

GURU NANAK COLLEGE (AUTONOMOUS)

A Sikh Minority Institution | Unit of Guru Nanak Educational Society (Regd.)

Affiliated to University of Madras | Approved by AICTE

Accredited at A++ Grade by NAAC (CGPA 3.68/4)

Guru Nanak Salai, Velachery, Chennai - 600042



SCHOOL OF INFORMATION TECHNOLOGY PROGRAMME BACHELOR OF COMPUTER SCIENCE WITH ARTIFICIAL INTELLIGENCE (SEMESTER PATTERN WITH CHOICE BASED CREDIT SYSTEM)

Syllabus

(For the UG Batch of 2026-29 and thereafter)

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LOCF - LEARNING OUTCOME BASED CURRICULUM FRAMEWORK

PREAMBLE

1. ABOUT THE PROGRAMME

Bachelor of Computer Science with Artificial Intelligence (AI) is a 3 - Year Undergraduate Programme spread over six semesters. The course is designed to achieve a high degree of technical skills in Problem solving and Modern application development. The course develops requisite professional skills and problem solving along with developing the analytical abilities for pursuing a successful career in software industry and forms the required basics for further higher studies in Computer Science specifically in the area of Artificial Intelligence. The program is designed to foster a deep understanding of how computer systems operate, from fundamental hardware and software interactions to complex algorithmic problem-solving techniques. Alongside this, students are introduced to the rapidly expanding domain of AI, where they explore the creation and application of intelligent systems capable of learning, reasoning, and making decisions autonomously. The integration of theoretical knowledge and hands-on practice ensures that students gain the skills needed to design and implement cutting-edge AI solutions that address real-world challenges across various domains, including healthcare, finance, transportation, and entertainment.

This multidisciplinary course is structured to provide students with the essential technical, mathematical, and analytical tools needed to excel in the fast-evolving field of AI while maintaining a robust grounding in traditional computer science principles. The program aligns with the growing need for AI-driven solutions in industries such as healthcare (diagnostic tools and personalized medicine), autonomous vehicles (self-driving technology), smart cities (IoT and automation), and financial services (fraud detection and risk assessment). The Specialized AI Topics covers areas such as machine learning, neural networks, natural language processing, robotics, and computer vision with Practical Experience includes coding labs, software development workshops, AI toolkits, and collaboration on real-world projects. The innovation and creativity encourage problem-solving through creativity and innovation, fostering the ability to design AI systems that adapt and evolve. Finally, ethics and social responsibility focuses on the ethical implications of AI, highlighting issues like data privacy, fairness, transparency, and societal impact. According to BLOOM's Taxonomy, the curriculum, instructional strategies, and evaluation techniques are matched with suitable cognitive levels. The assessment of students' cognitive abilities and the evaluation of the attainment of expected course outcomes will be made possible by the OBE based evaluation methodologies.

The B.Sc. in Computer Science with Artificial Intelligence aims to nurture tech-savvy, innovative graduates who are prepared to lead and adapt in an ever-evolving digital landscape. It provides the tools to harness the potential of AI for societal advancement, addressing global challenges and shaping the future.

2. VISION

To lead in academic excellence by fostering innovation, ethics, and transformative AI advancements, empowering students to shape technology and benefit society

3. MISSION

To deliver comprehensive and innovative education seamlessly integrates foundational computer science knowledge with advanced artificial intelligence techniques. The program aims to foster innovation and emphasizes the ethical development with the deployment of AI technologies, ensuring graduates are socially responsible and conscious of the broader implications of their work

4. PROGRAMME EDUCATIONAL OBJECTIVES (PEOS) *(will be given by ODA)*

PEO1: Technical and Professional Excellence: Graduates will demonstrate strong foundations in computer science, software engineering, data management, and emerging technologies, enabling them to excel in industry, academia, and research.

PEO2: Innovation and Problem-Solving: Graduates will apply analytical thinking, creativity, and modern IT tools to design, develop, and implement solutions for complex technological and societal challenges.

PEO3: Ethics and Responsible Computing: Graduates will uphold ethical standards, practice responsible computing, and contribute to sustainable development by leveraging technology for societal benefit.

PEO4: Leadership and Collaboration: Graduates will exhibit effective communication, teamwork, and leadership skills, preparing them to manage diverse projects and collaborate across multidisciplinary environments.

PEO5: Adaptability and Lifelong Learning: Graduates will engage in continuous professional development, research, and upskilling to remain adaptable in dynamic global IT environments and contribute to innovation and knowledge creation.

5. PROGRAMME OUTCOMES(POS)

PO1: Knowledge - Apply computer science and artificial intelligence knowledge to design intelligent solutions for real-world challenges.

PO2: Problem Solving - Utilize appropriate techniques, modern tools, and emerging AI technologies to solve problems aligned with current industry requirements.

PO3: Critical Thinking - Integrate critical thinking with technical competence to perform effectively in regional, national, and global professional environments.

PO4: Individual and Team Work - Engage in individual and collaborative learning to upgrade skills in Artificial Intelligence and Computing.

PO-5: Communication and Lifelong Learning - Exhibit innovation through communication and lifelong learning in developing advanced solutions.

6. PROGRAMME SPECIFIC OUTCOMES (PSOS)

PSO1: Specialized knowledge - Apply core Computer Science principles integrated with Artificial Intelligence techniques such as Machine Learning, NLP, Robotics, and Computer Vision to address real-world problems.

PSO2: Experiential and Tool usage - Utilize contemporary AI tools, platforms, and frameworks to design, implement, and validate real-world solutions through hands-on practice.

PSO3: Investigation and Research - Analyze complex datasets, formulate problem statements, and derive evidence-based insights using scientific and analytical approaches.

PSO4: Employability - Align technical and professional skills with current industry requirements in AI, enabling effective participation in diverse computing roles.

PSO5: Interdisciplinary and Multidisciplinary - Integrate AI methodologies with domains such as healthcare, business, and social sciences to develop cross-disciplinary solutions.

7. PEO – PO MAPPING

	PEO 1	PEO2	PEO3	PEO4	PEO5
PO 1	3	2	1	1	2
PO 2	3	3	2	1	2
PO3	2	3	2	2	2
PO 4	1	2	2	3	2
PO 5	2	2	2	3	3

8. PEO – PSO MAPPING

	PEO 1	PEO2	PEO3	PEO4	PEO5
PSO 1	3	3	1	2	2
PSO 2	3	3	2	2	3
PSO3	2	3	2	2	3
PSO 4	3	2	2	3	3
PSO 5	2	3	3	3	2

9. CHOICE BASED CREDIT SYSTEM (CBCS)

The College follows the CBCS with Grades under the Semester pattern. Each course is provided with a credit point based on the quantum of subject matter, complexity of the content and the hours of teaching allotted. This is done after a thorough analysis of the content of each course by the members of the Board of Studies and with the approval of the Academic Council. Students are also offered a variety of Job oriented Elective, Multidisciplinary skill-based courses as part of the curriculum. Students can earn extra credits by opting for Massive Open Online Courses (MOOCs) and Certificate Courses.

The evaluation method under CBCS involves a more acceptable grading system that reflects the personality of the student. This is represented as Cumulative Grade Point Average (CGPA) and Grade Point Average (GPA) which are indicators of the Academic Performance of the student. It provides students with a scope for horizontal mobility and empowers them with the flexibility of learning at their convenience.

Eligibility for Admission

Candidates admitted to the first year of the Bachelor of Computer Science with Artificial Intelligence should have passed the higher Secondary Examinations (Academic or Vocational Stream) with Mathematics conducted by the Government of Tamil Nadu or an examination accepted as equivalent thereof by the Syndicate of the University of Madras. Students applying for the PG Programme should have taken the UG degree in the relevant subject from a recognized university as per the norms of the University of Madras.

Duration of the Course

The UG Programme is of three years duration with six semesters and the PG Programme is of two years duration with four semesters. The period from June to November is termed as the odd semester and the period from December to April is referred to as the even semester. Each semester must compulsorily have 90 working days before the students appear for the final End Semester Exam.

Course of Study

The main course of study for the Bachelor's Degree shall consist of the following:

Foundation Courses

PART - I: Tamil/ Hindi /Sanskrit/French

PART - II: English

Core Courses

PART - III: Consisting of (a) Core Courses (*Including Project*) (b) Allied Courses (c) Elective Courses

related to the main subject of study.

PART – IV: Those who have not studied Tamil up to XII standard and have taken a Non-Tamil language under Part – I, shall opt for Basic Tamil in the first two semesters.

Those who have studied Tamil up to XII standard (State Board) or Tamil up to X Standard (CBSE and other boards) and opted for a Non -Tamil language under Part – I, shall opt for Advanced Tamil in the first two semesters.

Others, who do not come under either of the clauses mentioned above, can choose a Non-Major Elective (NME) in the first two semesters.

Ability Enhancement Skills (I, II, III & IV Semesters)

Value Education (I Semester)

Self-Study (Compulsory) Course (III Semester)

Indian Knowledge System (Domain Specific) – (IV Semester)

Summer Internship (After IV Semester)

Environmental Studies (V Semester)

PART - V: Compulsory Extension Services

A Student shall be awarded one credit for compulsory extension service. A student must enroll in NSS / NCC /Sports & Games/ Citizen Consumer Club / Enviro Club or any other service organization in the College and should put in compulsory minimum attendance of 40 hours, which shall be duly certified by the Principal of the College. If a student lacks 40 hours compulsory minimum attendance in the extension services in any Semester, s/he shall have to compensate the same, during the subsequent Semesters.

10. COURSE STRUCTURE

The B.Sc. Computer Science with Artificial Intelligence programme consists of 16 Core courses with 4 credits for each course, 2 Elective courses with 5 credits and 4 Allied courses with 4 credits each, 4 credits for Inter-disciplinary Elective, 4 Ability Enhancement Skills courses with 2 credits each and 2 Non-Major Elective courses with two credits each, 2 Life Skill courses (Value Education and EVS) with two credits each, 1 Self-study course with 2 credits and a domain specific IKS course with one credit. Internship is a compulsory component with 2 credits and Project is a compulsory core course with 4 credits for all the UG & PG programmes. Extension activity is a compulsory component with 1 credit.

Consolidated Credit Structure for all the 3 years

Course component		No. of Courses	Credits
Part I	Language	4	12
Part II	English	4	12
Part III	Core	16	64
	Allied	4	16
	Elective	3	14
Part IV	NME	2	4
	Ability Enhancement Skills	4	8
	EVS	1	2
	Value Education	1	2
	Internship	1	2
	Self-study course	1	2
	IKS	1	1
Part V	Extension activity	1	1
Total		43	140

Credit Distribution for Each Semester:

Semester I		Subject	Credit	Hours per week	Marks		Total
Course Component					Internal	External	
Part I	Language	Language – I	3	6	50	50	100
Part II	English	English – I	3	4	50	50	100
Part III	Core – I	Data Structures using python	4	5	50	50	100
	Core-II	Practical - I: Data Structures using python	4	4	50	50	100
	Allied-I	Mathematics - I	4	5	50	50	100
Part IV	Non-Major Elective-I	Basic Tamil-I/ Advanced Tamil-I/ Artificial Intelligence for Beginners	2	2	50	50	100
	Life Skills - I	Value Education	2	2	50	50	100
	Ability Enhancement Skills-I	Communication skills and Personality Development skills	2	2	50	50	100
	Total		24	30			
Semester II		Subject	Credit	Hrs/ Week	Marks		Total
Course Component					Internal	External	
Part I	Language	Language – II	3	6	50	50	100
Part II	English	English – II	3	4	50	50	100
Part III	Core –III	Java Programming	4	6	50	50	100
	Core-IV	Practical - II: Java Programming for Applications	4	4	50	50	100
	Allied-II	Mathematics - II	4	6	50	50	100
Part IV	Non-Major Elective-II	Basic Tamil-II/ Advanced Tamil- II/ Practical - Design using Generative AI and Open-Source Tools	2	2	50	50	100
	Ability Enhancement Skills - II	Foundations of Quantitative Aptitude	2	2	50	50	100
Total			22	30			

Semester III		Subject	Credit	Hrs/ Week	Marks		Total
Course Component					Internal	External	
Part I	Language	Language – III	3	6	50	50	100
Part II	English	English – III	3	4	50	50	100
Part III	Core - V	Relational Database Systems with PL/SQL	4	6	50	50	100
	Core -VI	Practical – III: RDBMS with PL/SQL	4	6	50	50	100
	Allied - III	Statistics – I	4	6	50	50	100
Part IV	Ability Enhancement Skills - III	Practical - Artificial Intelligence Tools and Applications	2	2	50	50	100
	Self- Study Course (Compulsory)	Indian Heritage and Knowledge Systems / Contemporary World and Sustainable	2	-	-	100	100
Total			22	30			
Semester IV		Subject	Credit	Hrs/ Week	Marks		Total
Course Component					Internal	External	
Part I	Language	Language – IV	3	6	50	50	100
Part II	English	English – IV	3	4	50	50	100
Part III	Core -VII	Foundations of Artificial Intelligence	4	6	50	50	100
	Core - VIII	Practical - IV: AI Problem Solving using Prolog	4	5	50	50	100
	Allied - IV	Statistics - II	4	6	50	50	100
Part IV	Indian Knowledge System	Indian Knowledge System (IKS) with Artificial Intelligence	1	1	50	50	100
	Ability Enhancement Skills - IV	Resume writing and Interview skills	2	2	50	50	100
Total			21	30			

Semester V		Subject	Credit	Hrs/ Week	Marks		Total
Course Component					Internals	Externals	
Part III	Core - IX	Principles of Operating Systems	4	6	50	50	100
	Core - X	Computer Vision	4	6	50	50	100
	Core - XI	Practical - V: Computer Vision	4	5	50	50	100
	Elective - I IDE (Inter Disciplinary Elective)	Ethics of Artificial Intelligence	4	5	50	50	100
	Elective - II	Platform Engineering/Computer Networks/Software Engineering	5	6	50	50	100
Part IV	Life Skills - II	Environmental Studies	2	2	50	50	100
	Internship	Internship	2	-	-	-	-
Total			25	30			
Semester VI		Subject	Credit	Hrs/ Week	Marks		Total
Course Component					Internals	Externals	
Part III	Core - XII	Machine Learning for Intelligent Systems	4	5	50	50	100
	Core - XIII	Internet of Things	4	6	50	50	100
	Core - XIV	Natural Language Processing (NLP)	4	5	50	50	100
	Core - XV	Practical - VI: Machine Learning & NLP Applications	4	4	50	50	100
	Core - XVI	Project	4	4	50	50	100
	Elective - III	Information Security / Robotics & its Applications / Artificial Neural Networks	5	6	50	50	100
Part V	Extension Activity	Participation in NSS/NCC etc.	1	-	-	-	-
Total			26	30			
Total Credits			140				
*** Programmes can choose one extra core course(optional) if they give four credit to allied courses							

11. EXAMINATION

Continuous Internal Assessment (CIA) will be for 50 percent and End Semester Examination (ESE) will be for 50 percent. The CIA marks for the two credit courses (NME, EVS, Value Education and Ability Enhancement skill courses) and one credit course on Indian Knowledge System coming under Part IV, shall be awarded based on the nature of the course or at the course instructor's discretion (Assignment/project/presentation). The mode of examination for IKS will be conducted through CIA with 5 out of 10 questions carrying 20 marks each.

Continuous Internal Assessment (CIA)

Every semester will have a mid-semester examination which will be conducted on completion of 45 working days in each semester. A Model exam for three hours duration will be conducted on completion of 85 working days in each semester. Internship credits will be given in semester V after verification of documents by the respective Heads.

The schedule for these tests is as follows:

CIA	Schedule	Syllabus Coverage
Mid Semester Examination	After 45 working days of the Semester	50%
Model Examination	After 85 working days of the Semester	100%

The components for the CIA (Theory & Practical) are as follows:

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment			5
Workbook/record book/notebook			5
Class activity 1			5
Class activity 2			5
Class activity 3			5
Attendance	Marks will be given based on the attendance percentage of respective course		5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

- 1) Quiz with MCQ
- 2) Case-Study analysis
- 3) Debate
- 4) Seminar/ Presentation
- 5) Peer/Self-Assessment
- 6) Role play
- 7) Scrap book
- 8) Monograph
- 9) Puzzle
- 10) Group Discussion
- 11) Group activity
- 12) Surprise class tests

A record of all such assessment procedures will be maintained by the department and is open for clarification. Students will have the right to appeal to the Principal in case of glaring disparities in marking. CIA marks for practical subjects will be awarded by the respective faculty based on the performance of the student in the model practical examination, observation notebook, submission of record books, regularity and attendance for the practical classes. The attendance particulars for practical classes will be maintained by the concerned faculty.

The marks for attendance will be awarded as per the following:

Percentage of General Attendance	Marks Awarded
90-100	5
75-89	4
60-74	3
<60	0

End Semester Examinations (ESE)

After the completion of a minimum of 90 working days each semester, the End Semester Examinations will be conducted. Examinations for all UG and PG programmes will be held for all courses in November/December and April/May. Practical examinations will be conducted only during the end of the odd / even semester before, during or after the commencement of the theory exam. The schedule for ESE Practical's will be notified by the Controller of Examinations in consultation with the Dean Academics.

Mode of Evaluation

METHODS OF EVALUATION		
Internal Evaluation	Mid Sem Exam (10)	50 Marks
	Model Exam (10)	
	Assignment (10)	
	Class activity (15)	
	Attendance (5)	
External Evaluation	End Semester Examination	50 Marks
Total		100 Marks

Method of assessment

Remembering (K1)	- The lowest level of questions requires students to recall information from the course content - Knowledge questions usually require students to identify information in the textbook. - Suggested Keywords: Choose, Define, Find, How, Label, List, Match, Name, Omit, Recall, Relate, Select, Show, Spell, Tell, What, When, Where, Which, Who, Why
Understanding (K2)	- Understanding off acts and ideas by comprehending organizing, comparing, translating, interpolating and interpreting in their own words. - The questions go beyond simple recall and require students to combined at altogether - Suggested Keywords: Classify, Compare, Contrast, Demonstrate, Explain, Extend, Illustrate, Infer, Interpret, Outline, Relate, Rephrase, Show, Summarize, Translate
Application (K3)	- Students have to solve problems by using / applying a concept learned in the classroom. - Students must use their knowledge to determine a exact response. - Suggested Keywords: Apply, Build, Choose, Construct, Develop, Experiment with, Identify, Interview, Make use of, Model, Organize, Plan, Select, Solve, Utilize
Analyze (K4)	- Analyzing the question is one that asks the students to breakdown something into its component parts. - Analyzing requires students to identify reasons causes or motives and reach conclusions or generalizations. - Suggested Keywords: Analyze, Assume, Categorize, Classify, Compare, Conclusion, Contrast, Discover, Dissect, Distinguish, Divide, Examine, Function, Inference, Inspect, List, Motive, Relationships, Simplify, Survey, Take part in, Test for, Theme
Evaluate (K5)	- Evaluation requires an individual to make judgment on something. - Questions to be asked to judge the value of an idea, a character , a work of art, or a solution to a problem. - Students are engaged in decision-making and problem–solving. - Evaluation questions do not have single right answers. - Suggested Keywords:

	Agree, Appraise, Assess, Award, Choose, compare, Conclude, Criteria, Criticize, Decide, Deduct, Defend, Determine, Disprove, Estimate, Evaluate, Explain, Importance, Influence, Interpret, Judge, Justify, Mark, Measure, Opinion, Perceive, Prioritize, Prove, Rate, Recommend, Rule on, Select, Support, Value
Create (K6)	• The questions of this category challenge students to get engaged in creative and original thinking. • Developing original ideas and problem solving skills • Suggested Keywords: Adapt, Build, Change, Choose, Combine, Compile, Compose, Construct, Create, Delete, Design, Develop, Discuss, Elaborate, Estimate, Formulate, Happen, Imagine, Improve, Invent, Make up, Maximize, Minimize, Modify, Original, Originate, Plan, Predict, Propose, Solution, Solve, Suppose, Test, Theory

SEMESTER I

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: CORE – I
COURSE NAME: DATA STRUCTURES USING PYTHON	COURSE CODE: 26UCAI301
SEMESTER: I	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

To introduce Python programming with high-level data structures, building foundational skills in computing and problem-solving, enabling students to use data structures to solve real-life problems

COURSE OUTCOMES:

1. Develop programs using Python fundamentals including syntax, data types, operators, and control flow statements
2. Apply Python data structures and functions such as lists, tuples, sets, dictionaries, and user-defined functions
3. Utilize Python modules, packages, and NumPy for structured programming and numerical computations
4. Design solutions using linear data structures and algorithms such as arrays, searching, sorting, and stacks using Python
5. Implement and manipulate linked and non-linear data structures, including queues, linked lists, trees, and graph traversal techniques

UNIT 1

12 Hours

Introduction and Control Flow statements in Python

Features of Python - interactive, object oriented, interpreted, platform independent. Python building blocks - identifiers, keywords, indentation, variables, comments. Python data types: numbers, string, tuples, lists, dictionary. Basic operators: arithmetic, comparison/ relational, assignment, logical, bitwise, membership, identity operators, Python operator precedence. Control flow: conditional statements (if, if else, nested if), looping in python (while loop, for loop, nested loops) loop manipulation using continue, pass, break, else.

UNIT II

12 Hours

Python specific Data Structures and functions

Lists: Defining lists, accessing values in list, deleting values in list, updating lists, basic list operations, built - in list functions. Tuples: Accessing values in tuples, deleting values in tuples, and updating tuples, basic tuple operations, built - in tuple functions. Sets: Accessing values in set, deleting values in set and updating sets, basic set operations, built - in set functions. Dictionaries:

Accessing values in dictionary, deleting values in dictionary and updating dictionary, basic dictionary operations, built- in dictionaries functions.

Use of Python built- in functions (e.g. type/ data conversion functions, math functions etc.)

User defined functions: Function definition, function calling, function arguments and parameter passing, return statement, scope of variables: global variable and local variable.

UNIT III

12 Hours

Python Modules and Packages

Modules: writing modules, importing modules, importing objects from modules, Python built- in modules (e.g. numeric and mathematical module, functional programming module). Python packages: introduction, writing Python packages. Using standard Numpy: methods in Numpy, creating arrays and initializing, reading arrays from files, special initializing functions, slicing and indexing, reshaping arrays, combining arrays, NumPy maths.

UNIT IV

12 Hours

Linear Data Structure using Python

Linear Data Structures using Python: Introduction to Data Structures – Definition – Classification of Data Structures (Linear and Non-Linear). Arrays: Concept of Arrays – Types of Arrays – Operations on Arrays – Arrays vs Lists in Python. Searching Techniques: Linear Search – Binary Search – Implementation using Python. Sorting Techniques: Bubble Sort – Insertion Sort – Implementation using Python. Stacks: Introduction to Stacks – Stack Operations – Applications of Stacks: Expression Evaluation – Infix, Prefix and Postfix Expressions.

UNIT V

12 Hours

Linked Structures and Non-Linear Data Structures

Queues: Introduction to Queues – Queue Operations – Applications of Queues. Linked Lists: Introduction – Types of Linked Lists: Singly Linked List, Doubly Linked List - Basic Operations – Linked List implementation using Python.

Introduction to Non-Linear Data Structures. Trees: Tree Terminology – Binary Trees – Tree Traversals (Inorder, Preorder, Postorder). Binary Search Trees (BST): Concept – Operations on BST – Insertion, Deletion and Searching.

Graph Traversal Concepts: Depth First Search (DFS) – Breadth First Search (BFS).

PRESCRIBED BOOKS:

1. “Python Programing” by Rao, K. Nageswara Shaikh Akbar, Scitech Publications (India) Pvt. Ltd. ISBN: 9789385983450
2. “Data Structures and Algorithms in Python”, Michael T. Goodrich, Roberto Tamassia, Wiley publication New Delhi 2016 ISBN: 978-81- 265-5423-2

REFERENCE BOOKS:

1. “Python Essential Reference”, Beazley, David, 4th Edition, Addison-Wesley Professional, ISBN: 9780672329784
2. “Hands-On Data Structures and algorithms with Python”, Dr.Basant Agarwal, 3rd Edition, Packt publisher, ISBN : 9781801073448

E-LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs26/preview
2. <https://www.geeksforgeeks.org/graph-data-structure-and-algorithms>
3. <https://www.freecodecamp.org/news/object-oriented-programmin g-in-python/>
4. <https://realpython.com/python3-object-oriented-programming/>
5. https://onlinecourses.nptel.ac.in/noc21_cs21/

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer any 10 out of 12 questions (each in 50 words)	1-12	3	30
B	Answer any 5 out of 7 questions (each in 300 words)	13-19	6	30
C	Answer any 4 out of 6 questions (each in 1200 words)	20-25	10	40
TOTAL MARKS				100

BREAK UP OF QUESTIONS FOR THEORY AND PROBLEM

UNITS	SECTION A	SECTION B	SECTION C
I	3	1	1
II	2	2	1
III	3	1	2
IV	2	1	1
V	2	2	1
SECTION A - 12		SECTION B - 7	SECTION C - 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	2	2	1	1
CO 2	3	3	2	2	1
CO 3	3	3	2	2	2
CO 4	3	3	3	2	1
CO 5	3	3	3	2	2
Ave.	3.0	2.8	2.4	1.8	1.4

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	2	1	2	1
CO 2	2	3	2	2	1
CO 3	3	3	2	2	2
CO 4	3	3	3	2	2
CO 5	3	3	3	2	2
Ave.	2.6	2.8	2.2	2.0	1.6

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOMES	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Develop programs using Python fundamentals including syntax, data types, operators, and control flow statements	PO1, PO2, PO3	PSO1, PSO2, PSO4	K1, K2, K3
CO2	Apply Python data structures and functions such as lists, tuples, sets, dictionaries, and user-defined functions	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3, PSO4	K2, K3, K4
CO3	Utilize Python modules, packages, and NumPy for structured programming and numerical computations	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO3, PSO5	K3, K4
CO4	Design solutions using linear data structures and algorithms such as arrays, searching, sorting, and stacks using Python	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3, PSO4	K3, K4, K5, K6
CO5	Implement and manipulate linked and non-linear data structures, including queues, linked lists, trees, and graph traversal techniques	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO3, PSO5	K3, K4, K5, K6

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

DATA STRUCTURES USING PYTHON (Theory)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Written assignment from the syllabus	10	5
Workbook / Record book / Notebook	Notebook	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Puzzle	10	5
Class activity 3	Case-Study Analysis	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE	BATCH: 2026 - 29
WITH ARTIFICIAL INTELLIGENCE	
PART: III	COURSE COMPONENT: CORE – II
COURSE NAME: PRACTICAL - I: DATA STRUCTURES USING PYTHON	COURSE CODE: 26UCAI302P
SEMESTER: I	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
PRACTICAL	

COURSE OBJECTIVE:

An ability to develop Python program using basic syntactical constructs, Modules, Packages in Python for given problem and Implement Linear Data Structure in Python

COURSE OUTCOMES:

1. Execute basic programs using operators and control flow statements
2. Apply Python data structures such as lists, tuples, sets, and dictionaries to solve problems
3. Develop user-defined functions, modules, and packages using Python
4. Utilize NumPy and perform array operations along with linear data structures like stacks, queues, and linked lists
5. Implement searching, sorting, and basic tree structures using Python

LAB EXERCISES:

1. Install Python integrated development environment

- a) Install and configure Python IDE
- b) Write Python program to display message on screen

2. Implement basic operators in Python

Write simple Python program using operators: a) Arithmetic operators b) Logical operators c) Relational operators d) Conditional operators e) Bitwise operators f) Ternary operator

3. Implement control flow operations for solving given task

Write simple Python program to demonstrate use of conditional statements:

- i) if ii) if...else iii) Nested if iv) Switch case

4. Implement while control loop for solving iterative problems

Develop a simple Python program to demonstrate use of control loop: while

5. Implement for loop for solving iterative problems

Create a simple program to demonstrate use of for loop in Python (e.g : various pattern

building, printing multiplication table, checking palindrome number etc.)

6. Perform basic operations on the lists

Write Python program to perform following operations on lists: a) Create b) Access c) Update d) Delete elements in list

7. Execute various tuple operations

Develop Python program to perform following operations on tuples: a) Create b) Access c) Update d) Delete tuple elements

8. Implement various set operations

Write Python program to perform following operations on set: a) Create b) Access c) Update d) Delete access set elements

9. Execute various operations on dictionaries

Create a program to perform following operations on dictionaries in Python: a) Create b) Access c) Update d) Delete e) Looping through dictionary

10. Use built-in math functions in Python

Apply math built - in function in Python

11. Create user-defined functions to solve the given task

Develop user defined Python function for given problem: write a function with minimum 2 arguments

12. Apply built-in mathematical modules from python

Create a program to demonstrate use of built-in module (e.g. numeric, mathematical functional and programming module) in Python

13. Write user-defined module in Python

Write program to create a user - defined module (e.g : building calculator) in Python

14. Apply built-in packages from Python

Develop Python program to demonstrate use of NumPy packages for creating, accessing and performing different array operations

15. Create user-defined packages in Python

Write a program to create user defined packages in Python

16. Execute the array operations using Python.

Write a program in Python for handling array to demonstrate following operations:

a) Array declaration b) Insertion c) Deletion d) Append e) Index f) Reverse

17. Implement the linked list operations using Python.

Write a program in Python for linked list to demonstrate following operations:

a) Insertion b) Deletion c) Updating d) Merging to list

18. Implement the queue operations using Python.

Write a program in Python to demonstrate queue data structure operations:

a) Enqueue b) Dequeue c) Display

19. Implement searching techniques in Python

Use the searching techniques in data structures: a) Linear Search b) Binary Search

20. Implement sorting techniques in Python.

Write a Python program to implement following sorting techniques:

a) Bubble Sort b) Insertion Sort

21. Implement stack data structure in Python. Write a program in Python to evaluate an expression

22. Implement sorting techniques in Python. Write a program to create binary tree from the given list using binary tree module in Python.

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	2	2	1	1	1
CO 2	3	3	2	2	1
CO 3	3	3	2	2	2
CO 4	3	3	3	2	2
CO 5	3	3	3	2	1
Ave.	2.8	2.8	2.2	1.8	1.4

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	2	1	2	1
CO 2	3	3	2	2	1
CO 3	3	3	2	2	2
CO 4	3	3	3	2	2
CO 5	3	3	3	2	1
Ave.	2.8	2.8	2.2	2.0	1.4

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOMES	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Execute basic programs using operators and control flow statements	PO1, PO2, PO3	PSO1, PSO2, PSO4	K1, K2, K3
CO2	Apply Python data structures such as lists, tuples, sets, and dictionaries to solve problems	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3, PSO4	K2, K3, K4
CO3	Develop user-defined functions, modules, and packages using Python	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO4, PSO5	K3, K4
CO4	Utilize NumPy and perform array operations along with linear data structures like stacks, queues, and linked lists	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3, PSO4	K3, K4, K5
CO5	Implement searching, sorting, and basic tree structures using Python	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO3, PSO5	K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PRACTICAL – I: DATA STRUCTURES USING PYTHON

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Practical examination with programming/problem-solving tasks for 90 minutes	50	10
Model Examination	Practical examination with programming/problem-solving tasks for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook / Record book / Notebook	Handwritten record of experiments, observations, results and conclusions	10	5
Class activity 1	Debugging Test	10	5
Class activity 2	Problem-Solving Exercise	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARITIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: ALLIED – I
COURSE NAME: MATHEMATICS - I	COURSE CODE: 26UCAIM3A1
SEMESTER: I	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY AND PROBLEMS	

COURSE OBJECTIVE:

To improve basics in mathematical and analytical skills.

COURSE OUTCOMES:

1. Apply the concepts of binomial, exponential, and logarithmic series to solve mathematical problems involving summation of series.
2. Analyze and perform operations on different types of matrices, and apply the Cayley–Hamilton Theorem to compute matrix inverses and verify matrix equations.
3. Demonstrate understanding of trigonometric expansions, hyperbolic functions, and inverse hyperbolic functions in solving algebraic and trigonometric problems.
4. Solve problems involving higher-order derivatives, apply Leibniz Theorem, evaluate Jacobians, and determine maxima and minima for functions of two variables.
5. Solve second-order linear differential equations with constant coefficients and apply appropriate methods to obtain particular integrals involving trigonometric functions.

UNIT I

12 Hours

Summation of series: Binomial series -Exponential series - Logarithmic series –Simple Problem
Chapter 2: Sections: 2.1.3, 2.2.1, 2.3.3

UNIT II

12 Hours

Matrices: Symmetric, Skew-Symmetric, Hermitian, Skew- Hermitian, Orthogonal and Unitary matrices, Cayley –Hamilton theorem (without proof) – Verification- Computation of inverse of matrix using Cayley - Hamilton theorem.
Chapter 4: Sections: 4.1.1–4.1.6, 4.5.2 and 4.5.3.

UNIT III

12 Hours

Trigonometry: Expansions of $\sin^n \theta$, $\cos^n \theta$ in a series of powers of $\sin \theta$ and $\cos \theta$, Expansions of $\sin(n\theta)$ and $\cos(n\theta)$ in a series of sines and cosines of multiples of “ θ ”, Hyperbolic and inverse hyperbolic functions.

Chapter 6: Section 6.1.1, 6.1.2, 6.2, 6.2.2, 6.3

UNIT IV

12 Hours

Differential Calculus: n^{th} derivatives, Leibnitz theorem (without proof) and applications, Jacobians, maxima and minima of functions of two variables- Simple problems.

Chapter 1: Section 1.1.1 to 1.3.1.

UNIT V

12 Hours

Differential Equations: Second order differential equation with constant coefficients - differential equation of the form $(aD^2 + bD + c)y = e^{ax} \phi$ where a, b, c are constants, $\phi = \sin mx$ (or) $\cos mx$ Chapter 5, Section 5.2, 5.2.1

PRESCRIBED BOOK:

1. Treatment and content as in “Allied mathematics” – P. Durai Pandian, Dr. S. Udayabaskaran, Volume I & II S. Chand and company limited, Reprint 2018

REFERENCE BOOKS:

1. P. R. Vittal – Allied Mathematics, Margham Publications
2. S. G. Venkatachalapathy – Allied Mathematics, Margham Publications
3. P. Kandasamy & K. Thilagavathi – Allied Mathematics, Volume I & II, S. Chand & Company Ltd.
4. K. Balasubramanian & K. G. Subramanian – Ancillary Mathematics, Volume I & II, Tata McGraw-Hill / S. Chand
5. A. Singaravelu – Allied Mathematics, Meenakshi Agency

E - LEARNING RESOURCES:

1. <https://nptel.ac.in/courses/111107107>
2. <https://nptel.ac.in/courses/111106146>
3. <https://nptel.ac.in/courses/111101005>
4. https://archive.org/details/mathematics_lectures
5. <https://www.khanacademy.org/math>

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer any 10 out of 12 questions	1 - 12	3	30
B	Answer any 5 out of 7 questions	13 - 19	6	30
C	Answer any 4 out of 6 questions	20 - 25	10	40
TOTAL MARKS				100

BREAK UP OF QUESTIONS FOR THEORY AND PROBLEM

UNITS	THEORY	PROBLEM	THEORY	PROBLEM	THEORY	PROBLEM
I	1	2	-	1	-	1
II	1	1	-	1	-	2
III	-	2	-	2	-	1
IV	1	2	-	1	-	1
V	-	2	-	2	-	1
TOTAL	12		7		6	
	SECTION A - 12		SECTION B – 7		SECTION C - 6	

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	3	2	2	3
CO 2	3	2	2	3	2
CO 3	3	2	3	3	2
CO 4	2	3	2	2	3
CO 5	2	3	3	3	2
Ave.	2.4	2.6	2.4	2.6	2.4

PSO-CO-question paper mapping

CO No	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Apply the concepts of binomial, exponential, and logarithmic series to solve mathematical problems involving summation of series.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO3, PSO4, PSO5	K1,K4
CO2	Analyze and perform operations on different types of matrices, and apply the Cayley – Hamilton Theorem to compute matrix inverses and verify matrix equations.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO3, PSO4, PSO5	K1, K2
CO3	Demonstrate understanding of trigonometric expansions, hyperbolic functions, and inverse hyperbolic functions in solving algebraic and trigonometric problems.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO3, PSO4, PSO5	K3,K5
CO4	Solve problems involving higher-order derivatives, apply Leibniz Theorem, evaluate Jacobians, and determine maxima and minima for functions of two variables.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO3, PSO4, PSO5	K3, K4
CO5	Solve second-order linear differential equations with constant coefficients and apply appropriate methods to obtain particular integrals involving trigonometric functions.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO3, PSO4, PSO5	K4, K5

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

MATHEMATICS - I

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Written examination for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Content -3, Presentation – 2	5	5
Workbook/Record book/Notebook	Completeness - 3, Accuracy – 2	5	5
Class activity 1	Quiz with MCQ (Correct Answers - 3, Speed - 2) / Rapid Fire (Quick Response - 3, Accuracy - 2) / Formula Drill Game (Correct Formula Recall - 3, Application - 2) / Others	5	5
Class activity 2	Problem Solving (Correct Answer - 3, Proper Steps - 2) / Error Detection Activity (Identification of Errors - 3, Reasoning - 2) / Scrap Book (Relevance of Content - 3, Creativity and Presentation - 2) / Others	5	5
Class activity 3	Real-Life Application Task (Understanding of Concept - 3, Application of Real Situation - 2) / Seminar (Preparation - 3, Presentation - 2) / Peer Quiz Creation (Quality of Questions - 3, Relevance to Topic - 2) / Others	5	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: OPEN TO ALL PROGRAMMES EXCEPT B.Sc., COMPUTER SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: IV	COURSE COMPONENT: NON-MAJOR ELECTIVE - I
COURSE NAME: ARTIFICIAL INTELLIGENCE FOR BEGINNERS	COURSE CODE: 26UNME4A108
SEMESTER: I	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

COURSE OBJECTIVE:

The course provides a comprehensive understanding of AI, covering key concepts, project workflows, applications, societal impacts, and advanced techniques for effective AI implementation.

COURSE OUTCOMES:

1. Describe the basics of Artificial Intelligence, its features, and applications in daily life.
2. Learn the concepts of data, working of AI systems, and learning techniques in AI
3. Analyse the types of AI, its evolution, and the role of generative AI in society
4. Apply the impact of AI on careers, industries, and learning environments
5. Explore advanced AI techniques and future trends, with an emphasis on ethical development

UNIT I

6 Hours

Understanding the Basics of AI: Introduction to AI, AI Concepts, Applications of AI, AI vs Non-AI Systems, AI in Daily Life, Basics of AI Tools, Prompt-Based AI Usage, Using AI for Information Retrieval

UNIT II

6 Hours

AI Working, Data Concepts, and Learning Techniques: Working of AI, Introduction to Data, Importance of Data in AI, AI Learning from Data, Machine Learning Basics, Deep Learning Basics, Machine Learning vs Deep Learning

UNIT III

6 Hours

Types of AI: Narrow AI and General AI, History and Evolution of AI, Capabilities of AI, Introduction to Generative AI, Impact of Generative AI on Society, Communication with AI Systems, Applications of Generative AI in various Fields

UNIT IV

6 Hours

AI in Careers, Learning, and Workplace Transformation: Impact of AI on Jobs and Industries, AI-Driven Changes in the Workplace, Advantages and Limitations of AI at Work, Career Opportunities in the AI Era, AI for Enhanced Learning, Role of AI in Personalized Education

UNIT V

6 Hours

Responsible and Ethical Use of AI: Introduction to Ethical AI, Importance of Ethics in AI, Ethical Challenges in AI Systems, Responsible Use of AI Technologies

PRESCRIBED BOOK:

1. Co-Intelligence: Living and working with AI by Ethan Mollick. First Edition, Portfolio/Penguin, 2024, ISBN-13: 978-0593716717
2. The Coming Wave: Technology, Power, and the Twenty-First Century's Greatest Dilemma by Mustafa Suleyman and Michael Bhaskar. First Edition, Crown, 2023, ISBN-13: 978-0593593967
3. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig. Fourth Edition, Pearson, 2020, ISBN-13: 978-0134610993

REFERENCE BOOKS:

1. Supremacy: AI, ChatGPT and the Race That Will Change the World by Parag Mehta. First Edition, Pan Macmillan, 2024, ISBN-13: 978-1250337747
2. The Singularity Is Nearer: When We Merge with AI by Ray Kurzweil. First Edition, Penguin, 2024, ISBN-13: 978-0399562761
3. Artificial Intelligence Basics: A Non-Technical Introduction – Tom Taulli, Apress, 2019
4. Empire of AI: Dreams and Nightmares in Sam Altman's OpenAI – Karen Hao, 2025
5. All-in On AI: How Smart Companies Win Big with Artificial Intelligence by Thomas H. Davenport and Nitin Mittal. First Edition, Harvard Business Review Press, 2023, ISBN-13: 978-1647824693

E - LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc24_ge47/
2. <https://www.coursera.org/learn/introduction-to-ai>
3. <https://www.edx.org/learn/artificial-intelligence>
4. <https://huggingface.co/learn>
5. <https://developers.google.com/machine-learning/crash-course>

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	2	2	1	1	1
CO 2	3	2	2	1	1
CO 3	3	3	3	1	2
CO 4	3	3	2	2	2
CO 5	3	3	3	2	3
Ave.	2.8	2.6	2.2	1.4	1.8

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	1	1	1	1
CO 2	2	2	2	1	1
CO 3	3	2	2	2	2
CO 4	3	3	2	3	2
CO 5	3	3	3	2	3
Ave.	2.6	2.2	2.0	1.8	1.8

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOMES	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Describe the basics of Artificial Intelligence, its features, and applications in daily life.	PO1, PO2	PSO1, PSO2,	K1, K2
CO2	Learn the cconcepts of data, working of AI systems, and learning techniques in AI	PO1, PO2, PO3,	PSO1, PSO2, PSO3	K2, K3
CO3	Analyse the types of AI, its evolution, and the role of generative AI in society	PO1, PO2, PO3, PO5	PSO1, PSO3, PSO5	K3, K4
CO4	Apply the impact of AI on careers, industries, and learning environments	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4, PSO5	K3, K4, K5
CO5	Explore advanced AI techniques and future trends, with an emphasis on ethical development	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO3, PSO5	K4, K5, K6

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

NON-MAJOR ELECTIVE – I: ARTIFICIAL INTELLIGENCE FOR BEGINNERS

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Assignment	Written topic related to the course	25	25
Workbook / Record book / Notebook	Notebook	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Case-Study Analysis	10	5
Class activity 3	Debate	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

UG - ABILITY ENHANCEMENT SKILLS /LIFE SKILLS

PROGRAMME: ALL UG	BATCH: 2026 - 29
PART: IV	COURSE COMPONENT: VALUE EDUCATION
COURSE NAME: VALUE EDUCATION	COURSE CODE: 26UVED401
SEMESTER: I	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

COURSE OBJECTIVE:

To inculcate human values, ethical principles, social responsibility, and awareness of responsible technology use for holistic personal and societal development.

COURSE OUTCOMES:

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

1. Recall core value systems and their relevance to real-life situations and ethical decision-making in personal and social contexts.
2. Describe the role of culture and civilization in shaping individual and collective identities.
3. List salient values for life such as forgiveness, sacrifice, self-esteem, teamwork, and creative thinking.
4. Describe the role of human rights, social values, and ethical use of Artificial Intelligence in addressing contemporary social issues.
5. Recall the teachings of Guru Nanak Dev Ji and describe their connection to values and sustainable living.

UNIT 1: EDUCATION AND VALUES

6 Hours

Definition, Concept, Classification, Theory, Criteria and Sources of values Aims and objectives of value education Role and Need for value education in the contemporary society, Role of education in transformation of values in society Role of parents, teachers, society, peer group and mass media in fostering values

UNIT 2: VALUE EDUCATION AND PERSONAL DEVELOPMENT

6 Hours

Human Values: Truthfulness, Sacrifice, Sincerity, Self-Control, Altruism, Scientific Vision, relevancy of human values to good life. Character Formation towards Positive Personality Modern challenges of adolescents: emotions and behavior Self-analysis and introspection: sensitization towards gender equality, differently abled, Respect for - age, experience, maturity, family members, neighbors, strangers, etc.

UNIT 3: HUMAN RIGHTS AND MARGINALIZED PEOPLE

6 Hours

Concept of Human Rights – Principles of human rights – human rights and Indian constitution – Rights of Women and children – violence against women – Rights of marginalized People – like

women, children, minorities, transgender, differently abled etc.

Social Issues and Communal Harmony Social issues – causes and magnitude - alcoholism, drug addiction, poverty, unemployment – communal harmony –concept –religion and its place in public domain –secular civil society

UNIT 4: VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL DEVELOPMENT 6 Hours

Constitutional Values: (Sovereign, Democracy, Socialism, Secularism, Equality, Justice, Liberty, Freedom, Fraternity)

Social Values: (Pity and Probit, Self-Control, Universal Brotherhood).

Professional Values: (Knowledge Thirst, Sincerity in Profession, Regularity, Punctuality, Faith).

Religious and Moral Values: (Tolerance, Wisdom, character).

Aesthetic Values: (Love and Appreciation of literature, fine arts)

Environmental Ethical Values, National Integration and international understanding.

Need for Humanistic values for espousing peace in society.

Conflict of cross-cultural influences, cross-border education.

Emerging Technologies and Human Values: (Ethical and responsible use of Artificial Intelligence, digital citizenship, privacy, academic integrity and technology for social good).

UNIT 5

6 Hours

Guru Nanak Devji's Teachings

Relevance of Guru Nanak Devji's teachings' relevance to Modern Society

The Guru Granth Sahib

The five Ks, Values and beliefs

Rights and freedom (Right of equality, Right to Education, Right to Justice, Rights of women, Freedom of religion, Freedom of culture, Freedom of assembly, Freedom of speech), Empowerment of women, Concept of Langar, Eminent Sikh personalities

REFERENCES BOOKS:

1. Dr. Abdul Kalam. My Journey-Transforming Dreams into Actions. Rupa Publications, 2013.
2. Steven R Covey, 8th Habit of Effective People (From Effectiveness to Greatness), Free Press, New York, 2005.
3. Prem Singh, G.J. (2004). 'Towards Value Based Education', University News. Vol. 42 (45): P.11-12.
4. V.R. Krishna Iyer. Dialectics & Dynamics of Human Rights in India (Tagore Law Lectures) The Yesterday, Today and Tomorrow, Eastern Law House (1999, Reprint 2018)
5. <http://www.ncert.nic.in/rightside/links/pdf/framework/english/nf2005.pdf>
6. Saptarsi Goswami, Amit Kumar Das and Amlan Chakrabarti, AI for Everyone: A Beginner's Handbook for Artificial Intelligence (AI), Pearson India Education Services Pvt. Ltd., First Edition, 2024. ISBN: 978-9361590832.

QUESTION PAPER PATTERN: MCQ

ABILITY ENHANCEMENT SKILLS - I COMMON TO ALL	BATCH: 2026 - 29
PART: IV	COURSE COMPONENT: ABILITY ENHANCEMENT SKILLS - I
COURSE NAME: COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT SKILLS	COURSE CODE: 26USKL401
SEMESTER: I	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

COURSE OBJECTIVE:

To build communication skills for personal and professional development.

COURSE OUTCOMES:

1. Demonstrate the ability to actively listen to others, understand diverse perspectives, and paraphrase key points accurately, enhancing their comprehension skills in various personal and professional contexts.
2. Articulate thoughts, ideas, and information clearly and concisely, using appropriate language and structure to convey messages effectively in both written and verbal communication.
3. Develop confidence in expressing opinions, asserting boundaries, and advocating for themselves and others, leading to enhanced self-assurance and effectiveness in interpersonal and group communication.
4. Demonstrate their communication style and approach based on the audience, context, and purpose of communication, fostering flexibility and versatility in interacting with diverse individuals and groups.
5. Acquire techniques for resolving conflicts, managing disagreements, and negotiating mutually beneficial outcomes through effective communication strategies, promoting constructive problem-solving and collaboration in personal and professional settings.

UNIT I Types of Communication

6 Hours

Verbal Communication - Nonverbal Communication - Visual Communication - Written Communication - Interpersonal Communication - Group Communication - Mass Communication - Digital Communication- Barriers – Language- Cultural- Psychological- Semantic- Technological Barriers

UNIT II Etiquette & Ethical Practices in Communication

6 Hours

Active Listening - Respectful Language - Clarity and Conciseness – Truthfulness-Professionalism-Tone -Timeliness - Constructive Feedback - Confidentiality - Cultural Sensitivity - - Emotional Intelligence-Social Intelligence- Social Etiquettes-Accountability

UNIT III Self Actualization

6 Hours

SWOC Analysis- Self Regulation-Self Evaluation, Self-Monitoring, Self- Criticism, Self-Motivation, Self-awareness and Reflection

UNIT IV Leadership and Teamwork

6 Hours

Leadership Skills: Leadership styles- Goal-setting and decision-making- Motivation and influence- Team Dynamics: Team building activities- Conflict resolution- Collaborative problem-solving

UNIT V Stress and Time Management

6 Hours

Definition of Stress, Types of Stress, Symptoms of Stress, Stress coping ability, Stress Inoculation Training, Time Management and Work-Life Balance: Self-discipline Goal-setting

RECOMMENDED TEXTBOOKS

1. Goleman, Daniel (2006) *Emotional Intelligence*, Bantam Books
2. Linden, Wolfgang (2004) *Stress Management- From Basic Science to Better Practice-* University of British Columbia, Vancouver, Canada.
3. Hasson, Gill (2012) *Brilliant Communication Skills*. Great Britain: Pearson Education.
4. Monippally, Matthukutty, M. *Business Communication Strategies*. New Delhi: Tata McGraw-Hill Publishing Company Ltd., 2001.
5. Raman, Meenakshi & Sangeetha Sharma (2011) *Communication Skills*, Oxford University Press.

REFERENCE BOOKS

1. N. Krishnaswamy *Current English for College* (1st Edition) - Trinity Press
2. Wood, Julia T (2015) *Interpersonal Communication: Everyday Encounters* 8th Edition, Cengage Learning.

E-LEARNING RESOURCES

1. <http://www.albion.com/netiquette/corerules.html>
2. <http://www.englishdaily626.com/c-errors.php>
3. <https://www.helpguide.org/articles/relationships-communication/nonverbal-communication.htm>
4. <https://www.communicationtheory.org/verbal-vs-non-verbal-communication-with-examples/>
5. <https://letstalkscience.ca/educational-resources/backgrounders/digital-citizenship-ethics>
6. <https://www.switchboard.app/learn/article/teamwork-leadership-skills>

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

Section	Question Component	Numbers	Marks	Total
A	Answer any 5 out of 7 questions (answer in 50 words)	1-7	2	10
B	Answer any 4 out of 6 questions (answer in 300 words)	8-13	5	20
C	Answer any two (Internal (Choice)	14-15	10	20
	Internal & Viva Voce		50	50

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	----
II	2	1	1
III	1	1	1
IV	1	1	1
V	1	1	1
TOTAL	7		
SECTION A – 7		SECTION B – 6	SECTION C - 4

SEMESTER II

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: CORE - III
COURSE NAME: JAVA PROGRAMMING	COURSE CODE: 26UCAI303
SEMESTER: II	MARKS: 100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

To provide fundamental knowledge of object-oriented programming, programming knowledge in Core Java from the basics up with the usage of AWT controls, Event Handling and Swing for GUI.

COURSE OUTCOMES:

1. Implement object-oriented concepts and core Java constructs including data types, control structures, strings, and I/O operations.
2. Develop object-oriented applications using classes, objects, inheritance, polymorphism, packages, and interfaces.
3. Apply exception handling mechanisms and multithreading concepts including synchronization and inter-thread communication
4. Create GUI applications using AWT components and coordinate events.
5. Design interactive GUI applications using Swing components and utilize Java Collections for data management

UNIT 1

12 Hours

Introduction: Review of Object-Oriented concepts - Java buzzwords (Platform independence, Portability, Threads)- JVM architecture –Java Program structure - Java main method - Java Console output (System.out) - simple java program - Data types - Variables - type conversion and casting- Java Console input: Buffered input - operators - control statements - Static Data - Static Method - String and String Buffer Classes

UNIT II

12 Hours

Java user defined Classes and Objects: Arrays - constructors - Inheritance: Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword -Packages: Definition - Access Protection - Importing Packages - Interfaces: Definition - Implementation - Extending Interfaces

UNIT III

12 Hours

Exception Handling: try – catch - throw - throws -- finally – Built-in exceptions - Creating own Exception classes - garbage collection, finalise -Multithreaded Programming: Thread Class -

Runnable interface – Synchronization – Using synchronized methods – Using synchronized statement - Interthread Communication – Deadlock.

UNIT IV

12 Hours

The AWT class hierarchy - Swing: Introduction to Swing - Hierarchy of swing components. Containers - Top level containers - JFrame - JWindow - JDialog - JPanel - JButton - JToggleButton - JCheckBox - JRadioButton - JLabel, JPasswordField - JTextArea - JList - JComboBox – JScrollPane - Event Handling: Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events.

UNIT V

12 Hours

Adapter classes - Inner classes -Java Util Package / Collections Framework: Collection & Iterator Interface- Enumeration- List and Array List- Vector- Comparator.

PRESCRIBED BOOKS:

1. Java: The Complete Reference, Herbert Schildt, 13th Edition, McGraw Hill Education, 2023.

REFERENCE BOOKS:

1. Core Java Volume I – Fundamentals, Cay S. Horstmann, 12th Edition, Pearson Education, 2021.
2. Head First Java, Kathy Sierra and Bert Bates, 3rd Edition, O'Reilly Publications, 2022.
3. Effective Java, Joshua Bloch, 3rd Edition, Addison-Wesley Professional, 2018.
4. Swing: A Beginner's Guide, Herbert Schildt, McGraw Hill Education, 2017.
5. Java Concurrency in Practice, Brian Goetz, Addison-Wesley Professional, 2006.

E-LEARNING RESOURCES:

1. Programming in Java, Debasis Samanta, NPTEL, IIT Kharagpur, 12 Weeks Course. https://onlinecourses.nptel.ac.in/noc25_cs05/preview
2. Fundamentals of Object-Oriented Programming, Balasubramanian Raman, NPTEL, IIT Roorkee, 8 Weeks Course. https://onlinecourses.nptel.ac.in/noc25_cs34/preview
3. <https://www.javatpoint.com/java-tutorial>
4. <https://www.coursera.org/specializations/java-programming>
5. <https://leetcode.com/problemset/>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer any 10 out of 12 questions (each in 50 words)	1-12	3	30
B	Answer any 5 out of 7 questions (each in 300 words)	13-19	6	30
C	Answer any 4 out of 6 questions (each in 1200 words)	20-25	10	40
TOTAL MARKS				100

BREAK UP OF QUESTIONS FOR THEORY AND PROBLEM

UNITS	SECTION A	SECTION B	SECTION C
I	3	2	1
II	3	1	1
III	2	2	1
IV	2	1	2
V	2	1	1
SECTION A - 12		SECTION B - 7	SECTION C - 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	2	2	1	1
CO 2	3	3	2	2	1
CO 3	3	3	3	2	2
CO 4	3	3	2	2	2
CO 5	3	3	3	2	2
Ave.	3.0	2.8	2.4	1.8	1.6

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	2	1	2	1
CO 2	3	3	2	2	1
CO 3	3	3	3	2	2
CO 4	3	3	2	2	2
CO 5	3	3	3	2	2
Ave.	2.8	2.8	2.2	2.0	1.6

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOMES	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Implement object-oriented concepts and core Java constructs including data types, control structures, strings, and I/O operations	PO1, PO2, PO3	PSO1, PSO2, PSO4	K1, K2, K3
CO2	Develop object-oriented applications using classes, objects, inheritance, polymorphism, packages, and interfaces	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3, PSO4	K2, K3, K4
CO3	Apply exception handling mechanisms and multithreading concepts including synchronization and inter-thread communication	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO3, PSO5	K3, K4, K5
CO4	Create GUI applications using AWT components and coordinate events	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4, PSO5	K3, K4, K5
CO5	Design interactive GUI applications using Swing components and utilize Java Collections for data management	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO3, PSO5	K4, K5, K6

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

JAVA PROGRAMMING (Theory)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Written assignment from the syllabus	10	5
Workbook / Record book / Notebook	Notebook	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Group Discussion	10	5
Class activity 3	Surprise Class Tests	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARITIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: CORE – IV
COURSE NAME: PRACTICAL – II: JAVA PROGRAMMING FOR APPLICATIONS	COURSE CODE: 26UCAI304P
SEMESTER: II	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
PRACTICAL	

COURSE OBJECTIVE:

To provide fundamental knowledge of object-oriented programming, programming knowledge in Core Java from the basics up with the usage of AWT controls, Event Handling and Swing for GUI.

COURSE OUTCOMES:

1. Develop Java programs using control structures, arrays, and methods to solve computational problems such as matrix operations, and text processing
2. Manipulate strings using character arrays, String, and String Buffer classes to perform search, concatenation, and modification operations
3. Apply multithreading concepts to execute concurrent tasks, including synchronization and independent thread operations
4. Handle runtime exceptions and perform file operations to validate input, manage errors, and process file attributes
5. Design GUI-based applications using AWT/Swing components, layouts, and event handling for interactive applications

LAB EXERCISES:

1. Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer?
2. Write a Java program to multiply two given matrices.
3. Write a Java program that displays the number of characters, lines and words in a text?
4. Generate random numbers between two given limits using Random class and print messages according to the range of the value generated.
5. Write a program to do String Manipulation using Character Array and perform the following string operations: a) String length b) Finding a character at a particular position c) Concatenating two strings
6. Write a program to perform the following string operations using String class: a) String Concatenation b) Search a substring c) To extract substring from given string
7. Write a program to perform string operations using String Buffer class: a) Length of a string b) Reverse a string c) Delete a substring from the given string

8. Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
9. Write a threading program which uses the same method asynchronously to print the numbers 1 to 10 using Thread1 and to print 90 to 100 using Thread2.
10. Write a program to demonstrate the use of following exceptions. a) Arithmetic Exception b) Number Format Exception c) Array Index Out of Bound Exception d) Negative Array Size Exception
11. Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes?
12. Write a program to accept a text and change its size and font. Include bold italic options. Use frames and controls.
13. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).
14. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.
15. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “stop” or “ready” or “go” should appear above the buttons in a selected color. Initially there is no message shown.

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	3	2	2	1
CO 2	3	2	2	1	1
CO 3	3	3	3	2	2
CO 4	3	3	2	2	2
CO 5	3	3	3	2	2
Ave.	3.0	2.8	2.4	1.6	1.6

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	2	2	2	1
CO 2	2	2	1	2	1
CO 3	3	3	2	2	2
CO 4	3	3	2	2	2
CO 5	3	3	3	2	2
Ave.	2.8	2.6	2.2	2.0	1.6

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOMES	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Develop Java programs using control structures, arrays, and methods to solve computational problems such as matrix operations, and text processing	PO1, PO2, PO3	PSO1, PSO2, PSO4	K2, K3, K4
CO2	Manipulate strings using character arrays, String, and String Buffer classes to perform search, concatenation, and modification operations	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4	K2, K3, K4
CO3	Apply multithreading concepts to execute concurrent tasks, including synchronization and independent thread operations	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO3, PSO5	K3, K4, K5
CO4	Handle runtime exceptions and perform file operations to validate input, manage errors, and process file attributes	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO3, PSO4	K3, K4, K5
CO5	Design GUI-based applications using AWT/Swing components, layouts, and event handling for interactive applications	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4, PSO5	K4, K5, K6

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PRACTICAL – II: JAVA PROGRAMMING FOR APPLICATIONS

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Practical examination with programming/problem-solving tasks for 90 minutes	50	10
Model Examination	Practical examination with programming/problem-solving tasks for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook / Record book / Notebook	Handwritten record of experiments, observations, results and conclusions	10	5
Class activity 1	Debugging Test	10	5
Class activity 2	Problem-Solving Exercise	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: ALLIED – II
COURSE NAME: MATHEMATICS - II	COURSE CODE: 26UCAI3A2
SEMESTER: II	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY AND PROBLEMS	

COURSE OBJECTIVE:

To improve basics in mathematical and analytical skills.

COURSE OUTCOMES:

1. Apply finite difference operators and interpolation techniques, including Newton's forward, backward, and Lagrange interpolation formulae, to estimate unknown values from given data.
2. Evaluate integrals using Bernoulli's formula and reduction formulae involving trigonometric functions such as powers of sine and cosine.
3. Formulate and solve partial differential equations, including Lagrange's linear equations and standard first-order partial differential equations.
4. Compute Laplace transforms and inverse Laplace transforms of standard functions and apply their properties in solving mathematical problems.
5. Analyze scalar and vector point functions and apply vector differentiation concepts such as gradient, divergence, curl, solenoidal, and irrotational fields in problem solving.

UNIT I

12 Hours

Finite Differences: Interpolation: Operators Δ , ∇ , E , E^{-1} -difference tables. Interpolation formulae: Newton's forward and backward interpolation formulae for equal intervals, Lagrange's interpolation formula.

Chapter 5: Sections: 5.1 and 5.2.

UNIT II

12 Hours

Integral calculus: Bernoulli's Formula, Reduction Formula $\sin^n \theta$, $\cos^n \theta$, $\sin^m \theta \cos^n \theta$ – Simple problems.

Chapter 2: Section: 2.7, 2.9 (Derivation of formula 1-3).

UNIT III

12 Hours

Partial Differential Equations: Formation, complete integrals and general integrals, four standard types and solving Lagrange's linear equation $Pp + Qq = R$.
Chapter 6: Section 6.1 to 6.4.

UNIT IV

12 Hours

Laplace Transforms: Laplace transformations of standard functions and simple properties, inverse Laplace transforms.
Chapter 7: Section 7.1.1 to 7.1.4 & 7.2 to 7.2.3.

UNIT V

12 Hours

Vector Differentiation: Introduction, scalar point functions, vector point functions, vector differential operator Gradient, Divergence, Curl, Solenoidal, irrotational. (Problems only)
Chapter 8: Section 8.1 to 8.4.4.

PRESCRIBED BOOK:

1. Treatment and content as in "Allied mathematics" – P. Durai Pandian, Dr. S. Udayabaskaran, Volume I & II, S. Chand and company limited, Reprint 2018.

REFERENCEBOOKS:

1. Allied Mathematics, S.G.Venkatachalapathy.
2. P. Kandasamy and K. Thilagavathi, Allied Mathematics Volume I and Volume II -- 2004, S.Chand and Co, New Delhi.
3. Ancillary Mathematics Volume 1 and 2 by Balasubramanian & K.G.Subramanian.
4. Mathematical Methods – S. Narayanan and T.K. Manickavachagam Pillai.
5. Advanced Engineering Mathematics – Erwin Kreyszig, Wiley Publication

E-LEARNINGRESOURCES:

1. https://ia801306.us.archive.org/5/items/MIT18.01JF07/ocw-18.01-f07-lec11_300k.mp4
2. <https://nptel.ac.in/courses/111107107>
3. <https://nptel.ac.in/courses/111106146>
4. <https://www.khanacademy.org/math>
5. <https://www.edx.org/learn/mathematics>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer any 10 out of 12 questions	1 – 12	3	30
B	Answer any 5 out of 7 questions	13 – 19	6	30
C	Answer any 4 out of 6 questions	20 – 25	10	40
TOTAL MARKS				100

BREAKUP OF QUESTIONS FOR THEORY AND PROBLEM

UNITS	THEORY	PROBLEM	THEORY	PROBLEM	THEORY	PROBLEM
I	1	1	-	1	-	2
II	-	2	-	1	-	1
III	-	2	-	2	-	1
IV	1	2	-	1	-	1
V	2	1	-	2	-	1
TOTAL	12		7		6	
	SECTION A – 12		SECTION B - 7		SECTION C – 6	

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	2	3	2	2	3
CO 2	3	2	2	3	2
CO 3	3	2	3	3	2
CO 4	2	3	2	2	3
CO 5	2	3	3	3	2
Ave.	2.4	2.6	2.4	2.6	2.4

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	3	2	2	3
CO 2	3	2	2	3	2
CO 3	3	2	3	3	2
CO 4	2	3	2	2	3
CO 5	2	3	3	3	2
Ave.	2.4	2.6	2.4	2.6	2.4

PO – PSO – CO - QUESTION PAPER MAPPING

CO No:	COURSE OUTCOMES	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Apply finite difference operators and interpolation techniques, including Newton's forward, backward, and Lagrange interpolation formulae, to estimate unknown values from given data.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO4	K1
CO2	Evaluate integrals using Bernoulli's formula and reduction formulae involving trigonometric functions such as powers of sine and cosine.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO4	K1, K2
CO3	Formulate and solve partial differential equations, including Lagrange's linear equations and standard first-order partial differential equations.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO3, PSO5	K3
CO4	Compute Laplace transforms and inverse Laplace transforms of standard functions and apply their properties in solving mathematical problems.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO3, PSO4	K3, K4
CO5	Analyze scalar and vector point functions and apply vector differentiation concepts such as gradient, divergence, curl, solenoidal, and irrotational fields in problem solving.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO4, PSO5	K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate

Continuous Internal Assessment – Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Written examination for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Content -3, Presentation – 2	5	5
Workbook/recordbook/ notebook	Completeness - 3, Accuracy – 2	5	5
Classactivity 1	Quiz with MCQ (Correct Answers - 3, Speed - 2) / Rapid Fire (Quick Response - 3, Accuracy - 2) / Formula Drill Game (Correct Formula Recall - 3, Application - 2) / Others	5	5
Classactivity 2	Problem Solving (Correct Answer - 3, Proper Steps - 2) / Error Detection Activity (Identification of Errors - 3, Reasoning - 2) / Scrap Book (Relevance of Content - 3, Creativity and Presentation - 2) / Others	5	5
Classactivity 3	Real-Life Application Task (Understanding of Concept - 3, Application of Real Situation - 2) / Seminar (Preparation - 3, Presentation -2) / Peer Quiz Creation (Quality of Questions - 3, Relevance to Topic - 2) / Others	5	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: OPEN TO ALL PROGRAMMES EXCEPT B.Sc. COMPUTER SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: IV	COURSE COMPONENT: NON-MAJOR ELECTIVE - II
COURSE NAME: PRACTICAL - DESIGN USING GENERATIVE AI AND OPEN-SOURCE TOOLS	COURSE CODE: 26UNME4B108
SEMESTER: II	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
PRACTICAL	

COURSE OBJECTIVE:

Generative AI tools help in creating new content or data, such as images, videos, music and text without human intervention. This course helps to maximize the productivity and boost creativity effortlessly with free and open AI generative tools.

COURSE OUTCOMES:

1. Produce AI-generated images using prompts
2. Design posters and create social media posts using digital tools
3. Create and edit videos using online tools.
4. Formulate and customize logo designs using AI tools.
5. Develop effective slide shows using Gen AI tools

LAB EXERCISES:

1. IMG2GO

- Art Generator: prompting – transform text to AI gen images
- Work with photo editor: crop and resize images
- Watermark images, convert image to documents, Convert videos to animated gif

2. DESIGNAI

- Create posters, Resize, Design cards, face book posts and Instagram posts, download and share designs

3. KAPWING AND AI STUDIOS

- Create videos from text – images, URLs
- Edit Videos Online.
- Text to Speech features – Choose languages.

4. LOGOMAKER

- Make a Logo – Add Slogans – Customize Designing – download zip files of various logo designs.

5. FREEPIK AND SLIDESGPT

- AI generated Images, Vectors, Icons, Editing and downloading Images
- Slides GPT: create decks, convert text requests into finished slideshows, download presentations.

E-RESOURCES

Web links

1. <https://www.img2go.com/ai-creator-studio>
2. <https://www.img2go.com/convert-video-to-gif>
3. <https://designs.ai/designmaker/start/search?Category=5d503d6cf8ead94a97909b23&query=Poster>
4. <https://www.kapwing.com/>
5. <https://v3.aistudios.com/dashboard>
6. <https://logo.com/>
7. <https://www.freepik.com/ai/images>
8. <https://www.freepik.com/photo-editor/new-artboard>
9. <https://slidesgpt.com/>

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	2	3	2	1	2
CO 2	2	3	3	2	3
CO 3	2	3	2	2	3
CO 4	2	3	3	2	2
CO 5	2	3	2	2	3
Ave.	2.0	3.0	2.4	1.8	2.6

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	3	1	2	2
CO 2	2	3	2	3	3
CO 3	2	3	2	3	2
CO 4	2	3	2	2	3
CO 5	2	3	2	3	3
Ave.	2.0	3.0	1.8	2.6	2.6

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOMES	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Produce AI-generated images using prompts	PO2, PO3, PO4	PSO2, PSO4, PSO5	K2, K3
CO2	Design posters and create social media posts using digital tools	PO2, PO3, PO4, PO5	PSO2, PSO4, PSO5	K3, K4
CO3	Create and edit videos using online tools.	PO2, PO3, PO4, PO5	PSO2, PSO4, PSO5	K3, K4, K5
CO4	Formulate and customize logo designs using AI tools.	PO2, PO3, PO5	PSO2, PSO4, PSO5	K3, K4
CO5	Develop effective slide shows using Gen AI tools	PO2, PO3, PO4, PO5	PSO2, PSO4, PSO5	K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

DESIGN USING GENERATIVE AI AND OPEN-SOURCE TOOLS (PRACTICAL)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Assignment	Written topic related to the course	25	25
Workbook / Record book / Notebook	Observation Notebook	10	5
Class activity 1	Debugging Test	10	5
Class activity 2	Problem Solving Exercise	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

UG - ABILITY ENHANCEMENT SKILLS /LIFE SKILLS

PROGRAMME: ALL UG	BATCH: 2026 - 29
PART: IV	COURSE COMPONENT: ABILITY ENHANCEMENT SKILLS - II
COURSE NAME: FOUNDATIONS OF QUANTITATIVE APTITUDE	COURSE CODE: 26USKL402
SEMESTER: II	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY AND PROBLEMS	

COURSE OBJECTIVES:

Develop learners' problem-solving skills and critical thinking abilities in the context of recruitment aptitude tests.

COURSE OUTCOME:

1. Apply the concepts of number systems, divisibility rules, and number series to solve numerical problems.
2. Compute HCF and LCM of numbers using prime factorization method.
3. Apply percentage concepts to solve problems involving profit, loss, cost price, and selling price.
4. Compare simple interest and compound interest to solve financial problems.
5. Interpret data from tables and graphs to draw meaningful conclusions.

UNIT I: Number system and Number series

6 Hours

Numbers: Numbers and their classification, test for divisibility of numbers, General properties of divisibility, division and remainder, remainder rules.

Number Series: Number series, three steps to solve a problem on series, two-line number series, sum rules on natural numbers.

UNIT II: HCF and LCM of Numbers

6 Hours

Factors, Multiples, Principal of Prime factorization, Highest Common Factor (HCF) and Least Common Multiple (LCM), Product of two numbers, Difference between HCF and LCM.

UNIT III: Percentage, Profit and Loss

6 Hours

Percentage: Introduction, fraction to rate percent, rate percent to fraction, rate percent of a number, express a given quantity as a percentage of another given quantity, convert a percentage into decimals and convert a decimal into percentage.

Profit and Loss: Gain/Loss and % gain and % loss, relation among Cost price, Sale price, Gain/Loss and % gain and % loss.

UNIT IV: Simple Interest and Compound Interest**6 Hours****Simple Interest:** Definition, effect of change of P , R and T on Simple Interest, amount.**Compound Interest:** Introduction, conversion period, basic formula, to find the Principal/Rate/Time, Difference between Simple Interest and Compound Interest.**UNIT V: Data interpretation****6 Hours**

Tabulation, Bar Graphs, Pie Charts, Line Graphs, average.

PRESCRIBED BOOK:

1. Quantitative Aptitude by R.S. Agarwal

REFERENCE BOOKS:

1. Quantitative Aptitude by Abhijit Guha, Fourth Edition.
2. Quantitative Aptitude by Ramandeep Singh.

E - LEARNING RESOURCES:

1. <https://byjus.com/maths/numeralsystem/#:~:text=crore%20is%207.International%20Numeral%20System,8%20%E2%80%93%20Ones>
2. <https://byjus.com/maths/hcf-and-lcm/>
3. <https://byjus.com/maths/profit-loss-percentage/>
4. <https://www.vedantu.com/jee-main/maths-difference-between-simple-interest-and-compound-interest>
5. <https://sites.utexas.edu/sos/guided/descriptive/descriptivec/frequency/>

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Multiple Choice Questions: Answer 20 out of 20 questions (each question carries one mark)	1 – 20	20	20
B	Answer any 5 out of 7 questions (each question carries 6 marks)	21 – 27	6	30
TOTAL MARKS				50

BREAK UP OF QUESTIONS FOR PROBLEMS

UNITS	SECTION A	SECTION B
I	4	1
II	4	1
III	4	1
IV	4	1
V	4	1
Any Unit	-	2
TOTAL	20	7

SEMESTER III

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 – 29
PART: III	COURSE COMPONENT: CORE – V
COURSE NAME: RELATIONAL DATABASE SYSTEMS WITH PL/SQL	COURSE CODE: 26UCAI305
SEMESTER: III	MARKS: 100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

To gain an understanding of the architecture, functioning of Database Management Systems, Apply Normalization techniques to normalize a database, understand the need of transaction processing, learn techniques for controlling the consequences of concurrent data access and understand the use of Structured Query Language (SQL) and its syntax.

COURSE OUTCOMES:

1. Describe basic concepts of database system
2. Design a Data model and Schemas in RDBMS
3. Analyze functional dependencies for designing robust Database
4. Apply SQL for data definition, manipulation, and querying
5. Develop PL/SQL programs using its structure and core elements

UNIT I

12 Hours

Introduction to DBMS - Data and Information - Database - Database Management System - Objectives - Advantages – Components - Architecture. ER Model: Building blocks of ER Diagram - Relationship Degree - Classification - ER diagram to Tables - ISA relationship – Constraints - Aggregation and Composition - Advantages

UNIT II

12 Hours

Relational Model: CODD's Rule- Relational Data Model - Key - Integrity - Relational Algebra Operations – Advantages and limitations – Relational Calculus – Domain Relational Calculus - QBE.

UNIT III

12 Hours

Structure of Relational Database. Introduction to Relational Database Design - Objectives – Tools – Redundancy and Data Anomaly – Functional Dependency - Normalization – 1NF – 2NF – 3NF – BCNF. Transaction Processing – Database Security.

UNIT IV

12 Hours

SQL: Commands – Data types – DDL - Selection, Projection, Join and Set Operations – Aggregate Functions – DML – Modification - Truncation - Constraints – Subquery.

UNIT V

12 Hours

PL/SQL: Structure - Elements – Operators Precedence – Control Structure – Iterative Control - Cursors - Procedure - Function - Packages – Exceptional Handling - Triggers.

RECOMMENDED TEXTBOOKS:

1. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Pearson, 7th Edition, 2016.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, McGraw-Hill, 7th Edition, 2019.
3. Ivan Bayross, “*SQL, PL/SQL: The Programming Language of Oracle*”, BPB Publications, 4th Revised Edition, 2023.
4. P. S. Deshpande, “*SQL/PLSQL for Oracle Developers (Black Book)*”, Dreamtech Press, 2011 (Revised Edition).
5. S. Sumathi, S. Esakkirajan, “Fundamentals of Relational Database Management System”, Springer International Edition 2007.

REFERENCE BOOKS:

1. Alexis Leon & Mathews Leon, “Fundamentals of DBMS”, Vijay Nicole Publications 2014, 2nd Edition
2. Carlos Coronel, Steven Morris, “Database Systems: Design, Implementation, and Management”, Cengage Learning, 14th Edition, 2023.

E-LEARNING RESOURCES:

1. <https://logicinaction.org/docs/ch2.pdf>
2. <https://nptel.ac.in/courses/106106093/>
3. <https://cloud.google.com/learn/what-is-a-relational-database>
4. <https://www.oracle.com/in/database/what-is-a-relational-database/>
5. <https://celerddata.com/glossary/relational-database-management-system>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer any 10 out of 12 questions (each in 50 words)</i>	<i>1-12</i>	<i>3</i>	<i>30</i>
B	<i>Answer any 5 out of 7 questions (each in 300 words)</i>	<i>13-19</i>	<i>6</i>	<i>30</i>
C	<i>Answer any 4 out of 6 questions (each in 1200 words)</i>	<i>20-25</i>	<i>10</i>	<i>40</i>
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	3	1	1
II	2	1	1
III	3	2	1
IV	2	1	2
V	2	2	1
TOTAL	12	7	6
SECTION A – 12		SECTION B – 7	SECTION C – 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	2	1	2	2
CO 2	3	3	2	2	2
CO 3	3	3	3	2	2
CO 4	3	3	2	2	2
CO 5	3	3	2	2	2
Ave.	3.0	2.8	2.0	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	1	1	1	2
CO 2	3	2	2	2	2
CO 3	3	2	3	2	2
CO 4	3	3	2	2	2
CO 5	3	3	2	3	2
Ave.	3.0	2.2	2.0	2.0	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Describe basic concepts of database system	PO1, PO2	PSO1	K1, K2
CO2	Design a Data model and Schemas in RDBMS	PO1, PO2, PO3	PSO1, PSO2, PSO3	K3, K4
CO3	Analyze functional dependencies for designing robust Database	PO1, PO2, PO3	PSO1, PSO3	K4
CO4	Apply SQL for data definition, manipulation, and querying	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4	K3
CO5	Develop PL/SQL programs using its structure and core elements	PO1, PO2, PO3, PO4, PO5	PSO1, PSO2, PSO4	K3, K6

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

RELATIONAL DATABASE SYSTEMS WITH PL/SQL (Theory)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Programs related to the course	10	5
Workbook/Record book/Notebook	Observation / Record book - 5, Viva - 5	10	5
Class activity 1	Debugging Test	10	5
Class activity 2	Problem Solving Exercise	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: CORE – VI
COURSE NAME: PRACTICAL - III: RDBMS with PL/SQL	COURSE CODE: 26UCAI306P
SEMESTER: IV	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
PRACTICAL	

COURSE OBJECTIVE:

To understand the SQL essentials: DDL, DML, queries, PL/SQL, and database app development.

COURSE OUTCOMES:

1. Execute various DDL commands
2. Apply various DML commands
3. Formulate SQL queries to retrieve information from databases
4. Leverage PL/SQL features like exception handling, cursors, and triggers
5. Develop database applications using front-end and back-end tools

LAB EXERCISES:

1. DDL commands with constraints.
2. DML Commands with constraints.
3. SQL Queries: Queries, sub queries, Aggregate function
4. PL/SQL: Exceptional Handling
5. PL/SQL: Cursor
6. PL/SQL: Trigger
7. PL/SQL: Packages
8. Design and Develop Application for Library Management
9. Design and Develop Application for Student Mark Sheet Processing
10. Design and Develop Application for Pay Roll Processing

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	3	1	2	2
CO 2	3	3	2	2	1
CO 3	3	3	3	2	2
CO 4	3	3	2	2	2
CO 5	3	3	3	2	3
Ave.	3.0	3.0	2.2	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	3	1	2	2
CO 2	2	3	2	2	2
CO 3	3	3	3	2	2
CO 4	3	3	2	3	2
CO 5	3	3	3	3	2
Ave.	2.6	3.0	2.2	2.4	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Execute various DDL commands	PO1, PO2	PSO2, PSO4	K3
CO2	Apply various DML commands	PO1, PO2, PO3	PSO2, PSO4	K3
CO3	Formulate SQL queries to retrieve information from databases	PO1, PO2, PO3	PSO1, PSO2, PSO3	K3, K4
CO4	Leverage PL/SQL features like exception handling, cursors, and triggers	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4	K3, K4
CO5	Develop database applications using front-end and back-end tools	PO1, PO2, PO3, PO4, PO5	PSO1, PSO2, PSO3, PSO4, PSO5	K3, K6

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PRACTICAL III: RDBMS PL/SQL

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Practical examination with programming/problem-solving tasks for 90 minutes	50	10
Model Examination	Practical examination with programming/problem-solving tasks for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/Record book/Notebook	Handwritten record of experiments, observations, results and conclusions	10	5
Class activity 1	Debugging Test	10	5
Class activity 2	Problem-Solving Exercise	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: ALLIED – III
COURSE NAME: STATISTICS – I	COURSE CODE: 26UCAI3A3
SEMESTER: III	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

Understand about data and use various statistical techniques to measure and compare the relation between data points.

COURSE OUTCOMES:

1. Explain the basic concepts of statistics and represent data graphically using bar charts, pie diagrams, histograms, frequency polygons, and ogives.
2. Calculate and interpret measures of central tendency such as mean, median, mode, quartiles, geometric mean, and harmonic mean.
3. Analyze the dispersion of data using statistical measures including range, mean deviation, quartile deviation, standard deviation, coefficient of variation, interquartile deviation, and mean absolute deviation.
4. Apply correlation and regression techniques, including Karl Pearson's coefficient, Spearman's rank correlation, and linear regression equations, to study relationships between variables.
5. Understand the fundamental concepts of probability and apply axioms, addition and multiplication theorems, independent events, and Bayes' Theorem in solving probability problems.

UNIT I

12 Hours

Introduction to statistics: Definition, limitations, Graphical Representation of data: Bar charts, Pie Diagrams, Histograms, Frequency polygon.
Chapter 1 and 4 (Part II)

UNIT II

12 Hours

Measures of Central Tendency: Mean, Median, Mode, quartiles, geometric mean and harmonic mean.
Chapter 5 (Part II)

UNIT III

12 Hours

Measures of Dispersion: Range, Mean deviation, Quartile deviation, Standard deviation, Coefficient of variation, Inter quartile deviation, Mean Absolute deviation.

Chapter 6 (Part II)

UNIT IV

12 Hours

Correlation and Regression: Correlation: Meaning, Applications, Scatter diagram, Karl Pearson's Coefficient of Correlation, Spearman's Rank Correlation. Regression: Meaning, uses, Difference between correlation and regression, linear regression equations.

Chapter 8 and 9 (Part I)

UNIT V

12 Hours

Probability: Basic probability, axioms of probability, independent events, Addition and Multiplication theorem (Statement only), Baye's theorem (Statement only).

Chapter 1 (Part I)

RECOMMENDED TEXTBOOKS:

1. Mathematical Statistics - by P. R. Vittal, Margham Publications, 1st edition 2002.

REFERENCE BOOKS:

1. Statistical Methods – S.P. Gupta, Sultan Chand & Sons 45th Edition(2017).
2. New Mathematical statistics - Sanjay Arora & Bansilal (2002), Meerat Publications, New Delhi.
3. Fundamentals of Mathematical Statistics - Gupta,S.C. and Kapoor, V.K. (2000): 10/e, Sultan Chand & Sons.
4. Basic Statistics - 3/Agarwal .B.L (1996),New Age International(P) Ltd.
5. Statistics for Business and Economics - Hooda.R.P. (2003): MacMillan.

E-LEARNING RESOURCES:

1. <https://www.khanacademy.org/math>
2. <https://www.digimat.in/nptel/courses/video/110107114/L01.html>
3. <https://ocw.mit.edu/courses/14-30-introduction-to-statistical-method-in-economics-spring-2006/>
4. <https://onlinecourses.nptel.ac.in>
5. <https://www.coursera.org/browse/math-and-logic>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer any 10 out of 12 questions	1 – 12	3	30
B	Answer any 5 out of 7 questions	13 – 19	6	30
C	Answer any 4 out of 6 questions	20 – 25	10	40
TOTAL MARKS				100

BREAK UP OF QUESTIONS FOR THEORY AND PROBLEM

UNITS	THEORY	PROBLEM	THEORY	PROBLEM	THEORY	PROBLEM
I	1	1	1	1	-	1
II	1	2	-	1	-	1
III	-	3	-	1	-	1
V	-	2	-	2	-	1
TOTAL	12		7		6	
	SECTION A - 12		SECTION B – 7		SECTION C - 6	

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	2	3	2	2	3
CO 2	3	2	2	3	2
CO 3	3	2	3	3	2
CO 4	2	3	2	2	3
CO 5	2	3	3	3	2
Ave.	2.4	2.6	2.4	2.6	2.4

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	3	2	2	3
CO 2	3	2	2	3	2
CO 3	3	2	3	3	2
CO 4	2	3	2	2	3
CO 5	2	3	3	3	2
Ave.	2.4	2.6	2.4	2.6	2.4

PO – PSO – CO - QUESTION PAPER MAPPING

CO No:	COURSE OUTCOMES	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Explain the basic concepts of statistics and represent data graphically using bar charts, pie diagrams, histograms, frequency polygons, and ogives.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO3, PSO4, PSO5	K1, K4
CO2	Calculate and interpret measures of central tendency such as mean, median, mode, quartiles, geometric mean, and harmonic mean.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO3, PSO4, PSO5	K1, K2
CO3	Analyze the dispersion of data using statistical measures including range, mean deviation, quartile deviation, standard deviation, coefficient of variation, inter quartile deviation, and mean absolute deviation.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO3, PSO4, PSO5	K3, K5
CO4	Apply correlation and regression techniques, including Karl Pearson's coefficient, Spearman's rank correlation, and linear regression equations, to study relationships between variables.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO3, PSO4, PSO5	K3, K4
CO5	Understand the fundamental concepts of probability and apply axioms, addition and multiplication theorems, independent events, and Bayes' Theorem in solving probability problems.	PSO1, PSO2, PSO3, PSO4, PSO5	PSO1, PSO2, PSO3, PSO4, PSO5	K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate

STATISTICS – I (Theory)

Continuous Internal Assessment – Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Written examination for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Content -3, Presentation – 2	10	5
Workbook/Record book/Notebook	Completeness - 3, Accuracy – 2	10	5
Class activity 1	Quiz with MCQ (Correct Answers - 3, Speed - 2) / Rapid Fire (Quick Response - 3, Accuracy - 2) / Formula Drill Game (Correct Formula Recall - 3, Application - 2) / Others	10	5
Class activity 2	Problem Solving (Correct Answer - 3, Proper Steps - 2) / Error Detection Activity (Identification of Errors - 3, Reasoning - 2) / Scrap Book (Relevance of Content - 3, Creativity and Presentation - 2) / Others	10	5
Class activity 3	Real-Life Application Task (Understanding of Concept - 3, Application of Real Situation - 2) / Seminar (Preparation - 3, Presentation - 2) / Peer Quiz Creation (Quality of Questions - 3, Relevance to Topic - 2) / Others	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTER SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026-29
PART: IV	COURSE COMPONENT: ABILITY ENHANCEMENT SKILLS - III
COURSE NAME: PRACTICAL - ARTIFICIAL INTELLIGENCE TOOLS AND APPLICATIONS	COURSE CODE: 26USKL409
SEMESTER: III	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
PRACTICAL	

COURSE OBJECTIVE:

To enable students to apply Artificial Intelligence concepts using modern tools and platforms for solving real-world problems with minimal coding.

COURSE OUTCOMES:

1. Use AI tools for real-world data analysis and visualization.
2. Apply pre-trained AI models for NLP and image tasks.
3. Develop AI applications using no-code/low-code platforms.
4. Integrate AI tools into simple workflows.
5. Build and present a mini-AI-based solution.

LAB EXERCISES:

1. AI Tools Setup and Exploration
 - Working with Google Colab
 - Exploring datasets and running sample notebooks
2. Data Visualization using AI Tools
 - Load dataset and generate charts
 - Use built-in visualization features
3. Automated Data Preprocessing
 - Handle missing values
 - Perform basic data cleaning using tools
4. Text Analysis using AI Tools
 - Perform sentiment analysis
 - Keyword extraction using Hugging Face
5. Text Summarization
 - Generate summaries from input text
 - Compare outputs from different tools

6. Image Classification using AI Tools
 - Train a model using Teachable Machine
 - Test with new images
7. Object Detection Basics
 - Detect objects using pre-trained tools
 - Analyze outputs
8. Face Detection Application
 - Perform face detection using AI tools
 - Test with sample images
9. Generative AI – Text Generation
 - Generate content using ChatGPT
 - Prompt engineering basics
10. Generative AI – Image Generation
 - Generate images using DALL·E
 - Experiment with prompts
11. Chatbot Development (Basic)
 - Create a simple chatbot using AI tools
 - Test conversation flow
12. Mini Project – AI Application
 - Build a small application (chatbot / classifier / analyzer)
 - Demonstration and report

E-LEARNING RESOURCES:

1. Google Colab (AI Execution Platform) - <https://colab.research.google.com/>
2. Hugging Face (NLP & Pre-trained Models) - <https://huggingface.co/course>
3. Teachable Machine (Vision Tool – No Code) - <https://teachablemachine.withgoogle.com/>
4. ChatGPT (Generative AI Tool) - <https://chat.openai.com/>

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	3	2	1	2
CO 2	3	3	2	2	1
CO 3	3	3	2	2	2
CO 4	3	3	3	2	2
CO 5	3	3	3	3	3
Ave.	3.0	3.0	2.4	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	3	3	2	2
CO 2	3	3	2	2	2
CO 3	3	3	2	3	2
CO 4	2	3	3	3	2
CO 5	3	3	3	3	3
Ave.	2.6	3.0	2.6	2.6	2.2

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Use AI tools for real-world data analysis and visualization.	PO1, PO2, PO3, PO5	PSO2, PSO3	K3, K4
CO2	Apply pre-trained AI models for NLP and image tasks.	PO1, PO2, PO3	PSO1, PSO2, PSO5	K3
CO3	Develop AI applications using no-code/low-code platforms.	PO1, PO2, PO4	PSO1, PSO2, PSO4	K3, K6
CO4	Integrate AI tools into simple workflows.	PO1, PO2, PO3, PO4	PSO2, PSO3, PSO4	K3, K4
CO5	Build and present a mini-AI-based solution.	PO1, PO2, PO3, PO4, PO5	PSO1, PSO2, PSO3, PSO4, PSO5	K4, K5, K6

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PRACTICAL - ARTIFICIAL INTELLIGENCE TOOLS AND APPLICATIONS

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Assignment	Written topic related to the course	25	25
Workbook / Record book / Notebook	Observation Notebook	10	5
Class activity 1	Debugging Test	10	5
Class activity 2	Problem Solving Exercise	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

UG - ABILITY ENHANCEMENT SKILLS /LIFE SKILLS

PROGRAMME: COMMON TO ALL	BATCH: 2026 - 29
PART: IV	COURSE COMPONENT: SELF STUDY
COURSE NAME: INDIAN HERITAGE AND KNOWLEDGE SYSTEM	COURSE CODE: 26USSP401
SEMESTER: III	MARKS:100
CREDITS: 2	TOTAL HOURS: SELF-STUDY
QUESTION PATTERN: MCQ	
THEORY	

Course Description:

Delving into Indian Heritage, this course focuses on South Indian cultures and ancient knowledge like Yoga, Ayurveda, and Siddha, shaping the Nation's identity.

Course Objectives:

Analyzing Indian heritage's impact on national identity, South India's culture, and holistic traditions like Yoga, Ayurveda, Siddha, Jyotish, and Natya Shastra.

Course Outcomes:

1. Recall the key features of Indian heritage and its role in shaping cultural identity.
2. Identify the artistic, architectural, and literary achievements of South India and other regions.
3. List traditional practices preserved through folklore across India.
4. Recall the principles of ancient Indian sciences related to physical, mental, and spiritual well-being.
5. Describe the connections between spiritual, medicinal, and artistic elements in Indian heritage.

UNIT I: Introduction to Indian Heritage

6 Hours

- **Concept of Heritage:** Definition, the importance of studying heritage, and its diverse forms.
- **Cultural Landscape of India:** Overview of major cultural zones in India, with a focus on South India.

Key Concepts: Cultural heritage, diversity, tangible heritage (e.g., monuments), intangible heritage (e.g., traditions, practices).

UNIT II: Cultural Tapestry of South India

6 Hours

- **Literature:** The classical Tamil literature of Sangam poetry, the epic Kannada works like the "Kuvempu Ramayana," the Telugu compositions of Annamacharya, and the poetic Malayalam works of Kerala's rich literary tradition.
- **Painting:** The intricate gold leaf work of Tanjore painting, the intricate patterns of Mysore painting, hand-painting or block-printing of Kalamkari.
- **Theatre:** The ancient art form of Koothu and the elaborate dance-dramas of Bhagavata Mela in

Tamil Nadu, and the colourful folk theatre of Yakshagana in Karnataka.

- **UNESCO Indian Heritage Sites:** Great Living Chola Temples artistry, Hampi-Virupaksha Temple and the Vijaya Vittala Temple, Mahabalipuram- a treasure trove of Pallava art, Mysore Palace-Indo-Saracenic architecture, Periyar National Park- Western Ghats, Kanchipuram-City of Thousand Temples

UNIT III: Tamil Nadu Folklores

6 Hours

- **Origins and Significance:** Historical background of Tamil Nadu folklore and its cultural significance.
 - **Folk Dances:** Exploration of traditional Tamil folk dances like Karakattam, Kolattam, and Kummi.
 - **Folk Music:** Overview of folk music traditions in Tamil Nadu, including Parai Attam and Villu Paatu.
 - **Rituals and Festivals:** Understanding the role of folklore in Tamil Nadu's rituals and festivals- Pongal and Jallikattu.
- Key Concepts:** Karakattam, Kolattam, Parai Attam, Villu Paatu, Tamil folk tales, cultural rituals.

UNIT IV: Unveiling the Knowledge Systems

6 Hours

- **Cultural Landscape of India:** Overview of major cultural zones in India, with a focus on South India.
 - **Yoga:** Exploring the various aspects of Yoga - its philosophy, Eight Limbs, practices (e.g., Asanas, Pranayama), and benefits for physical and mental well-being.
 - **Ayurveda:** Understanding the core principles of Ayurveda - its focus on holistic health, diagnosis, and treatment methods.
- Key Concepts:** Yoga philosophy, Asanas, Pranayama, Tridosha theory (Ayurveda), Doshas (Vata, Pitta, Kapha), Panchakarma, herbal medicine, Ayurvedic lifestyle.

UNIT V: Siddha Tradition and Other Knowledge Systems

6 Hours

- **Siddha Tradition:** Origins, philosophy, medicinal practices, and spiritual aspects.
 - **Other Important Knowledge Systems:** Jyotish Shastra (Indian astrology), Natya Shastra (Treatise on performing arts).
- Key Concepts:** Siddha literature, alchemy, and spirituality in Siddha tradition. Pancha Boothas (Siddha), herbal remedies, Planetary influences, elements of classical Indian dance and music, and aesthetics in Natya Shastra.

QUESTION PAPER PATTERN: MCQ

PROGRAMME: COMMON TO ALL	BATCH: 2026-2029
PART: IV	COURSE COMPONENT: SELF STUDY
COURSE NAME: CONTEMPORARY WORLD AND SUSTAINABLE DEVELOPMENT	COURSE CODE: 26USSP402
SEMESTER: III	MARKS:100
CREDITS: 2	TOTAL HOURS: SELF-STUDY
QUESTION PATTERN: MCQ	
THEORY	

Course Overview:

Delving into global dynamics, this course highlights Asia and India's pivotal role in achieving global sustainability objectives.

Course Objectives:

Exploring global challenges, Asian politics, conflict resolution, sustainability, and India's SDG efforts, with a focus on Tamil Nadu.

Course Outcomes:

1. Identify the key actors and institutions that shape the contemporary world order.
2. Describe the political, economic, and security challenges in major Asian regions.
3. Recall the causes and human impact of recent wars and conflicts.
4. Describe the principles of sustainable development and their relevance at local, national, and global levels.
5. Identify India's contributions to the SDGs through Tamil Nadu's programs.

UNIT I: Global Governance and Institutions

6 Hours

- **State & Non-State Actors:** Definition, types (nation-states, failed states), functions.
Key Actors: International states, Intergovernmental organizations (IGOs), nongovernmental organizations (NGOs), multinational corporations (MNCs).
- **United Nations (UN):** Structure, key organs (General Assembly, Security Council), functions, WB, & others.
Key Concepts: United Nations General Assembly, United Nations Security Council.
- **Regional Organizations:** European Union (EU), African Union (AU), North Atlantic Treaty Organization (NATO)
Key Concepts: European Union Commission, African Union Commission, North Atlantic Treaty Organization.
- **International Law and Treaties:** Significance, role in addressing global challenges.
Key Concepts: International Court of Justice, International Criminal Court, Geneva Conventions.

UNIT II: Contemporary Asia

6 Hours

Major Geographical Regions

- **Middle East:** Characterized by rich oil reserves, Complex political dynamics, and ongoing conflicts.
Key countries: Iran, Iraq, Israel, Saudi Arabia, Syria, Turkey
 - **Southeast Asia:** Rapid economic growth, Challenges- maritime security and environmental degradation.
Key countries: Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam
 - **Far East:** Major economic powerhouses and Potential flashpoints.
Key countries: China, Japan, North Korea, South Korea
 - **Rise of China:** Political-South China Sea, Territorial disputes and Competition for Resources. Economic- China's Belt and Road Initiative (BRI)
 - **Major Economic Centers:** **Singapore-** Global financial hub, **Hong Kong-** Special Administrative Region of China, **United Arab Emirates (UAE)-** Diversified economy driven by oil and gas, tourism, and trade.
- Regional Organizations:**
- Association of Southeast Asian Nations (ASEAN)
 - South Asian Association for Regional Cooperation (SAARC)
 - Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC)
 - Asia-Pacific Economic Cooperation (APEC)
 - Shanghai Cooperation Organization (SCO)

UNIT III: Recent Wars of the World

6 Hours

- **Syrian Civil War (2011-present):** Bashar al-Assad regime, Syrian opposition groups, ISIS.
Key Concepts: Origins of the conflict, humanitarian crisis, foreign intervention, refugee crisis.
- **Yemeni Civil War (2015-present):** Houthi rebels, Yemeni government, Saudi-led coalition.
Key Concepts: Proxy war dynamics, humanitarian crisis, role of Iran and Saudi Arabia, UN peace efforts.
- **Ukraine Conflict (2014-present):** Ukrainian government, Russian-backed separatists, Russia.
Key Concepts: Annexation of Crimea, Donbas region conflict, Minsk agreements, NATO-Russia tensions.
- **Ethiopia Civil War (2020-present):** Ethiopian government, Tigray People's Liberation Front (TPLF), Eritrean forces.
Key Concepts: Tigray conflict, humanitarian crisis, regional implications, efforts for ceasefire and peace talks.
- **Nagorno-Karabakh War (2020):** Armenia, Azerbaijan, Russia.
Key Concepts: Conflict over Nagorno-Karabakh region, ceasefire agreement, role of Turkey, peace negotiations.
- **Myanmar Civil War (2021-present):** Myanmar military (Tatmadaw), ethnic armed groups, and Civilian resistance.
Key Concepts: Coup aftermath, Rohingya crisis, ethnic conflicts, ASEAN mediation efforts.

UNIT IV: Sustainable Development Goals

6 Hours

- **Definition of Sustainable Development:** Balancing economic, social, and environmental needs.
Key Concepts: United Nations Development Programme (UNDP), World Wildlife Fund (WWF), Sustainable Development Solutions Network (SDSN).
- **UN Sustainable Development Goals (SDGs):** Overview, targets.
Key Concepts: United Nations, national governments, NGOs, private sector.

- **Challenges and Opportunities:** Achieving sustainability, global cooperation.
Key Concepts: United Nations, national governments, civil society organizations, multinational corporations.

UNIT V: India's Role in Achieving Sustainable Development Goals (SDGs) with Tamil Nadu Initiatives

6 Hours

Addressing Basic Needs:

- **Goal 1: No Poverty**
 - National Rural Employment Guarantee Act (NREGA)
 - Kalaigiar Kanchi Thalaiyalar Scheme
 - Ungal Thozhil Udhayanam (UTOY)
- **Goal 2: Zero Hunger**
 - National Food Security Act (NFSA)
 - Nutritious Noon Meal Programme
 - Annadhanam Scheme
 - Amma Unavagam
- **Goal 3: Good Health and Well-being**
 - National Health Mission (NHM)
 - Health Insurance of Tamil Nadu
 - Chief Minister's Comprehensive Health Insurance Scheme
 - Maruthuva Mitri
 - Amma Mini Clinics

Ensuring Essential Services:

- **Goal 4: Quality Education**
 - Sarva Shiksha Abhiyan (SSA)
 - Rashtriya Madhyamik Shiksha Abhiyan (RMSA)
 - Namakkal District Library Scheme
 - Pudhumai Penn Scheme under Higher Education Assurance Scheme (HEAS)
 - Free Coaching for Competitive Exams
- **Goal 6: Clean Water and Sanitation**
 - Swachh Bharat Mission (Clean India Mission)
 - National Rural Drinking Water Programme (NRDWP)
 - Jal Jeevan Mission Tamil Nadu
 - Namakku Naatheey Scheme
 - Kudimaramathu Scheme
- **Goal 7: Affordable and Clean Energy**
 - National Solar Mission
 - Tamil Nadu Solar Energy Policy
 - Green House Scheme

Building Sustainable Communities:

- **Goal 11: Sustainable Cities and Communities**
 - Smart Cities Mission
 - Atal Mission for Rejuvenation and Urban Transformation (AMRUT)
 - Adi Dravidar Housing Scheme
- **Goal 13: Climate Action**
 - National Action Plan on Climate Change (NAPCC)
 - International Solar Alliance
 - Tamil Nadu Wind Energy Policy 2019
- **Goal 17: Partnerships for the Goals**
 - Development Assistance Programmes (DAPs)
 - International Development Cooperation (IDC)

QUESTION PAPER PATTERN: MCQ

SEMESTER IV

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARITIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: CORE – VII
COURSE NAME: FOUNDATIONS OF ARTIFICIAL INTELLIGENCE	COURSE CODE: 26UCAI307
SEMESTER: IV	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

This course introduces foundations of AI and its foundations, basic principles of AI toward problem solving, inference, perception, Knowledge representation, and learning

COURSE OUTCOMES:

1. Examine the evolution, foundations, and societal impact of Artificial Intelligence, including agents and knowledge-based systems
2. Apply propositional logic to represent problems and evaluate logical expressions using truth tables, normal forms, and inference patterns
3. Formulate and solve problems using First-Order Logic through quantifiers, unification, resolution, and chaining techniques.
4. Develop logic-based programs using Prolog by applying syntax, rules, unification, and goal satisfaction
5. Discuss the scope, limitations, and societal implications of Artificial Intelligence.

UNIT I

12 Hours

Introduction, growth and Applications of AI

What Is Artificial Intelligence? Brain Science and Problem Solving, The Turing Test and Chatterbots-The History of AI: The First Beginnings, Logic Solves (Almost) All Problems, The New Connectionism, Reasoning Under Uncertainty, distributed; Autonomous and Learning Agents, AI Grows Up-The AI Revolution: AI and Society, Does AI Destroy Jobs? - Agents Knowledge - Based Systems

UNIT II

12 Hours

Propositional logic: Reasoning in Daily Life-Inference Patterns, Validity, and Invalidity-Classification, Consequence, and Update-The Language of Propositional Logic: From natural language to logical notation, Inclusive and exclusive disjunction, implications, Double implications, Ambiguity - Semantic Situations, Truth Tables, Binary Arithmetic, Tautology, Contradiction, conjunctive normal form, equivalence of propositions

UNIT III**12 Hours**

First-Order Predicate Logic Inference rules: Modus Ponens, Modus Tollens, Hypothetical Syllogism, Disjunctive Syllogism, Addition, Simplification, Resolution - Quantifiers in First-order logic - Properties of Quantifiers-Free and Bound Variables-Inference in First-Order Logic: FOL inference rules for quantifier: Universal Generalization, Universal Instantiation, Existential Instantiation, Existential introduction - Unification: Conditions for Unification, Unification Algorithm- Resolution: Steps for Resolution - Forward Chaining and backward chaining

UNIT IV**12 Hours**

Prolog: Why prolog for AI- Rules- Syntax- Constants- variables- characters - operators- Equality & unification -Arithmetic's - Satisfying goals

UNIT V**12 Hours**

Data structures in Prolog: Trees- lists- Recursive search- Mapping- Recursive Comparison-Joining Structures - Accumulators (VS)Difference structures - Backtrack: Multiple solutions-The 'Cut': Uses of Cut- problems with Cut

RECOMMENDED TEXTBOOKS:

1. Introduction to Artificial Intelligence, Wolfgang Erte, Springer, Cham
2. Programming in Prolog, W.F. Clocksin, C.S. Mellish. - 5th edition Springer

REFERENCE BOOKS:

1. Artificial Intelligence for Dummies, John Paul Mueller, Luca Massaron: Dummies
2. Artificial Intelligence: A Modern Approach. Stuart Russell, Peter Norvig; Prentice Hall
3. PROLOG: Programming for Artificial Intelligence, BRATKO, Pearson
4. Prolog by Example: by Helder Coelho, Jose C. Cotta, Springer
5. Artificial Intelligence for Humans, Volume 1: Fundamental Algorithms, Jeff Heaton,

E-LEARNING RESOURCES:

1. <https://logicinaction.org/docs/ch2.pdf>
2. <https://www.computer.org/resources/ai-resources>
3. <https://or.niscpr.res.in/index.php/ALIS/article/view/9071>
4. <https://jpl-nasa.libguides.com/subject-guides/artificial-intelligence-ai/ebooks>
5. <https://soas.libguides.com/c.php?g=704522&p=5135027>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer any 10 out of 12 questions (each in 50 words)</i>	<i>1-12</i>	<i>3</i>	<i>30</i>
B	<i>Answer any 5 out of 7 questions (each in 300 words)</i>	<i>13-19</i>	<i>6</i>	<i>30</i>
C	<i>Answer any 4 out of 6 questions (each in 1200 words)</i>	<i>20-25</i>	<i>10</i>	<i>40</i>
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	3	1	1
II	2	1	1
III	3	2	1
IV	2	1	2
V	2	2	1
TOTAL	12	7	6
SECTION A - 12		SECTION B – 7	SECTION C – 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	2	2	2	2
CO 2	3	3	2	2	2
CO 3	3	3	3	2	2
CO 4	3	3	2	2	2
CO 5	2	2	3	2	2
Ave.	2.8	2.6	2.4	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	1	2	1	2
CO 2	3	2	3	2	1
CO 3	3	2	3	2	2
CO 4	3	3	2	3	3
CO 5	2	2	2	2	2
Ave.	2.8	2.0	2.4	2.0	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Examine the evolution, foundations, and societal impact of Artificial Intelligence, including agents and knowledge-based systems	PO1, PO2, PO3, PO5	PSO1, PSO3, PSO5	K2, K4
CO2	Apply propositional logic to represent problems and evaluate logical expressions using truth tables, normal forms, and inference patterns	PO1, PO2, PO3	PSO1, PSO2, PSO3	K3
CO3	Formulate and solve problems using First-Order Logic through quantifiers, unification, resolution, and chaining techniques.	PO1, PO2, PO3	PSO1, PSO2, PSO3	K3, K4
CO4	Develop logic-based programs using Prolog by applying syntax, rules, unification, and goal satisfaction	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4	K3, K6
CO5	Discuss the scope, limitations, and societal implications of Artificial Intelligence.	PO3, PO5	PSO3, PSO5	K2, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

FOUNDATIONS OF ARTIFICIAL INTELLIGENCE (Theory)

Continuous Internal Assessment – Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Any topic related to the course	10	5
Workbook/Record book/Notebook	Notebook maintenance	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Group Discussion	10	5
Class activity 3	Seminar / Presentation	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 – 29
PART: III	COURSE COMPONENT: CORE - VIII
COURSE NAME: PRACTICAL - IV: AI PROBLEM SOLVING USING PROLOG	COURSE CODE: 26UCAI308P
SEMESTER: IV	MARKS: 100
CREDITS: 4	TOTAL HOURS: 60
PRACTICAL	

COURSE OBJECTIVE:

This course gives a formal logic, associated forms of programming, reasoning modelling, Interpret the logical consequences, validity of formulae using the rules of propositional and predicate logic

COURSE OUTCOMES:

1. Develop programs using logic programming and Prolog control constructs.
2. Represent real-world knowledge using First Order Predicate Logic (FOPL) and develop Prolog programs of moderate complexity
3. Apply propositional logic (PL) and First Order Predicate Logic (FOPL) to represent and solve real-world problems
4. Use Prolog predicates to manipulate list data structures and implement sorting algorithms.
5. Analyze resolution techniques including unification, soundness, completeness, and selective linear definite clause resolution

LAB EXERCISES:

1. Check if the predicate functor Term, F, A) succeeds if Term has functor F and arity A by defining a functor
2. Find the number of elements of a list (with size >1) and remove the middle element (at position size//2)
3. Create a list containing all integers within a given range and reverse the list
4. Write a function append to concatenate elements of two lists into a third list
5. Write a predicate table/3 which prints the truth table of a given logical expression in two variables
6. Write a Prolog program using (;) operator to decide whether or not any number was between two other numbers (i.e., to check if number N is between two numbers N1 and N2 if either N is greater than N1 and N is less than N2 or N is less than N1 or N is greater than N2.)
7. Write a Prolog function to find the factorial of a number
8. Query if an element is a member of a list, (using member predicate). To the in-built select function pass a member of the list and return the remainder of the list
9. Demonstrate the use of built-in predicate function find all in a program

10. Evaluate mathematical expressions involving power(**), integer division(/), mod, sqrt and the other basic math operations(+, -, *, %)
11. Use conditions to check the greatest of given two numbers in the stdin/input (not using the max operator)
12. Check the negation of the goal using \+ operator
13. Define a new infix operator is bigger to compare the size of two animals mentioned in the facts

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	3	2	2	2
CO 2	3	3	3	2	2
CO 3	3	3	3	1	2
CO 4	3	3	2	2	2
CO 5	3	3	3	3	2
Ave.	3.0	3.0	2.6	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	2
CO 2	3	3	3	2	2
CO 3	3	2	3	2	2
CO 4	3	3	2	3	2
CO 5	3	2	3	2	2
Ave.	3.0	2.6	2.6	2.4	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Demonstrate Logic Programming Paradigm, Prolog execution models, Prolog's basic	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4	K3, K6
CO2	Convert world knowledge into FOPL formula and construct well-crafted prolog programmes	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3, PSO4	K3, K6
CO3	Apply truth functional propositional Logic (PL) and first order predicate logic (FOPL) to world knowledge	PO1, PO2, PO3	PSO1, PSO3, PSO5	K3, K4
CO4	Describe the basic predicates to manipulate list data structure and sorting algorithms	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4	K3, K4
CO5	To assess the completeness of Resolution Procedure, Soundness and completeness of Linear Resolution	PO1, PO2, PO3	PSO1, PSO3	K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PRACTICAL - IV: AI PROBLEM SOLVING USING PROLOG

Continuous Internal Assessment – Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Practical examination with programming/problem-solving tasks for 90 minutes	50	10
Model Examination	Practical examination with programming/problem-solving tasks for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/Record book/Notebook	Handwritten record of experiments, observations, results and conclusions	10	5
Class activity 1	Debugging Test	10	5
Class activity 2	Problem-Solving Exercise	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARITIFICAL INTELLIGENCE	BATCH: 2026 – 29
PART: III	COURSE COMPONENT: ALLIED – IV
COURSE NAME: STATISTICS - II	COURSE CODE: 26UCAI3A4
SEMESTER: IV	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY AND PROBLEMS	

COURSE OBJECTIVE:

On completion of this course students will be able to use the mathematical knowledge in optimal use of resources

COURSE OUTCOMES:

1. Understand and analyze discrete and continuous random variables and compute mathematical expectation for probability distributions.
2. Apply standard probability distributions such as Binomial, Poisson, and Normal distributions in statistical problem solving.
3. Perform hypothesis testing using statistical techniques including t-test, Chi-square test, and ANOVA for decision making and data analysis.
4. Analyze time series data and measure trend and seasonal variations using methods such as moving averages, least squares, ratio to trend, and ratio to moving average.
5. Compute and interpret different types of index numbers, including weighted and un weighted index numbers, and apply tests such as time reversal and factor reversal in statistical analysis.

UNIT I

12 Hours

Random Variables and Expectation: Discrete Random Variables, Continuous Random Variables, Definition of Mathematical Expectation. (Problems only)

Book 1: Chapter 2 – Section 2.1 – 2.13 and Chapter 3 (Part I).

UNIT II

12 Hours

Discrete probability mass function, cumulative distribution function - Theory and problems based on it. Bernoulli distribution, Binomial Distribution and Poisson Distribution

UNIT III

12 Hours

Testing of Hypothesis: Meaning, types, standard hypothesis, null and alternative hypothesis, simple and composite hypothesis, type I and type II error, testing of hypothesis: t -test, F- test, Chi square, ANOVA (one way and two way classification).

Book 1: Chapter 25, 26, 27 and Chapter 29 – Section 29.1 (Part I)

UNIT IV

12 Hours

Time Series: Meaning, need and components of time series, Measurement of trend: Free hand, Semi average, moving average and least square methods. Measurement of seasonal indices: Simple average, Ratio to trend and Ratio to moving average method.

UNIT V

12 Hours

Hours Index Number: Meaning, Needs and components of time series, Types, Unweighted and Weighted index number Simple, Aggregative, Price relative methods, Laspeyres's, Paasche's, Bowley's and Fisher's index numbers, Time and Factor reversal tests, Cost of living index.
Book 2: Chapter 13

RECOMMENDED TEXTBOOKS:

1. Mathematical Statistics - by P. R. Vittal Margham Publications, 1st edition 2002.
2. Statistical Methods – S.P. Gupta, Sultan Chand & Sons 45th Edition (2017).

REFERENCE BOOKS:

1. Introduction to Probability and Statistics – William Mendenhall & Robert Beaver, Cengage Learning.
2. New Mathematical statistics - Sanjay Arora & Bansilal (2002), Meerat Publications, New Delhi.
3. Fundamentals of Mathematical Statistics - Gupta, S.C. and Kapoor, V.K. (2000): 10/e, Sultan Chand & Sons.
4. Basic Statistics - Agarwal .B.L (1996), New Age International(P) Ltd.
5. Statistics for Business and Economics - Hooda.R.P. (2003): MacMillan.

E - LEARNING RESOURCES:

1. <https://www.khanacademy.org/math>
2. <https://www.digimat.in/nptel/courses/video/110107114/L01.html>
3. <https://ocw.mit.edu/courses/14-30-introduction-to-statistical-method-in-economics-spring-2006/>
4. <https://onlinecourses.nptel.ac.in>
5. <https://www.coursera.org/browse/math-and-logic>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer any 10 out of 12 questions	1 – 12	3	30
B	Answer any 5 out of 7 questions	13 – 19	6	30
C	Answer any 4 out of 6 questions	20 – 25	10	40
TOTAL MARKS				100

BREAK UP OF QUESTIONS FOR THEORY

UNITS	THEORY	PROBLEM	THEORY	PROBLEM	THEORY	PROBLEM
I	1	2	-	1	-	1
II	1	1	-	2	-	1
III	-	2	-	1	-	2
IV	1	2	-	1	-	1
V	-	2	1	1	-	1
TOTAL	12		7		6	
	SECTION A – 12		SECTION B - 7		SECTION C - 6	

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	2	3	2	2	3
CO 2	3	2	2	3	2
CO 3	3	2	3	3	2
CO 4	2	3	2	2	3
CO 5	2	3	3	3	2
Ave.	2.4	2.6	2.4	2.6	2.4

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	3	2
CO 2	3	2	3	2	3
CO 3	2	3	2	3	2
CO 4	3	3	3	2	3
CO 5	3	2	3	3	3
Ave.	2.8	2.6	2.8	2.6	2.6

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand and analyze discrete and continuous random variables and compute mathematical expectation for probability distributions.	PO1, PO2	PSO1, PSO3	K1, K2
CO2	Apply standard probability distributions such as Binomial, Poisson, and Normal distributions in statistical problem solving.	PO1, PO2, PO3	PSO1, PSO3	K2
CO3	Perform hypothesis testing using statistical techniques including t-test, Chi-square test, and ANOVA for decision making and data analysis.	PO1, PO2, PO3	PSO1, PSO2, PSO3	K2, K3
CO4	Analyze time series data and measure trend and seasonal variations using methods such as moving averages, least squares, ratio to trend, and ratio to moving average.	PO1, PO2, PO3	PSO2, PSO3	K2, K3
CO5	Compute and interpret different types of index numbers, including weighted and un weighted index numbers, and apply tests such as time reversal and factor reversal in statistical analysis.	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO3, PSO5	K3, K4, K5

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

STATISTICS – II (Theory)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Content -3, Presentation – 2	10	5
Workbook/Record book/Notebook	Completeness - 3, Accuracy – 2	10	5
Class activity 1	Quiz with MCQ (Correct Answers - 3, Speed - 2) / Rapid Fire (Quick Response - 3, Accuracy - 2) / Formula Drill Game (Correct Formula Recall - 3, Application - 2) / Others	10	5
Class activity 2	Problem Solving (Correct Answer - 3, Proper Steps - 2) / Error Detection Activity (Identification of Errors - 3, Reasoning - 2) / Scrap Book (Relevance of Content - 3, Creativity and Presentation - 2) / Others	10	5
Class activity 3	Real-Life Application Task (Understanding of Concept - 3, Application of Real Situation - 2) / Seminar (Preparation - 3, Presentation - 2) / Peer Quiz Creation (Quality of Questions - 3, Relevance to Topic - 2) / Others	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

UG - ABILITY ENHANCEMENT SKILLS /LIFE SKILLS

SOFT SKILLS: COMMON TO BCA, B.Sc (CS), B.Sc (IT), B.Sc (DA), B.Sc CS with AI	BATCH: 2026 - 29
PART: IV	COURSE COMPONENT: INDIAN KNOWLEDGE SYSTEM
COURSE NAME: INDIAN KNOWLEDGE SYSTEM WITH ARTIFICIAL INTELLIGENCE	COURSE CODE: 26UIKS409
SEMESTER: IV	MARKS:100
CREDITS: 1	TOTAL HOURS: 15
THEORY	

COURSE OBJECTIVE:

Provide a concise understanding of Indian Knowledge Systems and AI, focusing on foundations, ethics, and interdisciplinary applications.

COURSE OUTCOMES:

1. Explain Indian Knowledge Systems and their relevance to modern technology.
2. Analyze AI concepts and compare them with Indian logical frameworks.
3. Evaluate the integration of IKS and AI in real-world applications.

UNIT I Introduction to Indian Traditional Knowledge

5 Hours

Concept, scope, and significance of Indian Traditional Knowledge (ITK) Concept and scope of Indian Knowledge Systems - Sources of IKS: Vedas, Upanishads, Puranas, Manuscripts, inscriptions, oral traditions - Major knowledge domains in IKS: Ayurveda, Yoga, Siddha, Mathematics, Astronomy, Architecture, Linguistics - Indian scientific and logical traditions: Nyaya, Vaisheshika, Sankhya - Relevance of IKS in the modern digital and technological era.

UNIT II Artificial Intelligence – Concepts and Indian Perspectives

5 Hours

Introduction to Artificial Intelligence: Definition, history, and applications - Core AI concepts: Machine Learning, Deep Learning, Natural Language Processing (NLP) - Data, knowledge representation, and reasoning - Indian logical frameworks and cognition: Comparison of Indian logic with modern AI reasoning - Ethical AI and Indian philosophical perspectives: Dharma, ethics, and responsible AI.

UNIT III Integration of IKS and AI Applications

5 Hours

Digitization of Indian Knowledge using AI: Manuscript digitization, OCR for Indian scripts, Knowledge extraction. AI applications in traditional knowledge systems: AI in Ayurveda

diagnosis and drug discovery, AI in Yoga and wellness analytics, AI in agriculture and traditional farming knowledge. Knowledge databases and digital repositories: Traditional Knowledge Digital Library (TKDL) – role and importance. Challenges and future scope of IKS with AI: Preservation, authenticity, bias, and ethics, Research and innovation opportunities.

RECOMMENDED TEXTBOOKS

1. Kapoor, Kapil, Indian Knowledge Systems, D.K. Printworld, 2017.
2. Russell, Stuart and Norvig, Peter, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson Education, New Delhi, 2021.
3. Chatterjee, Satischandra and Datta, Dhirendramohan, An Introduction to Indian Philosophy, University of Calcutta Press, Kolkata, 2016.

REFERENCE BOOKS

1. Plofker, Kim, Mathematics in India, Princeton University Press, Princeton, 2009.
2. Vagbhata, Ashtanga Hridayam (Selected English Translations), Chaukhambha Publications, Varanasi, 2014.
3. Bishop, Christopher M., Pattern Recognition and Machine Learning, Springer, New York, 2006.
4. Brachman, Ronald J. and Levesque, Hector J., Knowledge Representation and Reasoning, Morgan Kaufmann Publishers, San Francisco, 2004.
5. CSIR, Government of India, Traditional Knowledge Digital Library (TKDL): Documentation and Reports, Council of Scientific and Industrial Research, New Delhi, 2018.

E-LEARNING RESOURCES

1. <https://www.tkdl.res.in>
2. <https://www.namami.gov.in>
3. <https://www.dli.gov.in>
4. <https://www.unesco.org/en/digital-heritage>
5. <https://indianculture.gov.in>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	ESSAY ANSWER ANY 5 OUT OF 10 QUESTIONS (EACH IN 1200 WORDS)	1-10	20	100

BREAK UP OF QUESTIONS

Section	Units	No. of Questions	
		Theory	Problems
A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	

SOFT SKILLS: COMMON TO ALL	BATCH: 2026 – 29
PART: IV	COURSE COMPONENT: ABILITY ENHANCEMENT LEARNING - IV
COURSE NAME: RESUME WRITING AND INTERVIEW SKILLS	COURSE CODE: 26USKL405
SEMESTER: IV	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

COURSE OBJECTIVE:

To equip the students to acquire the relevant skills for better employability

COURSE OUTCOMES:

1. Prepare professional resumes, CVs, biodata and covering letters suitable for job applications.
2. Apprise the fundamental concepts, purpose and characteristics of job interviews.
3. Identify various types of interviews and their expectations in recruitment processes.
4. Apply interview techniques and strategies to effectively handle different stages of the interview process.
5. Demonstrate employability skills such as communication, personality development, time management, and presentation skills for career readiness

UNIT I: Preparing Biodata / CV / Resume

6 Hours

Essential characteristics of a job application – Difference between Biodata, CV, Resume – Covering letter – Tips to draft an application

UNIT II: Introduction to Interview Skills

6 Hours

Definition – Meaning – Concept of interview – Purpose – Objectives of interview – Characteristic features of job interviews

UNIT III: Types of Interviews

6 Hours

Traditional one-to-one job interview – Panel interview – Behavioural interview – Group interview – Phone interview – Preliminary interview – Patterned interview – Depth interview – Stress interview – Exit interview – Interview through tele and video conferencing

UNIT IV: Interviews – Techniques and Strategies

6 Hours

Preparing for the interview process – Before the interview – During the interview – After the interview – Tips to ace an interview – Commonly asked interview questions – Do's and Don'ts – Reasons for rejection.

UNIT V: Leveraging Employability Skills

6 Hours

Personality Development – Organizational skills – Time Management – Stress Management – Effective Communication Skills – Reasoning Ability – Verbal Ability – Group Discussion – Technical skills – Presentation skills

RECOMMENDED TEXTBOOKS

1. Monipally, Matthukutty M. (2017) *Business Communication: From Principles to Practice*
2. Peter, Francis. (2012) *Soft Skills and Professional Communication*. New Delhi: Tata McGraw Hill.

REFERENCE BOOKS

1. Higgins, Jessica JD (2018) 10 Skills for Effective Business Communication: Practical Strategies from the World's Greatest Leaders
2. Nicholas, Sonji (2023) *Interviewing: Preparation, Types, Techniques, and Questions*, Pressbooks
3. Storey, James (2016) *The Art of The Interview: The Perfect Answers to Every Interview Question*

E-LEARNING RESOURCES

1. <https://careermobilityoffice.cs.ny.gov/cmo/documents/Resume%20&%20Interviewing%20Handout.pdf>
2. <https://edu.gcfglobal.org/en/interviewingskills/interview-etiquette/1/>
3. <https://findjobhub.com/en/types-of-interviews>
4. <https://egyankosh.ac.in/bitstream/123456789/23411/1/Unit-2.pdf>
5. https://bharatskills.gov.in/pdf/E_Books/CTS/ES/English/ES_Part_1_62%20hour_English.pdf
6. https://bharatskills.gov.in/pdf/E_Books/CTS/ES/English/ES_Part2_58hour_English.pdf

GUIDELINES TO THE QUESTION PAPER SETTERS QUESTION PAPER PATTERN

Section	Question Component	Numbers	Marks	Total
A	Answer any 5 out of 7 questions (answer in 50 words)	1-7	2	10
B	Answer any 4 out of 6 questions (answer in 300 words)	8-13	5	20
C	Answer any two (Internal (Choice)	14-15	10	20
	Internal & Viva Voce		50	50

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	----
II	2	1	1
III	1	1	1
IV	1	1	1
V	1	1	1

SEMESTER V

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARITIFICAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: CORE - IX
COURSE NAME: PRINCIPLES OF OPERATING SYSTEMS	COURSE CODE: 26UCAI309
SEMESTER: V	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

To Understand and Evaluate the requirement for process synchronization and coordination handled by operating system.

COURSE OUTCOMES:

1. Describe the important computer system resources and the role of operating system in their management policies and algorithms.
2. Apply CPU scheduling algorithms in process management scenarios
3. Employ techniques for process synchronization and coordination in concurrent systems.
4. Analyze the memory management and its allocation policies
5. Compare storage management policies across different memory management approaches

UNIT I

12 Hours

Introduction to Operating Systems: Introduction- History & evolution of OS- Types of Operating Systems- Simple Batch Systems, Multiprogramming and Time-Sharing systems. Personal Computer Systems, Parallel Systems, Distributed Systems and Real time Systems. Operating System Structures: Operating System Services, System components, system calls.

UNIT II

12 Hours

Process Management: Process states, Process creation, process termination, Process Scheduling Algorithms-Non-Preemptive and Preemptive Scheduling Algorithms- Concurrent and Dependent Processes- Inter-process Communication

UNIT III

12 Hours

Process Synchronization: Critical Section problem- Semaphores - Deadlock: Deadlock Characterization, Necessary and Sufficient Conditions for Deadlock, Deadlock Handling Approaches: Deadlock Prevention, Deadlock Avoidance and Deadlock Detection and Recovery.

UNIT IV

12 Hours

Memory Management: Physical and Virtual Address Space; Memory Allocation Strategies– Fixed and -Variable Partitions, Paging, Segmentation, Virtual Memory. File Management: Directory Structure, File Operations, File Allocation Methods.

UNIT V

12 Hours

Advanced OS: Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems–Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems.

RECOMMENDED TEXTBOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc., 2012

REFERENCE BOOKS:

1. H.M. Deitel, An Introduction to Operating system, Second Edition, Addison Wesley.
2. Andrew S.Tanenbaum, Modern Operating Systems, Pearson Education, 2nd edition.

E-LEARNING RESOURCES:

1. <https://ajce.in/it/e-learning/categories/os.html>
2. <https://www.thelearningos.com/>
3. <https://www.ibm.com/docs/en/randori?topic=guidance-operating-system>
4. <https://medium.com/@algorhythm2411/operating-system-os-learning-resources-515d685ad1c3>
5. <https://www.britannica.com/technology/operating-system>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer any 10 out of 12 questions (each in 50 words)</i>	1-12	3	30
B	<i>Answer any 5 out of 7 questions (each in 300 words)</i>	13-19	6	30
C	<i>Answer any 4 out of 6 questions (each in 1200 words)</i>	20-25	10	40
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	3	1	1
II	2	1	1
III	3	2	1
IV	2	1	2
V	2	2	1
TOTAL	12	7	6
SECTION A - 12		SECTION B – 7	SECTION C – 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	2	2	1	2
CO 2	3	3	2	2	1
CO 3	3	3	3	2	2
CO 4	3	3	2	3	2
CO 5	2	2	3	2	3
Ave.	2.8	2.6	2.4	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	1	2	1	2
CO 2	3	2	3	2	2
CO 3	3	2	3	2	2
CO 4	3	3	2	3	2
CO 5	2	2	2	2	2
Ave.	2.8	2.0	2.4	2.0	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Describe the important computer system resources and the role of operating system in their management policies and algorithms	PO1, PO2, PO3, PO5	PSO1, PSO3, PSO5	K2, K4
CO2	Apply CPU scheduling algorithms in process management scenarios	PO1, PO2, PO3	PSO1, PSO2, PSO3	K3
CO3	Employ techniques for process synchronization and coordination in concurrent systems	PO1, PO2, PO3	PSO1, PSO2, PSO3	K3, K4
CO4	Analyze the memory management and its allocation policies	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4	K3, K6
CO5	Compare storage management policies across different memory management approaches	PO3, PO5	PSO3, PSO5	K2, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

OPERATING SYSTEMS (Theory)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Any topic related to the course	10	5
Workbook/Record book/Notebook	Technical Documentation Note book	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Case-Study Analysis	10	5
Class activity 3	Group Discussion	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARITIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: CORE – X
COURSE NAME: COMPUTER VISION	COURSE CODE: 26UCAI310
SEMESTER: VI	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

This course introduces the fundamentals of image formation ideas, methods, techniques of computer vision and pattern recognition

COURSE OUTCOMES:

1. Analyze core concepts, terminology, theories, models, and methods in computer vision
2. Describe principles of the human visual system
3. Utilize computer vision techniques such as multi-scale representation, edge detection, stereo vision, motion analysis, and object recognition.
4. Develop a computer vision system for a specific problem
5. Apply active appearance and shape models for face-related applications

UNIT I

12 Hours

Introduction: Image Processing, Computer Vision and Computer Graphics, what is Computer Vision - Low-level, Mid-level, High-level, Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality

UNIT II

12 Hours

Digital Image Formation and low-level processing: Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing

UNIT III

12 Hours

Feature Extraction & Image Segmentation: Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Gabor Filters and DWT; Image Segmentation: Contour based representation, Region based representation, Level set representations, Fourier and wavelet descriptors, Multi resolution analysis

UNIT IV**12 Hours**

Pattern & Motion Analysis: Clustering: K-Means, K-Medoids, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, Dimensionality Reduction: LDA, ICA, Background Subtraction and Modeling, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation

UNIT V**12 Hours**

Applications: Photo album – Face detection – Face recognition – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – tracking and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians

RECOMMENDED TEXTBOOKS:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.

REFERENCE BOOKS:

1. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.
2. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
3. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
4. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012
5. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012
6. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.

E-LEARNING RESOURCES:

1. <https://viso.ai/blog/>
2. <https://learnopencv.com/>
3. <https://www.analyticsvidhya.com/blog/>
4. <https://www.rsipvision.com/rsip-vision-learns/>
5. <https://link.springer.com/referencework/10.1007/978-3-030-63416-2>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer any 10 out of 12 questions (each in 50 words)</i>	1-12	3	30
B	<i>Answer any 5 out of 7 questions (each in 300 words)</i>	13-19	6	30
C	<i>Answer any 4 out of 6 questions (each in 1200 words)</i>	20-25	10	40
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	3	1	1
II	2	1	1
III	3	2	1
IV	2	1	2
V	2	2	1
TOTAL	12	7	6
SECTION A - 12		SECTION B – 7	SECTION C - 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	2	3	2	1
CO 2	3	2	2	2	2
CO 3	3	3	3	2	2
CO 4	3	3	3	2	3
CO 5	3	3	2	2	2
Ave.	3.0	2.6	2.6	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	2	3	2	1
CO 2	3	1	2	1	2
CO 3	3	3	3	2	2
CO 4	3	3	3	3	2
CO 5	3	3	2	2	3
Ave.	3.0	2.4	2.6	2.0	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Analyze core concepts, terminology, theories, models, and methods in computer vision	PO1, PO2, PO3	PSO1, PSO3	K2, K4
CO2	Describe principles of the human visual system	PO1, PO3	PSO1, PSO5	K2
CO3	Utilize computer vision techniques such as multi-scale representation, edge detection, stereo vision, motion analysis, and object recognition.	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3	K3, K4
CO4	Develop a computer vision system for a specific problem	PO1, PO2, PO3, PO4, PO5	PSO1, PSO2, PSO3, PSO4, PSO5	K3, K6
CO5	Apply active appearance and shape models for face-related applications	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4, PSO5	K3, K4

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

COMPUTER VISION (Theory)

Continuous Internal Assessment – Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Any topic related to the course	10	5
Workbook/Record book/Notebook	Continuous Learning Notebook	10	5
Class activity 1	Case-Study Analysis	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Group Activity	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARITIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: CORE – XI
COURSE NAME: PRACTICAL – V: COMPUTER VISION	COURSE CODE: 26UCAI311P
SEMESTER: V	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
PRACTICAL	

COURSE OBJECTIVE:

This course to understand a digital images, manipulating one pixel at a time, Pixel transformations, geometric operations

COURSE OUTCOMES:

1. Apply spatial operations in image processing
2. Utilize image gradients and edge detection techniques
3. Extract relevant features from images
4. Recognize objects employing image processing techniques
5. Perform pixel transformations and geometric operations

LAB EXERCISES:

1. Perform the image transformations that include the geometric and morphological transformations.
2. Perform the image enhancement by applying contrast limited adaptive histogram Equalization
3. Perform the Contours and Region based segmentation in images
4. Perform the Wavelet Transforms on image using PyWavelets
5. Perform the K-Means clustering for Image segmentation using CV2 library.
6. Perform basic motion detection and tracking using python and OpenCV
7. Perform face detection using OpenCV library
8. Perform Foreground Extraction in an image
9. Perform Pedestrian Detection using OpenCV and Python

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	3	2	2	2
CO 2	3	3	2	2	1
CO 3	3	3	3	2	2
CO 4	3	3	2	2	3
CO 5	3	3	2	2	2
Ave.	3.0	3.0	2.4	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	2	1
CO 2	3	3	2	1	2
CO 3	3	3	3	2	2
CO 4	3	3	3	2	2
CO 5	3	3	2	3	3
Ave.	3.0	3.0	2.4	2.0	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Apply spatial operations in image processing	PO1, PO2, PO3	PSO1, PSO2	K3
CO2	Utilize image gradients and edge detection techniques	PO1, PO2, PO3	PSO1, PSO2	K3
CO3	Extract relevant features from images	PO1, PO2, PO3	PSO1, PSO2, PSO3	K3, K4
CO4	Recognize objects employing image processing techniques	PO1, PO2, PO3, PO4	PO1, PO2, PO3, PO5	K3, K4
CO5	Perform pixel transformations and geometric operations.	PO1, PO2, PO3	PSO1, PSO2	K3

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

COMPUTER VISION (Practical)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Practical examination with programming/problem-solving tasks for 90 minutes	50	10
Model Examination	Practical examination with programming/problem-solving tasks for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/Record book/Notebook	Handwritten record of experiments, observations, results and conclusions	10	5
Class activity 1	Debugging Test	10	5
Class activity 2	Problem-Solving Exercise	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: OPEN TO ALL PROGRAMMES EXCEPT B.Sc. COMPUTER SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: ELECTIVE– I (Interdisciplinary Elective)
COURSE NAME: ETHICS OF ARTIFICIAL INTELLIGENCE	COURSE CODE: 26UCAI3E1
SEMESTER: V	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

To grasp the significance of natural language processing in solving real-world problems, Perspectives on Ethics of AI appropriate processing technique to a problem and implement the technique.

COURSE OUTCOMES:

1. Assess ethical implications of Artificial Intelligence systems
2. Examine ethical frameworks and models
3. Discuss accountability and key social issues in AI
4. Analyze ethical perspectives and approaches
5. Apply Ethical Principles to Real-World Scenarios

UNIT I

12 Hours

Introduction to Ethics of AI: Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities

UNIT II

12 Hours

Framework And Models: AI Governance by Human-right centered design, Normative models, Role of professional norms, Teaching Machines to be Moral

UNIT III:

12 Hours

Concepts And Issues: Accountability in Computer Systems, Transparency, Responsibility and AI. Race and Gender, AI as a moral right-holder

UNIT IV:**12 Hours**

Perspectives And Approaches: Perspectives on Ethics of AI, integrating ethical values and economic value, Automating origination, AI a Binary approach, Machine learning values, Artificial Moral Agents

UNIT V:**12 Hours**

Cases And Application: Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, Smart City Ethics

RECOMMENDED TEXTBOOKS:

1. Paula Boddington, —Towards a Code of Ethics for Artificial Intelligencell, Springer, 2017
2. Markus D. Dubber, Frank Pasquale, Sunit Das, —The Oxford Handbook of Ethics of AIII, Oxford University Press Edited book, 2020
3. S. Matthew Liao, —Ethics of Artificial Intelligencell, Oxford University Press Edited Book, 2020

REFERENCE BOOKS:

1. Wallach, W., & Allen, C, —Moral machines: ceaching robots right from wrongll, Oxford University Press, 2008.
2. Bostrom and E. Yudkowsky. —The ethics of artificial intelligencell. In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, Cambridge, 2014.

E-RESOURCES

1. <https://arxiv.org/abs/1907.07892>
2. <https://academic.oup.com/book/46748?login=false>
3. <https://www.scu.edu/ethics/all-about-ethics/>
4. <https://aiindex.stanford.edu/>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer any 10 out of 12 questions	1 – 12	3	30
B	Answer any 5 out of 7 questions	13 – 19	6	30
C	Answer any 4 out of 6 questions	20 – 25	10	40
TOTAL MARKS				100

BREAK UP OF QUESTIONS FOR THEORY

UNITS	SECTION A	SECTION B	SECTION C
I	2	1	1
II	3	1	1
III	3	1	2
IV	2	2	1
V	2	2	1
TOTAL	12	7	6
SECTION A – 12		SECTION B - 7	SECTION C - 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	2	2	3	2	3
CO 2	2	2	3	1	3
CO 3	2	2	3	2	3
CO 4	2	2	3	2	3
CO 5	2	3	3	3	3
Ave.	2.0	2.2	3.0	2.0	3.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	2	3	2	3
CO 2	2	2	3	1	3
CO 3	2	2	3	2	3
CO 4	2	2	3	2	3
CO 5	2	2	3	3	3
Ave.	2.0	2.0	3.0	2.0	3.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Assess ethical implications of Artificial Intelligence systems	PO3, PO5	PSO3, PSO5	K4, K5
CO2	Examine ethical frameworks and models	PO3, PO5	PSO3, PSO5	K2, K4
CO3	Discuss accountability and key social issues in AI	PO3, PO4, PO5	PSO3, PSO4, PSO5	K2, K5
CO4	Analyze ethical perspectives and approaches	PO3, PO5	PSO3, PSO5	K4
CO5	Apply Ethical Principles to Real-World Scenarios	PO2, PO3, PO4, PO5	PSO3, PSO4, PSO5	K3, K5

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

ETHICS OF ARTIFICIAL INTELLIGENCE (Theory)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Any topic related to the course	10	5
Workbook/Record book/Notebook	Continuous Learning Notebook	10	5
Class activity 1	Debate	10	5
Class activity 2	Group Discussion	10	5
Class activity 3	Seminar/Presentation	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.C.A, BSc (CS), BSc(IT), B.Sc (DA), B.Sc. Computer Science with AI	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: ELECTIVE – II
COURSE NAME: PRACTICAL - VI : PLATFORM ENGINEERING	COURSE CODE: 26UBCA3E2P
SEMESTER: VI	MARKS: 100
CREDITS: 5	TOTAL HOURS: 75
PRACTICAL	

COURSE OBJECTIVE:

To provide students with the knowledge and practical skills required to administer, secure, virtualize, monitor, and manage modern network, server, and cloud infrastructures in enterprise environments.

COURSE OUTCOMES:

1. Explain networking, server infrastructure, storage systems, and operating system fundamentals for enterprise environments
2. Apply Windows Server administration techniques for system configuration, storage management, and performance monitoring
3. Analyze Active Directory services and security mechanisms for efficient domain management
4. Apply Linux administration and virtualization techniques for managing systems and virtual environments
5. Analyze cloud services, backup strategies, and infrastructure monitoring tools for effective IT management

LIST OF PROGRAMS:

1. IT- Infrastructure
2. Windows Administration
3. Windows AD Administration
4. Unix Administration
5. Virtualization Concepts
6. Cloud Deployment
7. RDBMS - Database Administration
8. Backup, Restoration & Monitoring
9. Middleware Components
10. ITIL Process
11. Perform End to End Case Study

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	2	2	1	2
CO 2	3	3	2	2	2
CO 3	3	3	3	2	2
CO 4	3	3	2	2	2
CO 5	3	3	3	3	2
Ave.	3.0	2.8	2.4	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	2	1	3	2
CO 2	2	3	2	3	1
CO 3	2	2	3	3	2
CO 4	2	3	2	3	3
CO 5	2	3	3	3	2
Ave.	2.0	2.6	2.2	3.0	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Explain networking, server infrastructure, storage systems, and operating system fundamentals for enterprise environments	PO1, PO2, PO3	PSO2, PSO4	K1, K2
CO2	Apply Windows Server administration techniques for system configuration, storage management, and performance monitoring	PO1, PO2, PO3, PO4	PSO2, PSO4	K3
CO3	Analyze Active Directory services and security mechanisms for efficient domain management	PO1, PO2, PO3	PSO3, PSO4	K4
CO4	Apply Linux administration and virtualization techniques for managing systems and virtual environments	PO1, PO2, PO3, PO4	PSO2, PSO4	K3, K4
CO5	Analyze cloud services, backup strategies, and infrastructure monitoring tools for effective IT management	PO1, PO2, PO3, PO5	PSO2, PSO3, PSO4, PSO5	K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5

PLATFORM ENGINEERING

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Any topic related to the course	10	5
Workbook/Record book/Notebook	Continuous Learning Notebook	10	5
Class activity 1	Group Activity	10	5
Class activity 2	Seminar /Presentation	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc. COMPUTER SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 - 2029
PART: III	COURSE COMPONENT: ELECTIVE – II
COURSE NAME: COMPUTER NETWORKS	COURSE CODE: 26UCAI3E4
SEMESTER: V	MARKS:100
CREDITS: 5	TOTAL HOURS:75
THEORY	

COURSE OBJECTIVE:

To understand the concept of Data communication and Computer network with a knowledge on routing algorithms, networking and inter networking devices, Security over Network communication

COURSE OUTCOMES:

1. Interpret computer network architecture, including OSI and TCP/IP models
2. Compare telephone systems and satellite communication mechanisms
3. Apply elementary data link layer protocols
4. Analyze routing algorithms and congestion control techniques
5. Apply knowledge of network security mechanisms and protocols like FTP, HTTP, Telnet, and DNS in practical contexts

UNIT I

15 Hours

Introduction - Network Hardware - Software - Reference Models - OSI and TCP/IP Models - Example Networks: Internet, ATM, Ethernet and Wireless LANs - Physical Layer - Theoretical Basis for Data Communication - Guided Transmission Media

UNIT II

15 Hours

Wireless Transmission - Communication Satellites - Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues – Error Detection and Correction.

UNIT III

15 Hours

Elementary Data Link Protocols - Sliding Window Protocols - Data Link Layer in the Internet - Medium Access Layer - Channel Allocation Problem - Multiple Access Protocols – Bluetooth

UNIT IV**15 Hours**

Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms – IP Protocol – IP Addresses – Internet Control Protocols.

UNIT V**15 Hours**

Transport Layer - Services - Connection Management - Addressing, Establishing and Releasing a Connection – Simple Transport Protocol – Internet Transport Protocols (ITP) - Network Security: Cryptography.

RECOMMENDED TEXTBOOKS:

1. S. Tanenbaum, “Computer Networks”, 4th Edition, Prentice-Hall of India, 2008.

REFERENCE BOOKS

1. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition, 2015.
2. F. Halsall, “Data Communications, Computer Networks and Open Systems”, Pearson Education, 2008.
3. D. Bertsekas and R. Gallager, “Data Networks”, 2nd Edition, PHI, 2008.
4. Lamarca, “Communication Networks”, Tata McGraw- Hill, 2002

E-RESOURCES

1. <https://open.umn.edu/opentextbooks/textbooks/771>
2. https://www.youtube.com/playlist?list=PLBlnK6fEyqRjN2Plz5_mq1O6Kkxrth3nG
3. <https://www.computernetworkingnotes.com/>
4. https://www.tutorialspoint.com/data_communication_computer_network/
5. <https://networklessons.com/>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer any 10 out of 12 questions	1 – 12	3	30
B	Answer any 5 out of 7 questions	13 – 19	6	30
C	Answer any 4 out of 6 questions	20 – 25	10	40
TOTAL MARKS				100

BREAK UP OF QUESTIONS FOR THEORY

UNITS	SECTION A	SECTION B	SECTION C
I	2	1	1
II	2	1	1
III	2	1	1
IV	2	1	1
V	2	1	1
Any Unit	2	2	1
TOTAL	12	7	6
SECTION A – 12		SECTION B - 7	SECTION C - 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	2	2	2	2
CO 2	3	2	3	1	1
CO 3	3	3	2	2	2
CO 4	3	3	3	3	2
CO 5	3	3	2	2	3
Ave.	3.0	2.6	2.4	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	2	1	3	2
CO 2	2	1	2	3	2
CO 3	2	3	2	3	2
CO 4	2	2	3	3	2
CO 5	2	3	3	3	2
Ave.	2.0	2.2	2.2	3.0	2.0

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Interpret computer network architecture, including OSI and TCP/IP models	PO1, PO2, PO3	PSO2, PSO4	K2
CO2	Compare telephone systems and satellite communication mechanisms	PO1, PO3	PSO3, PSO4	K2, K4
CO3	Apply elementary data link layer protocols	PO1, PO2, PO3	PSO2, PSO4	K3
CO4	Analyze routing algorithms and congestion control techniques	PO1, PO2, PO3	PSO3, PSO4	K4
CO5	Apply knowledge of network security mechanisms and protocols like FTP, HTTP, Telnet, and DNS in practical contexts	PO1, PO2, PO3, PO4, PO5	PSO2, PSO3, PSO4, PSO5	K3, K4

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

COMPUTER NETWORKS (Theory)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Any topic related to the course	10	5
Workbook/Record book/Notebook	Continuous Learning Notebook	10	5
Class activity 1	Quiz with MCQ,	10	5
Class activity 2	Case-Study Analysis	10	5
Class activity 3	Seminar/Presentation	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc. COMPUTER SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 - 2029
PART: III	COURSE COMPONENT: ELECTIVE – II
COURSE NAME: SOFTWARE ENGINEERING	COURSE CODE: 26UCAI3E5
SEMESTER: V	MARKS:100
CREDITS: 5	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVE:

To introduce the software development life cycles, concepts related to structured and objected oriented analysis & design

COURSE OUTCOMES:

1. Specify software requirements and design software using appropriate tools
2. Develop test cases using various software testing techniques
3. Analyze software development life cycle (SDLC) models
4. Apply structured and object-oriented analysis and design techniques
5. Utilize UML diagrams and software testing techniques in software design

UNIT I

15 Hours

Introduction - Evolution - Software Development projects - Emergence of Software Engineering. Software Life cycle models - Waterfall model - Rapid Application Development - Agile Model - Spiral Model

UNIT II

15 Hours

Requirement Analysis and Specification - Gathering and Analysis - SRS - Formal System Specification

UNIT III

15 Hours

Software Design - Overview - Characteristics - Cohesion & Coupling - Layered design - Approaches. Function Oriented Design - Structured Analysis - DFD - Structured Design -Detailed design

UNIT IV

15 Hours

Object Modeling using UML – OO concepts – UML – Diagrams – Use case, Class, Interaction, Activity, State Chart – Postscript

UNIT V

15 Hours

Coding & Testing - coding – Review - Documentation - Testing - Black-box, White-box, Integration, OO Testing, Smoke testing

RECOMMENDED TEXTBOOKS:

1. Rajib Mall, “Fundamentals of Software Engineering”, PHI 2018, 5th Edition.

REFERENCE BOOKS:

1. Roger S. Pressman, “Software Engineering - A Practitioner’s Approach”, McGraw Hill 2010, 7th Edition.
2. Pankaj Jalote, “An Integrated Approach to Software Engineering”, Narosa Publishing House 2011, 3rd Edition.

E-RESOURCES:

1. <https://www.geeksforgeeks.org/software-engineering/>
2. https://www.tutorialspoint.com/software_engineering/index.htm
3. <https://www.coursera.org/specializations/software-engineering>
4. <https://www.khanacademy.org/computing>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer any 10 out of 12 questions (each in 50 words)</i>	1-12	3	30
B	<i>Answer any 5 out of 7 questions (each in 300 words)</i>	13-19	6	30
C	<i>Answer any 4 out of 6 questions (each in 1200 words)</i>	20-25	10	40
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	3	1	1
II	2	1	1
III	3	2	1
IV	2	1	2
V	2	2	1
TOTAL	12	7	6
SECTION A - 12		SECTION B - 7	SECTION C - 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	2	3	2	1
CO 2	3	3	2	2	2
CO 3	3	3	3	2	2
CO 4	3	3	2	2	3
CO 5	2	2	3	2	2
Ave.	2.8	2.6	2.6	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	1	2	1	3
CO 2	3	2	3	2	2
CO 3	3	2	3	2	1
CO 4	3	3	2	3	2
CO 5	2	2	2	2	2
Ave.	2.8	2.0	2.4	2.0	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Specify software requirements and design software using appropriate tools	PO1, PO2, PO3, PO5	PSO1, PSO3, PSO5	K2, K4
CO2	Develop test cases using various software testing techniques	PO1, PO2, PO3	PSO1, PSO2, PSO3	K3
CO3	Analyze software development life cycle (SDLC) models	PO1, PO2, PO3	PSO1, PSO2, PSO3	K3, K4
CO4	Apply structured and object-oriented analysis and design techniques	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4	K3, K6
CO5	Utilize UML diagrams and software testing techniques in software design	PO3, PO5	PSO3, PSO5	K2, K5

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

SOFTWARE ENGINEERING (Theory)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Any topic related to the course	10	5
Workbook/Record book/Notebook	Continuous Learning Notebook	10	5
Class activity 1	Case-Study Analysis	10	5
Class activity 2	Group Activity	10	5
Class activity 3	Seminar/Presentation	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: ALL UG	BATCH: 2026 - 2029
PART: IV	COURSE COMPONENT: EVS
COURSE NAME: ENVIRONMENTAL STUDIES	COURSE CODE: 26UEVS401
SEMESTER: IV	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

COURSE OBJECTIVE:

To make students realize the importance of Environmental Studies.

COURSE OUTCOMES:

1. Define the scope and importance of environmental studies and its relevance to sustainable development.
2. Identify different types of natural resources and classify them as renewable, non-renewable, and potentially renewable
3. Describe the concept of biodiversity and list major conservation strategies
4. Identify the causes and types of environmental pollution and recall common prevention measures.
5. List basic disaster management plans for common environmental hazards and recall preparedness measures at community level

UNIT 1

The Multidisciplinary nature of environmental studies Definition; Scope and importance, Need for public awareness.

UNIT 2

Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems.

- a) Forest resources: Use and Over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water dams benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. - Role of an individual in conservation of natural resources. - Equitable use of resources for sustainable lifestyles.

UNIT 3

Ecosystems - Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem.

- Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the following ecosystem: -

a. Forest ecosystem

b. Grassland ecosystem

c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT 4

Biodiversity and its Conservation

- Introduction-Definition: genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India.
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT 5

Environmental Pollution: Definition - Causes, effects and control measures of: -

a. Air pollution

b. Water pollution

- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution. - Pollution case studies. - Disaster management: floods, earthquake, cyclone and landslides.

QUESTION PAPER PATTERN: MCQ

PROGRAMME: B.Sc. COMPUTER SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: IV	COURSE COMPONENT: INTERNSHIP
COURSE NAME: INTERNSHIP	COURSE CODE: 26UINT401
SEMESTER: V	MARKS:- --
CREDITS: 2	TOTAL HOURS: --
INTERNSHIP	

COURSE OBJECTIVE:

To provide students with practical, hands-on experience in the field of computer science, complementing their academic learning with real-world applications.

COURSE OUTCOMES:

1. Apply academic knowledge to real-world IT problems.
2. Develop domain knowledge, multidisciplinary, and professional skills.
3. Gain industry exposure through practical experience.
4. Practice ethical and sustainable computing approaches.
5. Enhance employability skills.

GUIDELINES:

Each student should undergo training in software industry or related field for a minimum period of 4 weeks during IV Semester summer vacation. Student has to produce his/her Internship completion certificate from the concerned organization when the college reopens for V Semester.

SEMESTER VI

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 – 29
PART: III	COURSE COMPONENT: CORE - XII
COURSE NAME: MACHINE LEARNING FOR INTELLIGENT SYSTEMS	COURSE CODE: 26UCAI312
SEMESTER: VI	MARKS: 100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

To understand basic concepts of machine learning, to evaluate models generated from data, to discover how to build machine learning algorithms, prepare data, and use different techniques using Python

COURSE OUTCOMES:

1. Apply machine learning algorithms and techniques
2. Design machine learning solutions and measure their effectiveness.
3. Prepare datasets and apply appropriate machine learning techniques
4. Select and apply suitable datasets for machine learning algorithms.
5. Analyze and apply machine learning algorithms to solve real-world problems

UNIT I

12 Hours

Introduction: Machine Learning Foundations – Overview – Design of a Learning System –Types of Machine Learning – Supervised Learning and Unsupervised Learning – Applications of Machine Learning – Tools Overview for ML.

UNIT II

12 Hours

Supervised Learning – I: Simple Linear Regression – Multiple Linear Regression – Ridge Regression – Evaluating Regression Models – Model Selection.

UNIT III

12 Hours

Supervised Learning – II: Classification – Logistic Regression – Decision Tree Regression and Classification – Random Forest Regression – Bagging – Ensemble Methods and Classification – Support Vector Machine Regression and Classification - Evaluating Classification Models.

UNIT IV

12 Hours

Unsupervised Learning: Clustering – K-Means Clustering – Density-Based Clustering – Dimensionality Reduction – Collaborative Filtering.

Association Rule Learning: Association Rule Learning – Concepts related to ARL – ARL Algorithms - Apriori – Eclat – Concepts and Algorithms.

RECOMMENDED TEXTBOOKS:

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.

REFERENCE BOOKS:

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
2. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
3. Sebastian Raschka, Vahid Mirjalili, ” Python Machine Learning and deep learning”, 2nd edition, kindle book, 2018
4. Carol Quadros,” Machine Learning with python, scikit-learn and Tensorflow”, Packet Publishing, 2018
5. Gavin Hackeling,” Machine Learning with scikit-learn”, Packet publishing, O'Reilly, 2018

E-LEARNING RESOURCES:

1. <https://www.kaggle.com/discussions/general/196686>
2. <https://www.tensorflow.org/resources/learn-ml>
3. https://github.com/mdozmorov/MachineLearning_notes
4. <https://developers.google.com/machine-learning/crash-course>
5. <https://www.ibm.com/topics/machine-learning>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer any 10 out of 12 questions (each in 50 words)</i>	<i>1-12</i>	<i>3</i>	<i>30</i>
B	<i>Answer any 5 out of 7 questions (each in 300 words)</i>	<i>13-19</i>	<i>6</i>	<i>30</i>
C	<i>Answer any 4 out of 6 questions (each in 1200 words)</i>	<i>20-25</i>	<i>10</i>	<i>40</i>
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	3	1	1
II	2	1	1
III	3	2	1
IV	2	1	2
V	2	2	1
TOTAL	12	7	6
SECTION A - 12		SECTION B - 7	SECTION C – 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	3	2	2	1
CO 2	3	3	3	2	2
CO 3	3	3	3	2	2
CO 4	3	3	2	1	3
CO 5	3	3	3	3	2
Ave.	3.0	3.0	2.6	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	2	1
CO 2	3	3	3	2	2
CO 3	3	3	3	2	2
CO 4	3	3	2	1	3
CO 5	3	3	3	3	2
Ave.	3.0	3.0	2.6	2.0	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To implement different machine learning algorithm techniques	PO1, PO2, PO4	PSO1, PSO2	K3
CO2	To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models	PO1, PO2, PO3, PO4, PO5	PSO1, PSO2, PSO3, PSO5	K3, K4, K5
CO3	To build machine learning algorithms, prepare data, and use different techniques	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3	K3, K6
CO4	To apply appropriate data sets to the Machine Learning algorithms.	PO1, PO2, PO3	PSO1, PSO2, PSO3	K3
CO5	To identify and apply Machine Learning algorithms to solve real world problems	PO1, PO2, PO3, PO4, PO5	PSO1, PSO2, PSO3, PSO4, PSO5	K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

MACHINE LEARNING FOR INTELLIGENT SYSTEMS (Theory)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Any topic related to the course	10	5
Workbook/Record book/Notebook	Notebook	10	5
Class activity 1	Case-Study analysis	10	5
Class activity 2	Seminar / Presentation,	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARITIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: CORE - XIII
COURSE NAME: INTERNET OF THINGS	COURSE CODE: 26UCAI313
SEMESTER: VI	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

To understand the concepts of Internet of Things and the application of IoT

COURSE OUTCOMES:

1. Apply devices, gateways, and data management techniques in IoT systems
2. Design IoT applications in different domain and be able to analyses their performance
3. Implement basic IoT applications on embedded platform
4. Analyze Industrial Internet of Things (IIoT) concepts and applications
5. Evaluate privacy and security issues in IoT system

UNIT I

12 Hours

IoT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

UNIT II

12 Hours

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT III

12 Hours

IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

UNIT IV**12 Hours**

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

UNIT V**12 Hours**

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

RECOMMENDED TEXTBOOKS:

1. Vijay Madiseti and Arshdeep Bahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition.

REFERENCE BOOKS:

1. Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", kindle version.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications 2013, 1st Edition,.
3. WaltenegusDargie, ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice" 4..CunoPfister, "Getting Started with the Internet of Things", O'Reilly Media 2011

E-LEARNING RESOURCES:

1. <https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT>
2. <https://link.springer.com/book/10.1007/978-3-030-77528-5>
3. <https://www.ibm.com/topics/internet-of-things>
4. <https://www.fracttal.com/en/blog/the-9-most-important-applications-of-the-internet-of-things>
5. <https://www.slideshare.net/slideshow/internet-of-things-and-its-applications/9816846>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer any 10 out of 12 questions (each in 50 words)</i>	<i>1-12</i>	<i>3</i>	<i>30</i>
B	<i>Answer any 5 out of 7 questions (each in 300 words)</i>	<i>13-19</i>	<i>6</i>	<i>30</i>
C	<i>Answer any 4 out of 6 questions (each in 1200 words)</i>	<i>20-25</i>	<i>10</i>	<i>40</i>
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	3	1	1
II	2	1	1
III	3	2	1
IV	2	1	2
V	2	2	1
TOTAL	12	7	6
SECTION A - 12		SECTION B – 7	SECTION C - 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	2	2	1	2
CO 2	3	3	3	2	2
CO 3	3	3	2	2	2
CO 4	3	2	2	2	2
CO 5	2	3	3	3	2
Ave.	2.8	2.6	2.4	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	3	1	2	2
CO 2	3	3	3	2	3
CO 3	3	3	2	3	2
CO 4	2	2	2	3	3
CO 5	2	2	3	2	3
Ave.	2.4	2.6	2.2	2.4	2.6

PO- PSO-CO-QUESTION PAPER MAPPING

CO No	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Use of Devices, Gateways and Data Management in IoT.	PO1, PO2, PO3	PSO2, PSO4, PSO5	K2, K3
CO2	Design IoT applications in different domain and be able to analyses their performance	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3, PSO5	K3, K4, K6
CO3	Implement basic IoT applications on embedded platform	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4	K3, K6
CO4	To gain knowledge on Industry Internet of Things	PO1, PO2, PO5	PSO2, PSO4, PSO5	K2, K3
CO5	To Learn about the privacy and Security issues in IoT	PO2, PO3, PO5	PSO3, PSO4, PSO5	K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

INTERNET OF THINGS (Theory)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Any topic related to the course	10	5
Workbook/Record book/Notebook	Notebook	10	5
Class activity 1	Group Activity	10	5
Class activity 2	Seminar /Presentation	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARITIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: CORE - XIV
COURSE NAME: NATURAL LANGUAGE PROCESSING	COURSE CODE: 26UCAI314
SEMESTER: VI	MARKS: 100
CREDITS: 4	TOTAL HOURS: 60
THEORY AND PROBLEMS	

COURSE OBJECTIVE:

To grasp the significance of natural language processing in solving real-world problems, appropriate processing technique to a problem and implement the technique.

COURSE OUTCOMES:

1. Describe the fundamental concepts and techniques of natural language processing
2. Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each
3. Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions
4. Examine large volumes of text data from diverse real-world applications.
5. Analyze and design NLP techniques for handling large text collections

UNIT I

12 Hours

Introduction: Overview: Origins and challenges of NLP- Theory of Language Features of Indian Languages – Issues in Font –Models and Algorithms- NLP Applications.

UNIT II

12 Hours

Morphology and Parts-of-Speech: Phonology – Computational Phonology - Words and Morphemes – Segmentation – Categorization and Lemmatization – Word Form Recognition – Valency - Agreement - Regular Expressions – Finite State Automata – Morphology-Morphological issues of Indian Languages – Transliteration.

UNIT III

12 Hours

Probabilistic Models: Probabilistic Models of Pronunciation and Spelling - Weighted Automata - N-Grams - Corpus Analysis - Smoothing - Entropy - Parts-of-Speech - Taggers - Rule based - Hidden Markov Models - Speech Recognition.

UNIT IV

12 Hours

Syntax: Basic Concepts of Syntax – Parsing Techniques – General Grammar rules for Indian Languages – Context Free Grammar – Parsing with Context Free Grammars – Top-Down Parser – Earley Algorithm – Features and Unification - Lexicalised and Probabilistic Parsing.

UNIT V

12 Hours

Semantics and Pragmatics: Representing Meaning - Computational Representation - Meaning Structure of Language - Semantic Analysis - Lexical Semantics - WordNet - Pragmatics -Discourse - Reference Resolution - Text Coherence - Dialogue Conversational Agents

RECOMMENDED TEXTBOOKS:

1. Ronald Hausser, “Foundations of Computational Linguistics”, Springer-Verleg, 1999.

REFERENCE BOOKS:

1. Daniel Jurafsky and James H. Martin “Speech and Language Processing”, Prentice Hall, 2009.
2. Christopher D.Manning and Hinrich Schutze, “Foundation of Statistical Natural Language Processing”, MIT Press, 1999.
3. James Allen, “Natural Language Understanding”, Benjamin/Cummings Publishing Co. 1995.
4. Applied Natural Language Processing with Python: Implementing Machine Learning and Deep Learning Algorithms for Natural Language Processing, By Taweh Beysolow II, September 2018
5. Singh, Jyotika. Natural Language Processing in the Real World: Text Processing, Analytics, and Classification. CRC Press, 2023

E - LEARNING RESOURCES:

1. <https://nptel.ac.in/courses/106105158>
2. <https://blog.algorithmia.com/introduction-natural-language-processingnlp/>
3. <https://www.udacity.com/course/natural-language-processingnanodegree--nd892>
4. <https://www.coursera.org/learn/language-processing>
5. <https://towardsdatascience.com/a-practitioners-guide-to-naturallanguage-processing-part-i-processing-understanding-text-9f4abfd13e72>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer any 10 out of 12 questions	1 – 12	3	30
B	Answer any 5 out of 7 questions	13 – 19	6	30
C	Answer any 4 out of 6 questions	20 – 25	10	40
TOTAL MARKS				100

BREAK UP OF QUESTIONS FOR THEORY

UNITS	SECTION A	SECTION B	SECTION C
I	2	1	1
II	2	1	1
III	2	1	1
IV	2	1	1
V	2	1	1
Any Unit	2	2	1
TOTAL	12	7	6
SECTION A – 12		SECTION B – 7	SECTION C - 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	2	2	2	1
CO 2	3	2	3	2	2
CO 3	2	2	2	2	2
CO 4	3	3	3	2	3
CO 5	3	3	3	2	2
Ave.	2.8	2.4	2.6	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	1	2	1	2
CO 2	3	2	3	2	2
CO 3	2	2	2	2	2
CO 4	3	3	3	3	2
CO 5	3	3	3	2	2
Ave.	2.8	2.2	2.6	2.0	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No	COURSE OUTCOME	PSOs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Describe the fundamental concepts and techniques of natural language processing	PO1, PO2, PO3	PSO1, PSO3	K1, K2
CO2	Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each	PO1, PO2, PO3	PSO1, PSO3	K4
CO3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions	PO3, PO4, PO5	PSO2, PSO3, PSO4	K3, K4
CO4	Examine large volumes of text data from diverse real-world applications.	PO1, PO2, PO3	PSO1, PSO2, PSO3, PSO5	K4
CO5	Analyze and design NLP techniques for handling large text collections	PO1, PO2, PO3, PO4, PO5	PSO1, PSO2, PSO3, PSO4, PSO5	K3, K5, K6

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

NATURAL LANGUAGE PROCESSING (Theory)

Continuous Internal Assessment – Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Any topic related to the course	10	5
Workbook/Record book/Notebook	Notebook	10	5
Class activity 1	Group Discussion	10	5
Class activity 2	Case-Study Analysis	10	5
Class activity 3	Seminar/Presentation	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARITIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: CORE - XV
COURSE NAME: PRACTICAL - VI: MACHINE LEARNING & NLP APPLICATIONS	COURSE CODE: 26UCAI315P
SEMESTER: VI	MARKS:100
CREDITS: 4	TOTAL HOURS:60
PRACTICAL	

COURSE OBJECTIVE:

This course to understand the mathematical and statistical perspectives of machine learning algorithms through python programming.

COURSE OUTCOMES:

1. Perform basic NLP techniques for text preprocessing.
2. Analyze and extract information from text data
3. Apply data handling techniques using Python libraries
4. Develop and evaluate Machine Learning models.
5. Implement ML and NLP techniques for real-world problems.

LAB EXERCISES:

Part A: Natural Language Processing Applications

1. Tokenize a given text.
2. Extract sentences from a text document.
3. Tokenize text using stop words as delimiters.
4. Remove stop words and punctuation from text.
5. Perform stemming on a given text.
6. Perform lemmatization on a given text.
7. Extract usernames from email IDs using regular expressions.
8. Find the most common words excluding stop words.
9. Implement spell correction for a given text.
10. Perform sentiment analysis (positive/negative classification).
11. Extract noun phrases and verb phrases from text.
12. Identify the root word of words in a sentence.
13. Load a dataset (CSV) into a DataFrame and display structure (shape, type, sample rows).
14. Find synonyms and antonyms using lexical resources.
15. Generate and display random labeled names from a corpus.

Part B: Machine Learning Applications

16. Implement Simple and Multiple Linear Regression.
17. Implement Polynomial Regression.
18. Implement Bagging technique.
19. Implement AdaBoost algorithm.
20. Implement Logistic Regression.
21. Demonstrate Decision Tree Classification.
22. Implement Random Forest Classification.
23. Implement Support Vector Machine (SVM) Classification.
24. Perform K-Means Clustering.
25. Perform Density-Based Clustering.
26. Implement Apriori algorithm for Market Basket Analysis.
27. Compare performance of different supervised learning algorithms.

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	3	2	2	2
CO 2	3	3	3	1	2
CO 3	3	3	2	2	2
CO 4	3	3	3	3	2
CO 5	3	3	3	2	2
Ave.	3.0	3.0	2.6	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	2
CO 2	3	2	3	2	2
CO 3	2	3	2	2	2
CO 4	3	3	3	1	2
CO 5	3	3	3	2	2
Ave.	2.8	2.8	2.6	2.0	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Perform basic NLP techniques for text preprocessing.	PO1, PO2, PO3	PSO1, PSO2	K3
CO2	Analyze and extract information from text data	PO1, PO2, PO3	PSO1, PSO3	K4
CO3	Apply data handling techniques using Python libraries	PO1, PO2, PO4	PSO2, PSO4, PSO5	K3
CO4	Develop and evaluate Machine Learning models.	PO1, PO2, PO3, PO4, PO5	PSO1, PSO2, PSO3	K3, K4, K5
CO5	Implement ML and NLP techniques for real-world problems.	PO1, PO2, PO3, PO4, PO5	PSO1, PSO2, PSO3, PSO4, PSO5	K3, K4, K6

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

MACHINE LEARNING & NLP APPLICATIONS (Practical)

Continuous Internal Assessment – Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Practical examination with programming/problem-solving tasks for 90 minutes	50	10
Model Examination	Practical examination with programming/problem-solving tasks for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/Record book/Notebook	Handwritten record of experiments, observations, results and conclusions	10	5
Class activity 1	Debugging Test	10	5
Class activity 2	Problem-Solving Exercise	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARTIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: CORE - XVI
COURSE NAME: PROJECT	COURSE CODE: 26UCAI316
SEMESTER: VI	MARKS: 100
CREDITS: 4	TOTAL HOURS: 60
PRACTICAL	

Students should develop a software application in small scale, based on the concepts they have learnt in the previous five semesters the programme. It may be based on Database concepts, Object Oriented Programming concepts, Web development, Data Science, Machine Learning, Internet of Things and Big Data etc. Students can take individual or group project.

COURSE OBJECTIVE:

To demonstrate the ability to analyze requirements, identify challenges, and devise effective solutions to solve real world problems.

COURSE OUTCOMES:

1. Apply domain specific theories, principles, and methodologies to design and execute meaningful projects.
2. Identify complex problems and develop innovative, practical, and multidisciplinary solutions.
3. Demonstrate the ability to conduct research, analyse data, and interpret findings to support informed decision making.
4. Integrate ethical practices, sustainability, and social responsibility into project work, contributing positively to society.
5. Present and document project outcomes, while cultivating adaptability and continuous learning.

GUIDELINES:

- A student is expected to complete planning, analysing, designing and implementing the project in 3 months timeframe.
- Each individual students' contribution is mandatory for internal assessment and to appear for the final viva.

EVALUATION:

Internal assessment will be based on initial project proposal, two reviews and a comprehensive final report of the project. External assessment will be based on the presentation of the project work and Viva Voce.

PROJECT

Continuous Internal Assessment – Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Practical examination with programming/problem-solving tasks for 90 minutes	50	10
Model Examination	Practical examination with programming/problem-solving tasks for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/Record book/Notebook	Handwritten record of experiments, observations, results and conclusions	10	5
Class activity 1	Debugging Test	10	5
Class activity 2	Problem-Solving Exercise	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARITIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: ELECTIVE-III
COURSE NAME: INFORMATION SECURITY	COURSE CODE: 26UCAI3E3
SEMESTER: VI	MARKS: 100
CREDITS: 5	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVE:

To learn fundamentals of cryptography, network security threats, security services, authentication, firewalls; intrusion detection techniques and countermeasures.

COURSE OUTCOMES:

1. Analyze risks faced by computer systems and networks
2. Identify and analyze security issues in computer systems and network
3. Explain the functioning of standard security mechanisms
4. Design security mechanisms to protect computer systems and networks
5. Apply cryptographic algorithms and protocols to achieve computer security

UNIT I

15 Hours

Introduction to Information Security: Attacks, Vulnerability, Security Goals, Security Services and mechanisms

UNIT II

15 Hours

Conventional Cryptographic Techniques: Conventional substitution and transposition ciphers, One-time Pad, Block cipher and Stream Cipher, Steganography.

UNIT III

15 Hours

Symmetric and Asymmetric Cryptographic Techniques: DES, AES, RSA algorithms
Authentication and Digital Signatures: Use of Cryptography for authentication, Secure Hash function, Key management – Kerberos.

UNIT IV

15 Hours

Program Security: Non malicious Program errors – Buffer overflow, Incomplete mediation,

Time-of-check to Time-of-use Errors, Viruses, Trapdoors, Salami attack, Man-in-the-middle attacks, Covert channels

UNIT V

15 Hours

Security in Networks: Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP, S/MIME.

RECOMMENDED TEXTBOOKS:

1. Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education.

REFERENCE BOOKS:

1. Cryptography And Network Security Principles and Practice, Fourth or Fifth Edition, William Stallings, Pearson
2. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall.
3. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall.

E-LEARNING RESOURCES:

1. <https://www.cisa.gov/resources-tools/resources/free-cybersecurity-services-and-tools>
2. <https://guides.library.cmu.edu/c.php?g=572612&p=3948772>
3. <https://vigitrust.com/cybersecurity-awareness-resources/>
4. <https://www.getcybersafe.gc.ca/en/resources>
5. <https://www.cyberdegrees.org/resources/the-big-list/>

GUIDELINES TO THE QUESTION PAPER SETTERS QUESTION PAPER PATTERN

UNITS	SECTION A	SECTION B	SECTION C
I	3	1	1
II	2	1	1
III	3	2	1
IV	2	1	2
V	2	2	1
TOTAL	12	7	6
SECTION A – 12		SECTION B – 7	SECTION C – 6

BREAK UP OF QUESTIONS

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer any 10 out of 12 questions (each in 50 words)</i>	<i>1-12</i>	<i>3</i>	<i>30</i>
B	<i>Answer any 5 out of 7 questions (each in 300 words)</i>	<i>13-19</i>	<i>6</i>	<i>30</i>
C	<i>Answer any 4 out of 6 questions (each in 1200 words)</i>	<i>20-25</i>	<i>10</i>	<i>40</i>
TOTAL MARKS				100

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	2	2	2	2
CO 2	3	3	3	2	2
CO 3	3	2	2	2	2
CO 4	3	3	3	2	2
CO 5	3	3	2	2	2
Ave.	3.0	2.6	2.4	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	2	2	3	1
CO 2	2	2	3	3	2
CO 3	2	2	2	3	2
CO 4	3	3	3	3	3
CO 5	3	3	2	3	2
Ave.	2.4	2.4	2.4	3.0	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Analyze risks faced by computer systems and networks	PO1, PO2, PO3	PSO3, PSO4	K1, K2
CO2	Identify and analyze security issues in computer systems and network	PO1, PO2, PO3	PSO3, PSO4	K4
CO3	Explain the functioning of standard security mechanisms	PO1, PO2, PO3	PSO2, PSO4	K2
CO4	Design security mechanisms to protect computer systems and networks	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3, PSO4	K3, K6
CO5	Apply cryptographic algorithms and protocols to achieve computer security	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO4	K3, K4

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

INFORMATION SECURITY (Theory)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Any topic related to the course	10	5
Workbook/Record book/Notebook	Notebook	10	5
Class activity 1	Case-Study analysis	10	5
Class activity 2	Quiz with MCQ	10	5
Class activity 3	Group Discussion	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARITIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: ELECTIVE – III
COURSE NAME: ROBOTICS AND ITS APPLICATIONS	COURSE CODE: 26UCAI3E6
SEMESTER: VI	MARKS: 100
CREDITS: 5	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVE:

To make the students familiar with the various drive systems of robots, sensors and their applications in robots

COURSE OUTCOMES:

1. Explain components, working principles, and types of robots
2. Compare different robot architecture designs.
3. Model simple manipulator and mobile robots mathematically
4. Analyze kinematic models of robotic systems
5. Evaluate manipulation and navigation using coordinate frames

UNIT I

15 Hours

Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.

UNIT II

15 Hours

Actuators and sensors: Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge-based force torque sensor-proximity and distance measuring sensors

Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot.

UNIT III

15 Hours

Localization: Self-localizations and mapping - Challenges in localizations - IR based localizations - vision-based localizations - Ultrasonic based localizations - GPS localization systems.

UNIT IV

15 Hours

Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement-image data compression-visual inspection-software considerations

UNIT V

15 Hours

Application: Ariel robots-collision avoidance robots for agriculture-mining exploration-underwater-civilian- and military applications-nuclear applications-space applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning

RECOMMENDED TEXTBOOKS:

1. Richard D. Klafter, Thomas Achmielewski and Mickael Negin, Robotic Engineering and Integrated Approach, Prentice Hall India-New Delhi-2001.
2. Saeed B. Nikku, Introduction to robotics, analysis, control and applications, Wiley India, 2nd edition 2011

REFERENCE BOOKS:

1. Industrial robotic technology-programming and application by M.P. Groover et al., McGraw Hill 2008
2. Robotics technology and flexible automation by S.R. Deb, THH-2009

E-LEARNING RESOURCES:

1. <https://www.intel.com/content/www/us/en/robotics/types-and-applications.html>
2. <https://www.motoman.com/en-us/applications>
3. <https://www.hp.com/us-en/shop/tech-takes/everyday-robotics>
4. <https://www.slideshare.net/slideshow/robotics-30421670/30421670>
5. <https://ifr.org/>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer any 10 out of 12 questions (each in 50 words)</i>	<i>1-12</i>	<i>3</i>	<i>30</i>
B	<i>Answer any 5 out of 7 questions (each in 300 words)</i>	<i>13-19</i>	<i>6</i>	<i>30</i>
C	<i>Answer any 4 out of 6 questions (each in 1200 words)</i>	<i>20-25</i>	<i>10</i>	<i>40</i>
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	3	1	1
II	2	1	1
III	3	2	1
IV	2	1	2
V	2	2	1
TOTAL	12	7	6
SECTION A - 12		SECTION B – 7	SECTION C – 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	2	1	2	1
CO 2	3	2	2	1	2
CO 3	3	3	3	2	2
CO 4	3	2	3	3	2
CO 5	3	3	3	2	3
Ave.	3.0	2.4	2.4	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	2	1	2	1
CO 2	3	1	2	2	2
CO 3	3	2	3	2	2
CO 4	3	3	3	2	2
CO 5	3	2	3	2	3
Ave.	3.0	2.0	2.4	2.0	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Explain components, working principles, and types of robots	PO1, PO2	PSO1, PSO4	K1, K2
CO2	Compare different robot architecture designs.	PO1, PO3	PSO1, PSO5	K2
CO3	Model simple manipulator and mobile robots mathematically	PO1, PO2, PO3	PSO1, PSO3, PSO5	K3, K4
CO4	Analyze kinematic models of robotic systems	PO1, PO3	PSO1, PSO3	K2, K4
CO5	Evaluate manipulation and navigation using coordinate frames	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3, PSO5	K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

ROBOTICS AND ITS APPLICATIONS (Theory)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Any topic related to the course	10	5
Workbook/Record book/Notebook	Notebook	10	5
Class activity 1	Seminar / Presentation,	10	5
Class activity 2	Group Activity	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			

PROGRAMME: B.Sc., COMPUTE SCIENCE WITH ARITIFICIAL INTELLIGENCE	BATCH: 2026 - 29
PART: III	COURSE COMPONENT: ELECTIVE-III
COURSE NAME: ARTIFICIAL NEURAL NETWORKS	COURSE CODE: 26UCAI3E7
SEMESTER: VI	MARKS: 100
CREDITS: 5	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVE:

To understand the biological neural network, model equivalent neuron models, architecture and learning algorithms

COURSE OUTCOMES:

1. Analyze neurodynamic models for various problem domains
2. Differentiate biological and artificial neural networks
3. Apply learning rules to train neural networks
4. Examine forward and backward propagation mechanisms
5. Develop Hopfield network models

UNIT I

15 Hours

Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process.

UNIT II

15 Hours

Single Layer Perceptron's: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment

Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection.

UNIT III

15 Hours

Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning.

UNIT IV

15 Hours

Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

UNIT V

15 Hours

Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm Hopfield Models – Hopfield Models, restricted boltzman machine

RECOMMENDED TEXTBOOKS:

1. Neural Networks a Comprehensive Foundations, Simon S Haykin, PHI Ed.,
2. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

REFERENCE BOOKS:

1. Neural Networks in Computer Intelligence, Li Min Fu TMH 2003
2. Neural Networks -James A Freeman David M S Kapura Pearson Ed., 2004.
3. Artificial Neural Networks – B. Vegnanarayana Prentice Hall of India P Ltd 2005

E-LEARNING RESOURCES:

1. <https://www.geeksforgeeks.org/artificial-neural-networks-and-its-applications/>
2. <https://www.ibm.com/topics/neural-networks>
3. <https://developer.nvidia.com/discover/artificial-neural-network>
4. <https://www.simplilearn.com/tutorials/deep-learning-tutorial/neural-network>
5. <https://www.arm.com/glossary/artificial-neural-network>

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer any 10 out of 12 questions (each in 50 words)</i>	<i>1-12</i>	<i>3</i>	<i>30</i>
B	<i>Answer any 5 out of 7 questions (each in 300 words)</i>	<i>13-19</i>	<i>6</i>	<i>30</i>
C	<i>Answer any 4 out of 6 questions (each in 1200 words)</i>	<i>20-25</i>	<i>10</i>	<i>40</i>
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	3	1	1
II	2	1	1
III	3	2	1
IV	2	1	2
V	2	2	1
TOTAL	12	7	6
SECTION A - 12		SECTION B - 7	SECTION C – 6

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO5
CO 1	3	3	2	1	1
CO 2	3	2	2	1	2
CO 3	3	3	3	3	2
CO 4	3	3	2	2	3
CO 5	3	3	3	3	2
Ave.	3.0	2.8	2.4	2.0	2.0

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	2	3	2	1
CO 2	3	1	2	1	2
CO 3	3	3	3	2	2
CO 4	3	2	2	3	3
CO 5	3	3	3	2	2
Ave.	3.0	2.2	2.6	2.0	2.0

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs ADDRESSED	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Analyze neurodynamic models for various problem domains	PO1, PO2, PO3	PSO1, PSO3	K2, K3
CO2	Differentiate biological and artificial neural networks	PO1, PO3	PSO1, PSO5	K2
CO3	Apply learning rules to train neural networks	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3	K3, K4
CO4	Examine forward and backward propagation mechanisms	PO1, PO2, PO3	PSO1, PSO2	K2, K3
CO5	Develop Hopfield network models	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3	K3, K6

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

ARTIFICIAL NEURAL NETWORKS (Theory)

Continuous Internal Assessment - Components			
Assessment Type	Nature	Maximum Marks	Weightage
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Any topic related to the course	10	5
Workbook/Record book/Notebook	Notebook	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Case-Study Analysis	10	5
Class activity 3	Seminar / Presentation	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50
The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed) 1) Quiz with MCQ 2) Case-Study analysis 3) Debate 4) Seminar/ Presentation 5) Peer/Self-Assessment 6) Role play 7) Scrap book 8) Monograph 9) Puzzle 10) Group Discussion 11) Group activity 12) Surprise class tests			