textarea>, <fieldset>, and <legend>.
4. Design a simple horizontal navbar using only HTML + CSS (no Bootstrap). Navbar items: Home, About, Courses, Contact.
5. Create an HTML page that displays:
   - An image using <img>
   - A YouTube video using <iframe>
   - A hyperlink <a> that opens in a new tab
6. Design a Webpage for your college containing descriptions of courses, departments, faculties, library, etc., using list tags, href tags, and anchor tags.

7. Create a webpage using Frame with rows and columns including header frame, left frame, right frame, and status bar frame. Clicking on the left frame should display content in the right frame.
8. Using an external CSS file:
    - Change background color of body
    - Style all paragraphs with a specific font
    - Style all headings with different colors
    - Apply an ID selector and a class selector
9. Create your Resume using HTML (text, links, size, color, lists).
10. Create a 3-column layout using Bootstrap Grid:
    - On large screens: 3 columns (equal width)
    - On tablets: 2 columns
    - On mobile: 1 column
    - Use Bootstrap classes: col-lg-4 col-md-6 col-sm-12.
11. Create a Web Page for a supermarket using internal CSS.
12. Create a user login form using Bootstrap classes:
    - Container
    - Form-control
    - Buttons
    - Input groups (optional)
13. Use Inline CSS to format the resume created earlier.
14. Make a page that contains:
    - An ordered list
    - An unordered list
    - A fieldset that groups related information
    - A legend describing the group

15. Use External CSS to format the timetable created.
16. Create a webpage using tags with the following sections:
    - A header section with college name
    - A navigation bar (Home, About, Courses, Contact)
    - A main content section with two columns (left content + right sidebar)
    - A footer section
    - Use only HTML + CSS (no Bootstrap). Add borders and background colors to identify each section.
17. Apply all CSS types (inline, internal, external) to format the college webpage created earlier.
18. Write an HTML program to create a college website optimized for mobile devices.
19. Create a Contact Us webpage that includes:
    - A contact form with Name, Email, Phone, and Message
    - A Google Map embedded using the <iframe> tag
    - A clickable email link using mailto:
    - Proper use of <label> and <input> fields
20. Create a photo gallery using only HTML + CSS that:
    - Displays 6 images
    - Shows images in 3 columns on desktop
    - Automatically stacks images into 1 column on mobile using CSS @media queries
    - Uses borders, spacing, and hover effects

PART B (JavaScript, AJAX, XML, JSON)

1. Write an HTML/JavaScript page to create a login page with validations.
2. Develop a simple calculator for addition, subtraction, multiplication, and division using JavaScript.
3. Use Regular Expressions for validations in the login page using JavaScript.
4. Write a program to retrieve data from a text file and display it using AJAX.
5. Create an XML file to store student information (Register Number, Name, Mobile Number, DOB, Email-ID).
6. Create a DTD for the XML file.
7. Create an XML Schema for the XML file.
8. Create an XSL file to convert the XML file to XHTML format.
9. Write a JavaScript program using Switch Case.
10. Write a JavaScript program using 5 different events.
11. Write a JavaScript program using built-in JavaScript objects.
12. Write a program for populating values from JSON text.
13. Write a program to convert JSON text into a JavaScript object.
14. Write a JavaScript program to dynamically add items to a list using textbox + button. When the user enters text and clicks the button, the item should be added to an unordered list using DOM manipulation.
15. Create an XML file for a library system and use Book id, author, title, price and publication year as xml elements.
16. Develop a JavaScript form validator using patterns
    - Create a signup form that validates:
    - Name → only alphabets
    - Mobile → exactly 10 digits
    - Email → format check (Use Regular Expressions and DOM messages (no alert).)
17. Create a mini To-Do app using JavaScript and perform the following operations:
    - Add task
    - Mark task as completed (strike-through)
    - Delete task
    - Use DOM events + CSS manipulation.
18. Create a JSON file of employees and load it using AJAX. Display the results in an HTML table.
19. Write JavaScript that reads XML (given as string) , Converts it into JSON format , Displays it on screen and use DOMParser + custom logic.
20. Write JavaScript code to demonstrate onclick, onmouseover, onfocus, onblur event handling. Each event should update text on the page.

Semester II	Digital Content Creation	C	L	T	P
Course Code:	Total Teaching Hours: 45	3	3	0	0

Course Outcome

At the end of the course learners will be able to		
CO1	Explain core concepts and strategies in digital content planning and creation.	Understand
CO2	Design visually engaging graphics and infographics using professional tools.	Create
CO3	Produce, edit, and publish short-form video content tailored for digital platforms.	Analyze
CO4	Record and edit audio content for podcasts with basic production quality.	Create

DETAIL SYLLABUS

UNIT I	**Introduction to Digital Content Creation** Definition and types of digital content: textual, visual, audio, video, interactive; The digital content ecosystem: web, social media, streaming platforms; Content goals: informational, promotional, entertainment, educational; Overview of content creation workflow; Identifying target audiences using personas; Creating content goals and KPIs, Content lifecycle and editorial calendars, Storytelling techniques: narrative arc, visual grammar, tone and voice.	9
UNIT III	**Introduction to Video Content** Video formats: reels, shorts, vlogs, explainers; Pre-production: ideation, scriptwriting, storyboarding; Shooting basics: mobile and DSLR videography, framing, lighting, audio capture; Case studies of viral short-form videos; Importing and managing media; Timeline editing, basic transitions, text overlays; Tools: Adobe Premiere Pro (standard), CapCut (mobile-friendly) and Canva **Assignment: Edit a 60-second video for Instagram Reels**	9
UNIT III	**Writing for Digital Platforms** Writing headlines, captions, hashtags; SEO basics: keyword research, meta descriptions; Writing blogs and short-form posts; Tools: Grammarly, Hemingway, Google Trends	9
UNIT IV	**Social Media Content Creation** Platform-specific strategies: Instagram, YouTube, LinkedIn, Twitter, Facebook; Content buckets: promotional, behind-the-scenes,	9

	educational, entertaining; Scheduling and publishing with tools like Hootsuite and Buffer; Metrics: reach, engagement, CTR, conversion	
UNIT V	**Digital Ethics, Copyright & Monetization** Fair use, Creative Commons, copyright laws; Consent and representation in digital content; Introduction to monetization (ads, affiliate marketing, brand collaborations); Influencer economy and digital credibility **Project Presentation** • Each student presents a portfolio of three content types (video, textual, graphic/post)	9

Text Books & Reference Book

Text Books	1. Bullas, J. (2018). Digital content marketing: How to grow your brand. CreateSpace Independent Publishing. 2. Enfield, N. J. (2022). How we talk: The inner workings of conversation. Basic Books. **3.** McDonald, J. (2022). Adobe Premiere Pro classroom in a book (2022 release). Adobe Press.
Reference Books	1. Bayles, D., & Orland, T. (2001). *Art & fear: Observations on the perils (and rewards) of artmaking*. Image Continuum Press. 2. Hein, L., & Hein, M. (2021). *Master content strategy: How to maximize your reach and boost your bottom line every time you hit publish*. Independently Published. 3. Kern, J. (2008). *Sound reporting: The NPR guide to audio journalism and production*. University of Chicago Press. 4. Krug, S. (2014). *Don't make me think, revisited: A common sense approach to web usability* (3rd ed.). New Riders. 5. Lupton, E. (2014). *Thinking with type: A critical guide for designers, writers, editors, and students* (2nd ed.). Princeton Architectural Press. **6.** Rose, G. (2022). *Visual methodologies: An introduction to researching with visual materials* (5th ed.). SAGE Publications.

Semester II	Indian Constitution	C	L	T	P
Course Code:	Total Teaching Hours : 45	**3**	**3**	**0**	**0**

Course Outcome

At the end of the course learners will be able to		
CO1	Understand the meaning, historical background, and the salient features of the Indian Constitution, including the philosophy behind its making.	Understand
CO2	Explain the structure, functions, and powers of the Union Government including the President, Prime Minister, and the Parliament.	Understand
CO3	Describe the role and functions of State Governments and Union Territories, including the relationship between the Centre and States.	Understand
CO4	Analyze the structure, powers, and jurisdiction of the Indian Judiciary, along with the concepts of judicial review, activism, and PIL.	Understand
CO5	Understand the emergency provisions and types of emergencies under the Constitution.	Understand
CO6	Evaluate the role, powers, and functioning of the Election Commission and other constitutional and statutory bodies related to social justice	Understand

DETAIL SYLLABUS

UNIT I	**Introduction to Indian Constitution** Constitution meaning of the term - The making of the Indian Constitution - Sources and constitutional history –Salient features of the Constitution, Preamble as part of the Constitution, Philosophy of Constituent Assembly - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy – comparing parliamentary and presidential system, separation of powers, Citizenship	9
UNIT II	**Central Government** Union Government and its Administration Structure: President and Vice President: Role, power and position, PM and Council of ministers, Cabinet , Lok Sabha, Rajya Sabha, Parliament, Parliament, Union Budget	9
UNIT III	**The States and The Union Territories**	9

	State Government and its Administration: Governor - Role and Position - CM and Council of ministers, State Secretariat: Organization, Structure and Functions – Relation between the Union and the States.	
UNIT IV	**Indian Judiciary & Constitution Bodies** Supreme court and High court and subordinate courts: Jurisdictions and powers, Judicial review, Judicial activism, PIL: Features and scopes,	9
UNIT V	**Emergency Provisions and Election Commission** Emergency: Proclamation of Emergency, types of emergency - Elections in India, Election Process, Election Commission: Independence, Powers & Functions, Role of Chief Election Commissioner - State Election Commission - SC/ST Commissions for the welfare of SCs & STs	9

Text Books & Reference Book

Text Books	1. Bhargava, R. (2008). Ethics and politics of the Indian constitution. Oxford University Press. 2. Fadia, B. L. (2017). The constitution of India (New ed.). Sahitya Bhawan. **3.** Basu, D. D. (2018). Introduction to the constitution of India (23rd ed.). Lexis Nexis.
Web Resources	1. Constitution.org. (n.d.). *The Constitution of India*. https://www.constitution.org/cons/india/const.html 2. Legislative.gov.in. (n.d.). *Constitution of India*. http://www.legislative.gov.in/constitution-of-india 3. Supreme Court of India. (n.d.). *Constitution*. https://www.sci.gov.in/constitution 4. Toppr. (n.d.). *The Constitution of India*. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

SEMESTER -III

Semester – 3								
S.No	**Course Code**	**Course Tile**	**Course Category**	**IA Marks**	**ESE Marks**	**Total Marks**	**Credit**	**No of Classes**
1	UGBCADSC306C	Relational Database Management System	DSC	40	60	100	3T+2P	3+4
3	UGBCADSC307C	Design And Analysis of Algorithm	DSC	40	60	100	3T	3
5	UGBCADSE303T	Probability And Statistics	DSE	40	60	100	4	4
6	UGAIMDSE304T	Feature Engineering	DES	20	30	50	2	2
7		Organizational Behaviour	MDC	20	30	50	2	2
8		Hindi I	AEC	40	60	100	3	3
9		Python Programming	SEC	40	60	100	2T+2P	2+4
11		Yoga and Wellness	VAC	20	30	50	2	2
			TOTAL	260	390	650	25	29

Semester III	Relational Database Management System	C	L	T	P
Course Code: UGBCADSC306C	Total Teaching Hours: 50	**3**	**3**	**0**	**0**

Course Outcomes

At the end of the course learners will be able to		
CO1	Understand what DBMS is and what is its positioning in application design	Understand
CO2	Identify the components of DBMS and their Functioning	Analyze
CO3	Design database tables, functions and subroutines	Apply
CO4	Make use of PL SQL statements	Apply
CO5	Define and implement business logic through PL SQL statement	Create
CO6	Incorporate data integrity and security through customized PL SQL statements	Apply

Prerequisite: Basic knowledge of Set

DETAIL SYLLABUS

UNIT I	**Introduction to Databases:** Definition of Data, Database, and DBMS, Overview of Database Applications, Advantages and Disadvantages of DBMS, Roles of Database Users and Administrators **Data Models:** Introduction to Data Models, Types of Data Models (Hierarchical, Network, Relational, Object-oriented), Importance of Data Models in DBMS **Database Design Keys:** Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key, Alternate Key, Unique Key, Surrogate Key, Constraints in a table: Primary Key, Foreign Key, Unique Key, NOT NULL, CHECK, Entity-Relationship (ER) Model, Entities and Entity Sets, Attributes and Relationships, ER Diagrams, Key Constraints and Weak Entity Sets, Extended ER Features, Introduction to the Relational Model and Relational Schema	**10**
UNIT II	**Relational Algebra and Calculus:** Introduction to Relational Algebra, Operations: Selection, Projection, Set Operations, Join Operations, Division, Tuple and Domain Relational Calculus **Structured Query Language (SQL):** SQL Basics: DDL and DML, Aggregate Functions (Min(), Max(), Sum(), Avg(), Count()), Logical operators (AND, OR, NOT), Predicates (Like, Between, Alias, Distinct), Clauses(Group By, Having, Order by, top/limit), Inner Join, Natural Join, Full Outer Join, Left Outer Join, Right outer Join, Equi Join **Advanced SQL:** Analytical queries, Hierarchical queries, Recursive queries, Views, Cursors, Stored Procedures and Functions, Packages, Triggers,	**15**

	Dynamic SQL Normalization and Database Design: Functional Dependencies: Armstrong's Axioms, Definition, Properties (Reflexivity, Augmentation, Transitivity), Types (Trivial, Non-Trivial, Partial and Full Functional Dependency), Closure of Functional Dependencies, Normal Forms (1NF, 2NF, 3NF, BCNF), Denormalization.	
UNIT III	**Transaction Management:** ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control, Performance of Locking, Transaction Support in SQL, Introduction to Crash Recovery, 2PL, Serializability, and Recoverability, Introduction to Lock Management, Dealing with Deadlocks **Database Storage and Indexing:** Data on External Storage, File Organizations and Indexing, Index Data Structures, Comparison of File Organizations, Indexes and Performance Tuning, Guidelines for Index Selection, Basic Examples of Index Selection	**10**
UNIT IV	**NoSQL Databases and Big Data:** Introduction to NoSQL, Data Models: Document, Key value, Column family, Graph. Uses and Features of NO/SQL document databases. CAP theorem, BASE vs ACID, CRUD operations, MongoDB operators, Overview of Big Data Technologies: Hadoop, MongoDB, Cassandra. **Database Security and Advanced Topics**: Introduction to Database Security, Access Control, Discretionary Access Control, Introduction to Data Warehousing, OLAP, Data Mining	**15**

Text Books & Reference Book

Text Books	1. Raghu Ramakrishnan, Johannes Gehrke, *Database Management Systems*, 3rd Edition, McGraw- Hill, 2018. 2. Benjamin Rosenzweig, Elena Rakhimov, *Oracle PL/SQL by Example*, 5th Edition, Prentice Hall, 2015. 3. Brad Dayley, *NoSQL with MongoDB in 24 Hours*, 1st Edition, Sams Publishing, 2024.
Reference Books	1. Korth, Silbertz, Sudarshan, *Database System Concepts*, 7th Edition, McGraw-Hill, 2019. 2. R.P. Mahapatra, Govind Verma, *Database Management Systems*, Khanna Publishing House, 2025.
Web Resources	1.https://oracle-base.com/articles . 2.https://forums.oracle.com/ords/apexds/domain/dev-community/category/sql_and_pl_sql 3.https://asktom.oracle.com/ords/f?p=100:1:0 in format

Semester III	RDBMS Lab	C	L	T	P
Course Code: UGBCADSC306C	Total Practical Teaching Hours: 60	**2**	**0**	**0**	**4**

Lab Exercises

1. Draw an ER Diagram of Hospital Management System
2. Reduce The ER diagram in question no 1 into tables
3. Reduce the ER diagram of question no 2 into tables Consider the following Schema
   Supplier(SID, Sname, branch, city,
   phone) Part(PID, Pname, color, price)
   Supplies(SID, PID, qty, date_supplied)

DDL Commands

1. Create the above tables
2. Add a new attribute state in supplier table
3. Remove attribute city from supplier table
4. Modify the data type of phone attribute
5. Change the name of attribute city to address
6. Change a table's name, supplier to sup
7. Use truncate to delete the contents of supplies table
8. Remove the part table from database

DML Commands

1. Insert at least 10 records in tables supplier, part and supplies
2. Show the contents in tables supplier, part and supplies
3. Find the name and city of all suppliers
4. Find the name and phoneno of all suppliers who stay in 'Delhi'
5. Find all distinct branches of suppliers
6. Delete the record of the supplier whose SID is 204001
7. Delete all records of supplier table
8. Delete all records of suppliers whose city starts with capital A.
9. Find the supplier names which have 'lk' in any position
10. Find the supplier name where 'R' is in the second position
11. Find the name of supplier whose name starts with 'V' and ends with 'A'
12. Change the city of all suppliers to 'BOMBAY'.
13. Change the city of supplier 'Vandana' to 'Goa'

Queries with Constraints

1. Create the supplier table with Primary Key Constraint
2. Create supplies table with Foreign key Constraint
3. Create a part table with UNIQUE Constraint

4. Create supplier Table with Check Constraints
5. Create Supplier table with Default Constraint

Queries on TCL

1. Create Savepoints
2. Rollback to SavePoints
3. Use Commit to save on

Queries on Aggregate Functions

1. Find the minimum, maximum, average, and sum of costs of parts.
2. Count the total number of parts present.
3. Retrieve the average cost of all parts supplied by 'Mike'.

Queries on GROUP BY, HAVING, and ORDER BY Clauses

1. Display total price of parts of each color.
2. Find the branch and the number of suppliers in that branch for branches that have more than 2 suppliers.
3. Find all parts, sorted by pname in ascending order and cost in descending order.
4. Find the branch and the number of suppliers in that branch.

Queries on Analytical, Hierarchical, and Recursive Nature

1. Find out the 5th highest earning employee details.
2. Identify which department has the highest number of employees with a salary above $80,000, and what percentage of employees in that department have a salary above $80,000.
3. Retrieve employee table details using the hierarchy query and display that hierarchy path starting from the top level, indicating if it is a leaf and whether there exists a cycle.
4. Compute the average salary for employees in the top 2 departments with the highest average salary, and display the hierarchy of departments and sub-departments for these top 2 departments.
5. Use recursion to retrieve the employee table and display the result in breadth-first and depth-first order.
6. Write a recursive query to show the equivalent of level, connect by_root and connect_by_path
7. Use recursion to retrieve the employee table and display the result in depth first order showing id, parent_id, level, root_id, path and leaf.

Queries on Operators

1. Find the pname, phoneno and cost of parts which have cost equal to or greater than 200 and less than or equal to 600.
2. Find the sname , SID and branch of suppliers who are in ‘local’ branch or ‘global’ branch
3. Find the pname, phoneno and cost of parts for which cost is between 200 and 600.
4. Find the pname and color of parts , which has the word ‘NET’ anywhere in its pname.
5. Find the PID and pname of parts with pname either ‘NUT’ or ‘BOLT’
6. List the suppliers who supplied parts on ‘1st may2000’, ‘12 JAN 2021’ ,’17 dec 2000’ ,’10

Jan 2021'

7. Find all the distinct costs of parts.

Join Operators

1. Perform Inner join on two tables
2. Perform Natural Join on two tables
3. Perform Left Outer Join on tables
4. Perform Right Outer join on tables
5. Perform Full Outer Join on tables

Set Theory Operators

1. Show the use of UNION operator with union compatibility
2. Show the use of intersect operator with union compatibility

Semester III	Design and Analysis of Algorithms	C	L	T	P
Course Code: UGBCADSC307C	Total Teaching Hours : 48	**3**	**3**	**0**	**0**

Course Outcome

At the end of the course learners will be able to		
CO1	Understand fundamental concepts of algorithm design and analysis.	Understand
CO2	Apply problem-solving skills to design and optimize algorithms.	Apply
CO3	Implement algorithms using appropriate data structures and techniques.	Apply

Prerequisites:

1. **Basic Programming Knowledge**: Familiarity with programming concepts in C, C++, or Python.
2. **Data Structures**: Understanding of arrays, linked lists, stacks, queues, trees, and graphs.
3. **Mathematical Foundations**: Basics of discrete mathematics, probability, and set theory.

DETAIL SYLLABUS

UNIT I	Introduction to Algorithms and Complexity Analysis: Definition and importance of algorithms, Algorithm performance analysis: Time and Space Complexity, Asymptotic Notations (O, Ω, Θ), Analysis of sorting and searching algorithms (Sequential search, Bubble Sort, Selection Sort, Insertion Sort, Matrix multiplication), Recursion and Recursive Algorithm Analysis, Master's Theorem and Divide & Conquer Method.	12
UNIT II	Divide & Conquer and Greedy Algorithms: **Divide & Conquer Approach** - Binary search, Merge Sort, Quick Sort, Best and worst-case analysis, Strassen's Matrix Multiplication, Lower Bound for Comparison-based Sorting. **Greedy Algorithm Approach** - Knapsack Problem, Minimum Spanning Trees (Prim's & Kruskal's Algorithm), Single-source shortest path (Dijkstra's Algorithm).	12
UNIT III	Dynamic Programming and Graph Algorithms: **Dynamic Programming Approach** - Fibonacci series computation, Binomial Coefficients, All-Pairs Shortest Path (Floyd-Warshall Algorithm), 0/1 Knapsack Problem. **Graph Algorithms** - Breadth-First Search (BFS) and Depth-First Search (DFS), Finding Connected Components, Topological Sorting.	12
UNIT IV	Limitations of Algorithmic Power and Complexity Classes: **Backtracking and NP-Complete Problems** - N-Queen Problem, Hamiltonian Circuit Problem, Vertex Cover Problem. **Computational Complexity** - Overview of Non- Deterministic Algorithms, P, NP, NP-Complete, and NP-Hard Problems.	12

Text Books & Reference Book	
Text Books	1. Gajendra Sharma, *Design and Analysis of Algorithms*, Khanna Publishing House (AICTE Recommended) 2. Cormen Thomas H., Leiserson Charles E., Rivest Ronald L., Stein Clifford, *Introduction to Algorithms*, PHI, 3rd Edition, 2009 3. Horowitz Ellis, Sahni Sartaj, Rajasekaran Sanguthevar, *Fundamentals of Computer Algorithms*, University Press, 2012 4. Levitin Anany, *Introduction to Design and Analysis of Algorithms*, 3rd Edition, Pearson, 2012

Reference Books	1. Aho Alfred V., Hopcroft John E., Ullman Jeffrey D., *The Design & Analysis of Computer Algorithms*, Addison Wesley, 1983 2. Kleinberg Jon, Tardos Eva, *Algorithm Design*, Pearson Education, 2006
Web Resources	1. https://nptel.ac.in/courses/106101060 2. https://www.cs.umd.edu/~mount/451/Lects/451lects.pdf

Semester III	Probability and Statistics	C	L	T	P
Course Code: UGBCADSE303T	Total Teaching Hours: 60	**4**	**4**	**0**	**0**

Course Outcome

At the end of the course learners will be able to		
CO1	Understand and handle randomness scientifically using probability theory	Understand
CO2	Represent statistical data systematically and analyze it to extract meaningful information.	Analyze
CO3	Apply probabilistic and statistical techniques to solve real-life problems.	Apply

DETAIL SYLLABUS

UNIT I	**Introduction to Statistics:** Basic concepts, qualitative and quantitative data, classification of data, construction of frequency distribution, diagrammatic representation of data. **Measures of Central Tendency:** Arithmetic mean, median, and mode—their properties. **Measures of Dispersion:** Range, mean deviation, quartile deviation, variance, and standard deviation.	15
UNIT II	**Correlation:** Definition, scatter diagram, types of correlation, measures—Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient. **Regression:** Linear regression-fitting by least square method and interpretation.	14
UNIT III	**Concepts of Probability:** Experiment and sample space, events and operations with events, probability of an event, basic probability rules, applications of probability rules, conditional probability. **Random Variables:** Discrete and continuous random variables, probability distributions, probability mass function, probability density function, expectation and variance of a random variable. **Standard Probability Distributions:** Binomial, Poisson, and Normal distributions.	16
UNIT IV	**Sampling Distribution:** Concept of Population and Sample, parameter and statistic, sampling distribution of sample mean and sample proportion. **Statistical Inference:** Estimation and Hypothesis Testing (only concept). **Hypothesis Testing for a Single Population:** Concept of hypothesis testing, tests involving a population mean and population proportion (z-test and t-test). **Chi-Square Test:** Test for independence of attributes and goodness of fit.	15
Text Books & Reference Book		

Text Books	1. Manish Sharma, Amit Gupta, *The Practice of Business Statistics*, Khanna Book Publishing Company, 2010 (AICTE Recommended Textbook). 2. Das N. G., *Statistical Methods*, Combined Edition, Tata McGraw Hill, 2010. 3. Ross Sheldon M., *Introduction to Probability and Statistics for Engineers and Scientists*, 6th Edition, Elsevier, 2021. 4. Miller Irwin and Miller Marylees, *Mathematical Statistics with* 1. *Applications*, 7th Edition, Pearson Education, 2005.
Reference Books	1. Pal Nabendu and Sarkar Sahadeb, *Statistics: Concepts and Applications*, 2nd Edition, PHI, 2013. 2. Montgomery Douglas and Runger George C., *Applied Statistics and Probability for Engineers*, Wiley, 2016. 1. Reena Garg, *Engineering Mathematics*, Khanna Publishing House, 2024.

Semester III	Feature Engineering	C	L	T	P
Course Code: UGAIMDSE304T	Total Teaching Hours: 30	**2**	**2**	0	**0**

Course Outcome

At the end of the course learners will be able to		
CO1	Understand the importance of features in machine learning and differentiate between various types of data and features (structured vs. unstructured, categorical, numerical, text, and date-time).	Understand
CO2	Apply basic feature preprocessing techniques such as handling missing data, data cleaning, and feature scaling and normalization.	Apply
CO3	Implement feature engineering techniques for numerical data, including binning, discretization, polynomial and interaction features, and log transformation.	Apply
CO4	Utilize categorical data techniques, such as one-hot encoding and label encoding, and understand feature selection methods, including filter and wrapper methods.	Analyze
CO5	Perform feature transformation using techniques like Principal Component Analysis (PCA) and understand its application in machine learning.	Apply

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

DETAIL SYLLABUS

UNIT I	**Introduction to Feature Engineering:** Importance of Features in Machine Learning. **Data Types and Features:** Numerical, Categorical, Ordinal, Discrete, Continuous, Interval, and Ratio. **Basic Feature Preprocessing:** Handling Missing Data, Data Cleaning, Feature Scaling, Normalization, and Transformation..	15
UNIT II	**Feature Engineering Techniques for Numerical Data:** Binning and Discretization, Polynomial and Interaction Features. **Categorical Data Techniques:** One Hot Encoding, Label Encoding. **Feature Extraction vs. Feature Selection:** Steps in Feature Selection. **Feature Selection Methods:** Filter, Wrapper, and Hybrid. **Feature Reduction:** Introduction and application of Principal Components Analysis (PCA).	15
Text Books & Reference Book		
Text Books	1. M.C. Trivedi, *Data Science and Data Analytics Using Python Programming*, Khanna Publishing House, 2024. 2. Alice Zheng & Amanda Casari, *Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists*, O'Reilly Media, 2018.	

	3. J.K. Kalita, D.K. Bhattacharyya, & S. Roy, *Fundamentals of Data Science: Theory and Practice*, Elsevier, 2023.
Reference Books	1. R.O. Duda, P.E. Hart, & D. Stork, *Pattern Classification*, 2nd Ed., Wiley, 2007. 2. N. Bhaskar & Vasundhara, *Machine Learning*, Khanna Publishing House, 2024. 3. M.C. Trivedi, *Deep Learning and Neural Networks*, Khanna Publishing House, 2024. 4. Andrew Ng, *Machine Learning Yearning*, GitHub (Draft), 2018. 5. J. Han, M. Kamber, & J. Pei, *Data Mining: Concepts and Techniques*, 3rd Ed., Morgan Kaufmann, 2011.

Semester III	Organizational Behavior	C	L	T	P
Course Code:	Total Teaching Hours: 45	**3**	**3**	**0**	**0**

Course Outcome

At the end of the course learners will be able to		
CO1	Describe the multi-disciplinary nature of OB and understand its role and significance in achieving organizational goals.	Apply
CO2	Understand the key determinants of individual behavior in terms of concepts, processes, and models/theories (where applicable) and apply such knowledge to identify and analyze its implications for human behavior in organizations.	Analyze
CO3	Understand and manage the way r are organized into groups and teams, the internal structures, processes and dynamics thereof.	Evaluate
CO4	Identify the sources of power and understand the role it plays in organizational politics as well as suggest conflict resolution mechanisms.	Evaluate
CO5	Initiate, manage, and implement organizational change.	Evaluate

SYLLABUS

UNIT I	Conceptual Framework in understanding Organizational Behaviour (OB), Disciplines contributing to the development of OB; Significance of OB, Goals of OB. Personality: Determinants of Personality, Personality Theories: The Big Five Model; Type A and Type B personalities, Key personality traits influencing Organisational Behaviour	15
UNIT II	(a) Perception: Perceptual process; Factors influencing the perceptual process, Perceptual Errors. (b) Learning: Determinants of Learning; Elements of Learning; Learning Process (c) Group Dynamics: Group development stages; Group Norms; Group Cohesiveness; Factors influencing group cohesiveness (d) Teams: Difference between groups and teams,Types.	15
UNIT III	(a) Organisational Change: Process of Organisational Change; Resistance to Change; Managing organizational change – Kurt Lewin's Model of Organizational Change (b) Organizational Culture: Concept, Determinants, How employees learn organization, Creating an Ethical Organizational Culture	15
Text Books & Reference Book		

Text Books	1. Stephen P. Robbins, Timothy A. Judge & Neharika Vohra, Organizational Behavior, Pearson 2. Fred Luthans, Organizational Behavior – An Evidence Based Approach, McGraw Hill Education-Asia 3. Griffin & Moorhead, Organizational Behavior: Managing People and Organizations, Cengage
Reference Books	1. Steven L. McShane, Organizational Behavior, McGraw Hill (Special Indian Edition) 2. Paul Hersey, Kenneth H. Blanchard & Dewey E. Johnson, Management of Organizational Behavior, Pearson Education-Prentice Hall

Semester III	HINDI I	C	L	T	P
Course Code:	Total Teaching Hours: 27	2	2	0	0

Course Outcome

At the end of the course learners will be able to		
CO1	हिंदी भाषा की मूल संरचना, व्याकरण तथा प्रयोगात्मक स्वरूप को समझ सकेंगे।	Understand
CO2	व्यावहारिक परिस्थितियों में प्रभावी हिंदी संप्रेषण की क्षमता विकसित कर सकेंगे।	Understand
CO3	हिंदी के मूल व्याकरणिक नियमों का प्रयोग करके सुस्पष्ट रूप से संवाद कर सकेंगे।	Understand
CO4	सरल औपचारिक पत्र, आवेदन तथा सूचनाएँ लिख सकेंगे।	Evaluate
CO5	व्यावसायिक दस्तावेज, ई-मेल एवं रिपोर्ट आदि तैयार करने में सक्षम होंगे।	Apply
CO6	संप्रेषण के विभिन्न माध्यमों में हिंदी का व्यावहारिक उपयोग कर सकेंगे।	Apply

SYLLABUS

UNIT I	**भाषा की मूलभूत समझ** हिंदी भाषा का स्वरूप एवं महत्व, वर्णमाला, उच्चारण, संधि, शब्द-भंडार—पर्यायवाची एवं विलोम शब्द।	**6**
UNIT II	**व्याकरण का परिचय** संज्ञा, सर्वनाम, विशेषण, क्रिया, वचन, लिंग, कारक, काल। वाक्य रचना—सरल एवं संयुक्त वाक्य, वाक्य रचना की विविधताएँ, काल एवं क्रिया का प्रयोग।.	**6**
UNIT III	**मौखिक संप्रेषण कौशल** आत्म-परिचय देना, दैनिक संवाद (बाज़ार, कार्यालय, यातायात आदि), टेलीफोन/मोबाइल संवाद की भाषा, संवाद लेखन एवं भूमिका-निर्वाह (Role Play)।	**9**
UNIT IV	**लेखन अभ्यास** सरल पत्र लेखन (आवेदन, सूचना, निमंत्रण), अनुच्छेद लेखन, ई-मेल एवं संदेश लेखन।	**6**
Text Books & Reference Book		

Text Books	1. वर्मा, रामदेव**.** (2015). *हिंदी भाषा और व्याकरण.* दिल्ली: लोकभारती प्रकाशन. → Verma, R. D. (2015). *Hindi bhasha aur vyakaran*. Delhi: Lokbharti Prakashan. 2. तिवारी, गोविंद**.** (2014). *हिंदी भाषा की रूपरेखा.* वाराणसी: साहित्य भवन. → Tiwari, G. (2014). *Hindi bhasha ki rooprekha*. Varanasi: Sahitya Bhawan. 3. सिंह, बलदेव प्रसाद. (2010). *हिंदी व्याकरण दर्शन.* दिल्ली: भारती भवन. → Singh, B. P. (2010). *Hindi vyakaran darshan*. Delhi: Bharati Bhavan. 4. शर्मा, रमेश. (2017). *व्यावहारिक हिंदी संवाद और लेखन कौशल.* लखनऊ: नवीन प्रकाशन. → Sharma, R. (2017). *Vyavaharik Hindi samvad aur lekhan kaushal*. Lucknow: Naveen Prakashan. 5. वाजपेयी, हरिवंशराय. (2018). *हिंदी लेखन कला.* पटना: प्रभात प्रकाशन. → Vajpayee, H. R. (2018). *Hindi lekhan kala*. Patna: Prabhat Prakashan. *6. मिश्रा, सीमा**.** (2016).* हिंदी पत्र लेखन और संवाद*. दिल्ली: राजपाल एंड संस.* *→ Mishra, S. (2016).* Hindi patra lekhan aur samvad*. Delhi: Rajpal & Sons.*
Reference Books	1. Rai, U. S. (2004). Prayojanmulak Hindi. Vikas Publishing House. 2. Singh, B. P. (2012). Hindi vyakaran tatha rachna. Bharati Bhavan. 3. Tiwari, G. (2011). Rachnatmak evam Prayogatmak Hindi. Vani Prakashan. 4. Agrawal, N. (2010). Anuvad: Siddhant aur Prayog. Lokbharti Prakashan. 5. Verma, R. D. (2015). Vyavaharik Hindi vyakaran evam rachna. Lokbharti Prakashan. 6. Sharma, R. (2017). Vyavaharik Hindi samvad evam patra lekhan. Naveen Prakashan. 7. Pandey, R. N. (2016). Vyavsayik Anuvad. Rajpal & Sons. 8. Mishra, S. (2014). Hindi samvad aur sanchar kaushal. Diamond Books. 9. Chaturvedi, M. G., & Tiwari, B. N. (2012). Hindi vyakaran. Vani Prakashan. 10. Vajpayee, H. R. (2018). Hindi lekhan kala. Prabhat Prakashan.

Semester III	Python Programming	C	L	T	P
Course Code:	Total Teaching Hours: 45	4	2	1	4

Course Outcome

At the end of the course learners will be able to		
CO1	Develop modular Python programs.	Apply
CO2	Apply suitable Python programming constructs, built-in data structures using Python libraries to solve a problem.	Apply
CO3	Understand basic Data visualization and File handling in Python.	Understand

DETAIL SYLLABUS

UNIT I	**Introduction to Python:** History and application areas of Python; Structure of Python Program; Identifiers and Keywords; Operators and Precedence; Basic Data Types and Type Conversion; Statements and Expressions; Input/Output statements. **Strings:** Creating and Storing Strings, Built-in functions for strings; String Operators, String Slicing and Joining; Formatting Strings. **Control Flow Statements:** Conditional Flow Statements; Loop Control Statements; Nested Control Flow; Continue and Break Statements; Pass and Exit.	15
UNIT II	**Functions:** Built-In Functions, Function Definition and Call; Scope and Lifetime of Variables; Default Parameters, Command Line Arguments; Lambda Functions; Assert Statement; Importing User-defined Modules. **Mutable and Immutable Objects:** Lists, Tuples, and Dictionaries; Commonly used Functions on Lists, Tuples, and Dictionaries; Passing Lists, Tuples, and Dictionaries as Arguments to Functions. **Using Math and NumPy module:** Operations on List of Integers and Arrays.	15
UNIT III	**Files:** Types of Files; Creating, Reading, and Writing Text and Binary Files; The Pickle Module; Reading and Writing CSV and JSON Files. **Exception Handling:** Try-Except-Else-Finally block; Raise Statement; Hierarchy of Exceptions; Adding Custom Exceptions. **Data Visualization:** Plotting various 2D and 3D Graphics; Histogram; Pie Charts; Sine and Cosine Curves.	15
Text Books & Reference Book		
Text Books	1. Venkatesh, Nagaraju Y, Introduction to Python Programming, Khanna Publishing House, 2021. 2. Jeeva Jose, Introduction to Computing & Problem Solving With PYTHON, Khanna Publishing House, 2023. 3. Sheetal Taneja & Naveen Kumar, Python Programming: A Modular Approach with Graphics, Database, Mobile and Web Applications, Pearson,	

	2017.
Reference Books	1. Allen Downey, Think Python, 2nd Ed., O'Reilly, 2015. 2. Bob Dowling, An Introduction to Python for Absolute Beginners, Cambridge Univ. 3. John Guttag, Introduction to Computation and Programming Using Python, 2nd Ed., PHI India, 2016.
Web Resources	1. https://www.learnpython.org/ 2. https://www.w3schools.com/python/default.asp

Semester III	Python Programming Lab	C	L	T	P
Course Code:	Total Teaching Hours: 60	2	-	-	4

Part A

1. Write a program to check whether a given number is a prime number.
2. Write a program to compute m^n, where m and n are read from the user.
3. Write a program with a parameterized function that returns True if the given number is even, otherwise False.
4. Write a program to print the summation of the following series up to n terms: 1 - 2 + 3 - 4 + 5 - 6 + ... ± n.
5. Write a menu-driven program to perform the following string operations:
   a. Find the frequency of a character in a string.
   b. Replace a character with another character in a string.
   c. Remove the first occurrence of a character from a string.
   d. Remove all occurrences of a character from a string.
6. Write a program that accepts two strings and returns the indices of all occurrences of the second string in the first string as a list. If the second string is not present, return -1.
7. Using NumPy, write a menu-driven program to:
   a. Create an array filled with 1s.
   b. Find the maximum and minimum values in an array.
   c. Compute the dot product of two arrays.
   d. Reshape a 1-D array into a 2-D array.
8. Write a function that takes a sentence as input from the user and calculates the frequency of each letter. Use a dictionary to maintain the count.
9. Consider a tuple t1 = (1,2,5,7,9,2,4,6,8,10). Write a program to perform the following operations:
   a. Print the contents of t1 in two separate lines such that half of the values appear on one line and the other half on the next line.
   b. Print all even values of t1 as another tuple t2.
   c. Concatenate a tuple t2 = (11,13,15) with t1.
   d. Return the maximum and minimum values from t1.
10. Write a function that reads a file file1 and copies only alternative lines to another file file2. The copied lines should be the odd-numbered lines.
11. Write a Python program to handle a ZeroDivisionError exception when dividing a number by zero.
12. Write a program that reads a list of integers from the user and throws an exception if any numbers are duplicates.
13. Write a program that makes use of a function to display sine, cosine, polynomial, and exponential curves.
14. Take input for the months and profits made by a company ABC over a year. Represent this data using a line plot. The generated line plot must include:X-axis label: Month Number Y-axis label: Total Profit.
15. Write a Python program to read a file.
    a) If the file does not exist → catch FileNotFoundError.
    b) If content is not readable → catch a general exception.
    c) Display custom error messages.
    d) Use finally to close the file safely.

Part B

16. Define a custom exception InvalidAgeError.
    a) If age < 18, raise the exception.
    b) If valid, print "Eligible."
    c) Handle the custom exception in the program.
17. Given a list and dictionary, write a program that:
    a) Tries to access an index out of range (catch IndexError)
    b) Tries to access a key that doesn't exist (catch KeyError)
    c) Prints appropriate messages for each.

18. Simulate a banking withdrawal function:
    a) Raise ValueError for negative input
    b) Raise custom InsufficientBalanceError
    c) Use nested try blocks to validate input and process the transaction.
19. Given temperature data for 12 months:
    a) Plot a line chart
    b) Add labels, title, and grid
    c) Save the plot as an image file
20. Create a dataset of 5 students and their marks in 3 subjects.
    a) Plot grouped bar chart
    b) Add legend and axis labels
    c) Display highest scorer via annotation
21. Given market share % of 5 smartphone brands:
    a) Create a pie chart
    b) Add percentage labels
    c) Highlight the brand with the largest share (explode)
22. Generate 500 random values
    a) Plot histogram with bins
    b) Add mean/median lines on the plot
    c)Interpret the distribution
24. Create two lists: hours studied vs. exam score.
    a) Plot scatter graph
    b) Fit a regression line (using NumPy polyfit)
    c) Label axes and title
25. Create 1D, 2D, and 3D arrays using np.array() . Display array dimensions, shape, size, and data type.
26. Use np.zeros(), np.ones(), np.full() np.arange(), np.linspace() Create arrays and print them with shapes.
27. Given a 5×5 array, perform: Row & column slicing ,Extract alternate rows/columns Reverse the array using slicing
28. Given two arrays A and B:
    Perform element-wise addition, subtraction, multiplication, division
    Compute square root, exponential, trigonometric functions
29. Create a 3×4 array a) Reshape it to 2×6 and 4×3 b)Flatten using ravel() and flatten() and Compare
30. Stack arrays vertically & horizontally (vstack, hstack). Split a 1D array into 3 equal parts .Split a 2D array into sub-arrays

Semester III	Yoga & Wellness	C	L	T	P
Course Code:	Total Teaching Hours: 40	**2**	**2**	**0**	**0**

Course Outcome

At the end of the course learners will be able to		
CO1	To understand the importance of a healthy lifestyle	Understand
CO2	To familiarize students about physical and mental health	Apply
CO3	To create an awareness of various lifestyle related diseases	Analyze
CO4	To provide understanding of stress management	Apply
CO5	Apply yogic principles to manage psycho-somatic ailments and promote resilience.	Apply

DETAIL SYLLABUS

UNIT I	**Introduction to Health & Wellness** ● Definition of Health ● Importance of health in everyday life ● Components of health – physical, social, mental, spiritual and its relevance ● Concept of wellness ● Mental health and wellness ● Determinants of health behavior	8
UNIT II	**Mind Body and Well-Being** ● Mind body connection in health – concept and relation ● Implications of mind-body connection ● Wellbeing – why it matters? ● Digital wellbeing	8
UNIT III	**Deficiency & Diseases** ● Malnutrition, under nutrition and over nutrition ● Body system and common diseases ● Sedentary lifestyle and risk of disease ● Modern lifestyle and associated health risks	6
UNIT IV	**Indian system of well being** ● Health beliefs of India ● Health systems in India – AYUSH. ● Perspective of indigenous people towards health ● Happiness and well-being in India	8
Text Books & Reference Book		

Text Books	1. Carr, A. Positive Psychology: The science of happiness and human strength. UK: Routledge 2. C. Nyambichu & Jeff Lumiri, , Lifestyle Disease: Lifestyle Disease

SEMESTER -IV

Semester – 4								
S.No	**Course Code**	**Course Tile**	**Course Category**	**IA Marks**	**ESE Marks**	**Total Marks**	**Credit**	**No of Classes**
1	UGBCADSC408C	Computer Network	**DSC**	40	60	100	4T	4
2	UGBCADSC409T	Data Structure	**DSC**	40	60	100	3P+2P	3+4
3	UGBCADSC410C	Artificial Intelligence	**DSC**	40	60	100	3T+2P	3+4
4		Entrepreneurship And Innovation	**MDC**	40	60	100	3	3
5		German/Korean/Hindi II	**AEC**	20	30	50	2	2
7		Online course on Statistical tools(NPTEL, Coursera , EDX)	**Online Course**	50		50	2*	-
			TOTAL	270	330	600	19	23

Semester IV	Computer Networks	C	L	T	P
Course Code: UGBCADSC408C	Total Teaching Hours: 60	**5**	**4**	**0**	**0**

Course Outcome

At the end of the course learners will be able to		
CO1	Understand the fundamental concepts of Computer Networks and their applications.	Understand
CO2	Develop problem-solving skills related to network design, implementation, and troubleshooting.	Apply
CO3	Implement network protocols and configure network devices.	Apply

Prerequisites:

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

DETAIL SYLLABUS

UNIT I	Introduction to Computer Networks: Definition and Objectives, Applications and Examples, Network Components and Architecture, Network Models (OSI Model: Layers and Functions, TCP/IP Model: Layers and Functions), Comparison between OSI and TCP/IP Models, Network Topologies (Physical vs. Logical, Star, Ring, Bus, Mesh, Hybrid, Advantages & Disadvantages), Data Transmission (Analog vs. Digital Signals, Transmission Modes, Bandwidth & Latency), Networking Devices (Routers, Switches, Hubs, Bridges, Gateways: Functions & Configurations).	15
UNIT II	Data Link Layer and Networking Protocols: Functions of the Data Link Layer, Framing, Error Detection & Correction, Flow Control Mechanisms, Ethernet (Standards, Frame Structure, MAC Addressing, ARP), Ethernet Switching (Concepts & Methods), Network Protocols (TCP/IP Protocol Suite, IP Addressing: IPv4 & IPv6, Subnetting, CIDR Notation), Address Resolution Protocol (ARP Operation, Security Considerations), Virtual LANs (Concept, VLAN Tagging & Configuration, Benefits & Use Cases).	15

UNIT III	Network Layer and Transport Layer: IP Routing (Static vs. Dynamic), Routing Protocols (RIP, OSPF, BGP), Network Address Translation (NAT), Transport Layer (TCP vs. UDP, TCP Handshake & Connection Management, Flow Control & Congestion Control in TCP), Congestion Control Algorithms (Slow Start, Congestion Avoidance, Fast Retransmit, Fast Recovery, TCP Variants: Reno, Vegas), Quality of Service (QoS Principles, Differentiated Services, Integrated Services), Network Security Fundamentals (Threats, Vulnerabilities, Firewalls, VPNs, Encryption).	15
UNIT IV	Application Layer and Emerging Technologies: Application Layer Protocols (HTTP/HTTPS, FTP, SMTP, POP3, IMAP, DNS), Network Applications (Web Browsing, Email, File Transfer, VoIP, Streaming), Emerging Technologies (Software-Defined Networking (SDN), Network Function Virtualization (NFV), Internet of Things (IoT)), Network Management (SNMP, Monitoring Tools & Techniques), Future Trends in Networking (5G, Network Automation, AI in Networking).	15
Text Books & Reference Book		

Text Books	1. Andrew S. Tanenbaum, Computer Networks, 5th Edition, Pearson Education, 2011. 2. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach, 8th Edition, Pearson, 2021.
Reference Books	1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw-Hill Education, 2012. 2. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, 6th Edition, Morgan Kaufmann, 2019. 3. Bhavneet Sidhu, An Integrated Approach to Computer Networks, Khanna Publishing House, 2023. 4. Mastering PC Hardware & Networking, Khanna Publishing House, 2024
Web Resources	1. Cisco Networking Academy - Online Courses and Resources 2. NetworkLessons.com - Tutorials on Various Networking Topics

Semester IV	Data Structures	C	L	T	P
Course Code: UGBCADSC409T	Total Teaching Hours: 48	**3**	**3**	**0**	**4**

Course Outcome

At the end of the course learners will be able to		
CO1	Understand the fundamental concepts of data structures and their applications	Understand
CO2	Implement various linear and non-linear data structures	Apply
CO3	Analyze the efficiency of different searching and sorting algorithms	Analyze
CO4	Implement stacks, queues, linked lists, trees, and graphs	Apply
CO5	Solve real-world problems using appropriate data structures	Create

DETAIL SYLLABUS

UNIT I	**Introduction to Data Structures**: Basic concepts, Need for Data Structures, Types of Data Structures (Linear and Non-Linear), Operations on Data Structures (Traversal, Insertion, Deletion, Searching, Sorting, Merging). **Arrays**: Definition, Representation, Operations on Arrays (Insertion, Deletion, Searching, Traversing, Merging), Applications of Arrays. **Strings**: Representation, Operations on Strings, String Matching Algorithms (Brute Force, KMP, Rabin-Karp).	12
UNIT II	**Linked Lists**: Introduction, Representation of Linked Lists, Types (Singly Linked List, Doubly Linked List, Circular Linked List), Operations (Insertion, Deletion, Searching, Traversing, Merging), Applications of Linked Lists. **Stacks**: Definition, Representation using Arrays and Linked Lists, Operations (Push, Pop, Peek), Applications (Expression Evaluation, Backtracking, Function Call Stack). **Queues**: Definition, Types (Simple Queue, Circular Queue, Priority Queue, Deque), Operations (Enqueue, Dequeue, Peek), Applications.	12
UNIT III	**Trees**: Definition, Terminologies (Node, Degree, Depth, Height), Types (Binary Tree, Binary Search Tree, AVL Tree, B-Trees, Heap), Operations (Insertion, Deletion, Traversal: Inorder, Preorder, Postorder), Applications (Huffman Coding, Expression Trees). **Graphs**: Definition, Terminologies (Vertices, Edges, Degree, Paths), Representation (Adjacency Matrix, Adjacency List), Graph Traversal (BFS, DFS), Applications of Graphs.	12

UNIT IV	**Sorting Algorithms**: Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort, Radix Sort, Time Complexity Analysis. **Searching Algorithms**: Linear Search, Binary Search, Interpolation Search, Hashing (Hash Functions, Collision Handling: Chaining, Open Addressing). **Advanced Data Structures**: Tree, Segment Tree, Disjoint Set Union (DSU), Applications	12
Text Books & Reference Book		
Text Books	1. "Introduction to Data Structure in C', Ashok N Kamthane, Pearson 2. Seymour Lipschutz, "Data Structures with C", Schaum's Outlines, Tata McGraw-Hill, 2011. 3. Yashavant Kanetkar, "Data Structures Through C", 4th Edition, BPB Publications, 2022.	
Reference Books	1. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2014. 2. Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, Universities Press, 2007.	

Semester IV	Data Structure Lab	C	L	T	P
Course Code: UGBCADSC409T	Total Teaching Hours: 60	**2**	**0**	**0**	**4**

Lab Exercise:

Part A

1. Write a program for insertion and deletion operations in an array.
2. Write a program to search for an element in an array using Linear Search and Binary Search.
    a. Write a program to sort an array using Bubble Sort, Selection Sort, and Insertion Sort.
3. Write a program to merge two arrays.
4. Write a program to add and subtract two matrices.
5. Write a program to multiply two matrices.
6. Write a program to insert an element into a Singly Linked List:
    (a) At the beginning b) At the end c)At a specified position
7. Write a program to delete an element from a Singly Linked List:
    (a) At the beginning B)At the end c)A specified element
8. Write a program to perform the following operations in a Doubly Linked List:
    (a) Create B)Search for an element
9. Write a program to perform the following operations in a Circular Linked List:
    (a) Create (b) Delete an element from the end
10. Write a program to implement stack operations using an array.
11. Write a program to implement stack operations using a linked list.
12. Write a program to add two polynomials using linked lists.
13. Write a program to evaluate a postfix expression using a stack.
14. Write a program to perform the following using recursion:
    a. Find the factorial of a number
    b. Find the GCD of two numbers
    c. Solve Towers of Hanoi problem
15. Write a program to implement simple queue operations using an array.
16. Write a program to implement circular queue operations using an array.

Part B

17. Write a program to implement circular queue operations using a linked list.
18. Write a program to perform the following operations on a binary search tree:
19. (a)Preorder Traversal (b) Inorder Traversal (c) Postorder Traversal
20. Write a program to perform insertion operation in a binary search tree
21. Write a program to input a graph (directed/undirected) and represent it using:
    a)Adjacency Matrix b)Adjacency List c)Compare memory usage.

22. Implement BFS for a given graph using a queue.
    Print: Order of traversal, All nodes reachable from a given source
23. Implement DFS using recursion and stack.
24. Write a program to detect cycles in:
    Undirected graph (using DFS and parent array)
    Directed graph (using DFS and recursion stack)
25. Compute the shortest path from a single source to all vertices in a weighted graph.

26. Find shortest paths between all pairs of vertices in a weighted directed graph (allowing negative edges but no negative cycles).
27. Implement Prim's algorithm using Adjacency list
28. Write a program to count the number of connected components in an undirected graph using DFS/BFS.

Semester IV	Artificial Intelligence	C	L	T	P
Course Code: UGBCADSC410C	Total Teaching Hours: 48	**5**	**3**	**0**	**4**

Course Outcome

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

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

DETAIL SYLLABUS

UNIT I	**Introduction to AI**: Definition and Importance of AI, Intelligent Agents (Agents and Environment, Concept of Rationality, Nature of Environment, Structure of Agents), Knowledge-Based Agents (Introduction, The Wumpus World Example), Problem- Solving Agents	12
UNIT II	**Advanced Search Techniques**: Uninformed Search (DFS, BFS, Iterative Deepening Search), Informed Search (Best First Search, A* Search, AO* Search), Adversarial Search & Games (Two-Player Zero-Sum Games, Minimax Search, Alpha-Beta Pruning), Constraints & CSPs (Backtracking Search for CSP), Evolutionary Search (Genetic Algorithms, Applications in AI)	12
UNIT III	**Logical Reasoning and Uncertainty**: Logic (Propositional Logic, First-Order Predicate Logic, Propositional vs. First-Order Inference, Unification and Lifting), Inference (Forward Chaining, Backward Chaining, Resolution, Truth Maintenance Systems), Planning (Blocks World Problem, STRIPS), Handling Uncertainty (Non- Monotonic Reasoning, Probabilistic Reasoning, Fuzzy Set Theory)	12
UNIT IV	**Domains and Applications of AI**: AI Domains (Machine Learning, Computer Vision, Robotics, Natural Language Processing, Deep Neural Networks), Expert Systems (Architecture, Role, Two Case Studies), Legal and Ethical Issues in AI	12

Text Books & Reference Book	
Text Books	1.M.C. Trivedi, *A Classical Approach to Artificial Intelligence*, Khanna Book Publishing Company, 2024 *(AICTE Recommended)* 2. Nilsson Nils J., *Artificial Intelligence: A New Synthesis*, Morgan Kaufmann Publishers Inc. San Francisco, CA 3. Dan W. Patterson, *Introduction to Artificial Intelligence & Expert Systems*, PHI Learning, 2010. 4. Rajiv Chopra, *Data Science with Artificial Intelligence, Machine Learning, and Deep Learning*, Khanna Book Publishing Company, 2024
Reference Books	1. M.C. Trivedi, *Introduction to AI and Machine Learning*, Khanna Book Publishing Company, 2024 2. Russell, S. & Norvig, P., *Artificial Intelligence - A Modern Approach*, 3rd Edition, Prentice Hall 3. Van Hirtum, A. & Kolski, C., *Constraint Satisfaction Problems: Algorithms and Applications*, Springer, 2020 4. Rajiv Chopra, *Machine Learning and Machine Intelligence*, Khanna Book Publishing Company, 2024
Web Resources	1. https://nptel.ac.in/courses/106101060 2. https://www.cs.umd.edu/~mount/451/Lects/451lects.pdf

Semester IV	Artificial Intelligence Lab	C	L	T	P
Course Code: UGBCADSC410C	Total Teaching Hours: 60	**2**	**-**	**-**	**4**

Lab Exercise: Prerequisites: Basic understanding of algorithms and data structures (e.g., trees, graphs, lists). Proficiency in Python programming, including libraries like NLTK for NLP tasks.
The lab experiments may be implemented in Python. Libraries like NLTK, Tensorflow and Keras may be used for Machine learning experiments.

Part A

1. Demonstrate basic problem-solving using Breadth-First Search (BFS) on a simple grid.
2. Implement Depth-First Search (DFS) on a small graph.
3. Solve the Water Jug Problem using Breadth-First Search (BFS).
4. Implement a Hill Climbing Search to find the peak in a numeric dataset.
5. Apply the *A Search Algorithm** to find the shortest path in a 4x4 grid.
6. Implement the Minimax Search Algorithm for 2-player games using a game tree with 3 plies.
7. Solve the 4-Queens Problem as a Constraint Satisfaction Problem (CSP) using backtracking.
8. Use constraint propagation to solve a Magic Square Puzzle.
9. Apply optimization techniques to find the maximum value in a list.
10. Represent and evaluate Propositional Logic Expressions.

Part B

11. Implement a Basic Rule-Based Expert System for weather classification.
12. Implement a Basic AI Agent with simple decision-making rules.
13. Implement a Basic Rule-Based Chatbot.
14. Using Python NLTK, perform the following Natural Language Processing (NLP) tasks for text content:
    a) Tokenizing b) Filtering Stop Words c) Stemming d) Part of Speech (POS) Tagging
    e) Chunking f) Named Entity Recognition (NER)
15. Perform Image Classification for a given dataset using Convolutional Neural Networks (CNN). You may use
    TensorFlow/Keras.

Semester IV	Entrepreneurship And Innovation	C	L	T	P
Course Code:	Total Teaching Hours: 32	2	2	0	0

Course Outcome

At the end of the course learners will be able to		
CO1	To understand Entrepreneurship and its types	Understand
CO2	To understand that not all ideas can be turned into viable business models and guestimate business potential of an idea	Understand
CO3	To be able to draft business plans on an identified idea	Create
CO4	To know what is a Family Business and how is it different from Entrepreneurship	Analyze

DETAIL SYLLABUS

UNIT I	**Introduction to Entrepreneurship & Family Business** Definition and Concept of entrepreneurship Entrepreneur Characteristics Classification of Entrepreneurs Role of Entrepreneurship in Economic Development –Start-ups Knowing the characteristics of Family business with discussion on fewIndian cases of Family Business like Murugappa, Dabur, Wadia, Godrej, Kirloskar etc.	8
UNIT II	**Evaluating Business opportunity** • Sources of business ideas and opportunity recognition • Guesstimating the market potential of a business idea • Feasibility analysis of the idea • Industry, competition and environment analysis	8
UNIT III	**Building Blocks of starting ventures** • Low cost Marketing using digital technologies • Team building from scratch • Venture Funding • Establishing the value-chain and managing operations • Legal aspects like IPR and compliances	8
UNIT IV	**Start-up Ecosystem** • Know the components of the start-up ecosystem including Incubators, Accelerators, Venture Capital Funds, Angel Investors etc. • Know various govt. schemes like Start-up India, Digital India, MSME etc**.**	8

Text Books & Reference Book

1. Bessant, J. R., & Tidd, J. (2024). *Innovation and entrepreneurship* (4th ed.). Wiley.

2. Schilling, M. A. (2023). *Strategic management of technological innovation* (7th ed.). McGraw-Hill LLC

Semester IV	Hindi II	C	L	T	P
Course Code:	Total Teaching Hours: 30	2	2	0	0

Course Outcome

At the end of the course learners will be able to		
CO1	उच्च स्तर की हिंदी में स्पष्ट, सटीक एवं प्रभावी संवाद कर सकेंगे।	Understand
CO2	व्यावसायिक तथा डिजिटल माध्यमों में हिंदी के प्रयोग में आत्मविश्वास प्राप्त करेंगे।	Understand
CO3	हिंदी भाषा की जटिल व्याकरणिक संरचनाओं को समझकर उनका उचित प्रयोग कर सकेंगे।	Understand
CO4	तकनीकी एवं अकादमिक लेखन में उपयुक्त हिंदी का प्रयोग कर सकेंगे।	Apply
CO5	व्यावसायिक दस्तावेज, ई-मेल एवं रिपोर्ट आदि तैयार करने में सक्षम होंगे।	Apply
CO6	साक्षात्कार, समूह चर्चा एवं प्रस्तुतीकरण आदि में आत्मविश्वासपूर्वक भाग ले सकेंगे।	Apply

Prerequisites: Knowledge of Basic Hindi Grammar

DETAIL SYLLABUS

UNIT I	**उन्नत हिंदी भाषा एवं व्याकरण:** वाक्य रचना—सरल, संयुक्त एवं मिश्र वाक्य। वाच्य—कर्तृवाच्य, कर्मवाच्य एवं भाववाच्य। मुहावरे एवं लोकोक्तियाँ तथा उनका प्रयोग। पारिभाषिक शब्दावली (तकनीकी एवं प्रशासनिक)। तत्सम, तद्भव, देशज एवं विदेशी शब्दों का प्रयोग। व्यावसायिक शब्दावली का प्रभावी उपयोग।.	**6**
UNIT II	**औपचारिक एवं कार्यालयीय संचार**: औपचारिक पत्र लेखन—प्रार्थना पत्र, आवेदन पत्र, सूचना आदि। कार्यालयीन संप्रेषण—नोट, आलेख तथा संक्षेप लेखन। ज्ञापन, रिपोर्ट, रेज़्यूमे एवं बायोडाटा लेखन।	**6**
UNIT III	**मौखिक संप्रेषण कौशल:** समूह चर्चा, वाद-विवाद, साक्षात्कार की तैयारी एवं अभ्यास, भाषण, प्रस्तुति तथा मंच संचालन।	**6**

UNIT IV	**डिजिटल एवं सामाजिक माध्यमों में हिंदी**: सोशल मीडिया एवं ब्लॉग लेखन, समाचारों का विश्लेषण एवं संक्षेपण, तकनीकी भाषा एवं संप्रेषण।	**6**
UNIT V	**व्यावसायिक क्षेत्र-आधारित संवाद (**Stream-specific): छात्रों के व्यावसायिक क्षेत्र से संबंधित संवाद का अभ्यास, संबंधित शब्दावली एवं अभिव्यक्ति का प्रयोग, संप्रेषण शैली एवं शब्द चयन।	**6**

Text Books & Reference Book	
Textbooks	7. Verma, R. D. (2016). *Vyavaharik Hindi Vyakaran evam Rachna*. Delhi: Lokbharti Prakashan. 8. Sharma, R. (2018). *Karyalayin Hindi evam Patra Vyakaran*. Lucknow: Naveen Prakashan. 9. Agrawal, N. (2015). *Anuvad: Siddhant aur Prayog*. Delhi: Lokbharti Prakashan. 10. Tripathi, C. (2014). *Vyavsayik Sanchar aur Patrachar*. Delhi: Rajkamal Prakashan. 11. Pandey, R. N. (2017). *Vyavsayik Anuvad aur Sanchar Kaushal*. Delhi: Rajpal & Sons. 12. Mishra, S. (2019). *Samkaleen Hindi Sanchar Madhyam*. Delhi: Diamond Books. 13. Chaturvedi, M. G., & Tiwari, B. N. (2013). *Hindi Vyakaran aur Rachna*. Varanasi: Vani Prakashan. 14. Singh, B. P. (2012). *Hindi Vyakaran Darshan*. Allahabad: Bharati Bhavan. 15. Sinha, S. (2016). *Hindi Bhasha: Sampreshan aur Sanvad*. Delhi: Orient Publishing. Jain, P., & Awasthi, S. (2020). *Digital Madhyam aur Hindi Sanchar*. Delhi: Kitab Mahal.
Reference Books	15. Chaturvedi, M. G., & Tiwari, B. N. (2013). *Hindi vyakaran aur rachna*. Delhi: Vani Prakashan. 16. Rai, U. S. (2012). *Prayojanmulak Hindi*. New Delhi: Vikas Publishing House. 17. Mishra, S. (2018). *Vyavsayik sanchar kaushal aur karyalayin patrachar*. Delhi: Diamond Books. 18. Tripathi, C. (2015). *Karyalayin Hindi aur sanchar*. Lucknow: Naveen Prakashan. 19. Sharma, R. (2017). *Vyavaharik Hindi: Samvad aur patrachar*. Allahabad: Kitab Mahal. 20. Agrawal, N. (2014). *Anuvad: Siddhant, prakriya aur prayog*. Delhi: Lokbharti Prakashan. 21. Sinha, S. (2016). *Media aur Hindi bhasha*. Delhi: Rajkamal Prakashan. 22. Pandey, R. N. (2016). *Takneekik aur Vyavsayik Anuvad*. –Delhi: Rajpal & Sons. 23. Sharma, S. K. (2019). *Bhasha, Sanchar aur Manch Kaushal*. Jaipur: Surya Prakashan Mandir. Jain, P., & Awasthi, S. (2020). *Digital madhyam mein Hindi: Prayog evam chunautiyan*. Delhi: Kitab Ghar.