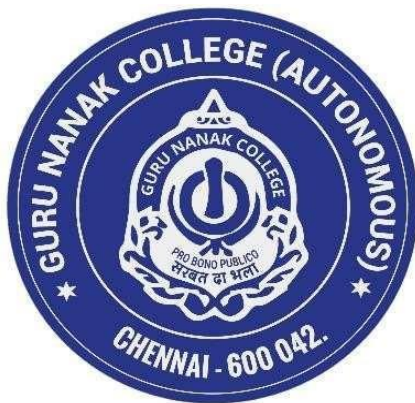


GURU NANAK COLLEGE (AUTONOMOUS)

(Affiliated to University of Madras and Accredited at 'A++' Grade by NAAC)

Guru Nanak Salai, Velachery, Chennai - 600042



SCHOOL OF INFORMATION TECHNOLOGY

M.Sc. Computer Science with Artificial Intelligence

(SEMESTER PATTERN WITH CHOICE BASED CREDIT SYSTEM)

LEARNING OUTCOME BASED CURRICULUM FRAMEWORK

(For the candidates admitted in the Academic year 2025-27 and hereafter)

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LEARNING OUTCOME BASED CURRICULUM FRAMEWORK

(For the UG batch of 2025-27 and thereafter)

PREAMBLE

The two-year, methodically planned **M.Sc. Computer Science with Artificial Intelligence** curriculum focuses on artificial intelligence (AI) and aims to provide students with advanced knowledge and practical skills in both core computer science concepts and cutting-edge AI technologies. This multidisciplinary programme prepares graduates for success in the rapidly evolving fields of automation, data science, machine learning, and AI by blending academic knowledge with real-world experience. The extensive curriculum covers a wide range of topics, including computer vision, natural language processing, machine learning, deep learning, big data analytics, data science, and AI ethics. By exploring both the ethical and technological aspects of AI, students will develop the ability to create intelligent systems capable of solving complex problems across various sectors. Students will have access to state-of-the-art labs, tools, and resources, enabling them to engage in both research and hands-on projects. The programme employs a mix of lectures, seminars, group projects, and individual study to foster creativity, critical thinking, and problem-solving skills. While mastering AI technologies, students will also emphasize the importance of communication and collaboration, preparing them to work effectively in multidisciplinary teams. Graduates will be well-equipped to assume leadership roles in AI-related industries or pursue further academic research in computer science and AI. By the end of the programme, students will possess a robust understanding of the fundamental concepts, challenges, and opportunities of AI, empowering them to contribute meaningfully to the development and future advancement of intelligent technologies.

VISION

- To develop the technical, analytical, and ethical skills necessary for success in AI, preparing professionals to address current and future challenges in the field.

MISSION

- To equip students with the skills and knowledge needed to solve real-world problems using AI.
- To focus on developing creativity, critical thinking, and ethical decision-making, preparing graduates to lead in the AI field.
- To provide hands-on experience and research opportunities, students will be equipped to tackle both current and future AI challenges.

PROGRAM EDUCATIONAL OUTCOMES (PEOs)

PEO 1: Values of Life, Ethics & Social Concern

The graduates exhibit truth, loyalty, and love as integral moral principles, thereby contributing to a society characterized by enhanced well-being and fundamental goodness in behavior.

PEO 2: Employability & Entrepreneurship

The graduates apply analytical, logical, and critical problem-solving skills in professional contexts, elevating employability and cultivating entrepreneurial capabilities through upskilling.

PEO 3: Regional/National/Global Relevance & Competency

The graduates foster advanced analytical skills and a heightened appreciation for current Regional/National/Global perspectives, enabling informed and sustainable decision-making in a dynamic environment.

PEO 4: Skill Enhancement, Self-Directed & Lifelong Learning

The graduates independently engage in skill-based learning, utilizing infrastructure and opportunities for continuous upskilling, enabling self-evaluation and lifelong excellence attainment.

PEO 5: Research Skills & Innovation

The graduates proficiently apply scientific reasoning, fostering creativity, strategic thinking, and effective problem-solving skills. They demonstrate a core competency in generating innovative ideas for advancements and inventions.

PROGRAMME OUTCOMES

PO 1: Having the ability to develop software that aids society to minimize the effort.

PO 2: Having the ability to employ techniques, skills, and modern hardware and software tools necessary to meet the current demand of the IT Industry.

PO 3: Having Regional/National/Global Competency and being employable.

PO 4: Have the ability to independently engage in Self-directed learning and an inclination to life-long learning and upskilling.

PO 5: Demonstrate competency in generating innovative ideas for advancements and inventions.

PROGRAMME SPECIFIC OUTCOMES

PSO 1: Attain in-depth knowledge of AI, machine learning, and computer science, enabling them to solve complex problems in diverse fields.

PSO 2: Apply theoretical knowledge to real-world scenarios, using cutting-edge AI technologies and tools to develop innovative solutions.

PSO 3: Demonstrate a strong understanding of the ethical implications of AI, ensuring responsible, transparent, and unbiased applications of AI systems.

PSO 4: Enhance their skills through research, professional development, and adapting to emerging AI trends and technologies.

PSO 5: Lead roles in AI projects and collaborate effectively with multidisciplinary teams to address complex environmental and other real-world challenges.

PEO – PO MAPPING

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

PO – PSO MAPPING

	PO 1	PO2	PO3	PO4	PO5
PSO 1	3	3	3	3	3
PSO 2	3	3	3	3	3
PSO3	3	3	3	3	2
PSO 4	3	3	3	3	3
PSO 5	3	3	3	3	3

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 subject paper 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 UG programme should have passed the higher Secondary Examinations (Academic or Vocational Stream) 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.

For B.Com. (Hons): Candidates admitted to the first year of the B.Com. (Hons.) programme should have passed the higher secondary examinations conducted by the Government of Tamil Nadu or an examination accepted as equivalent thereof by the Syndicate of the University of Madras with 75 % cut-off in Commerce/Business studies, Accountancy, Economics and Business Mathematics/ Mathematics.

For MBA: The basic requirement for admission to the MBA programme is a Bachelor's degree in any discipline with a minimum of 50% marks in aggregate and satisfactory test score in MAT Entrance Test conducted by AIMA, New Delhi / TANCET for MBA conducted by Government of Tamil Nadu / CAT / XAT or any other approved MBA Entrance Tests.

For MCA: Only those candidates who have passed B.C.A/B.Sc. in Computer Science or any other equivalent degree OR passed B.Sc./B.Com/BA with Mathematics at 10 + 2 level or at graduation level (with Optional bridge course in Mathematics), provided they have undergone the course under 10+2+3 pattern and obtained at least 50% of marks (45 % marks in case of candidates belonging to reserved category) in the qualifying examination shall be eligible for admission to the M.C.A. Programme.

For M.Sc. Computer Science With Artificial Intelligence: Only those candidates who have passed B.C.A/B.Sc. in Computer Science/B.Sc. Information Technology/B.Sc. Data Analytics/B.Sc. Data Science or any other equivalent degree at 10 + 2 level or at graduation level (with Optional bridge course in Mathematics), provided they have undergone the course under 10+2+3 pattern and obtained at least 50% of marks (45 % marks in case of candidates belonging to reserved category) in the qualifying examination shall be eligible for admission to the M.Sc. Computer Science With Artificial Intelligence Programme.

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) Main subject (b) Elective subjects related to the main subject of study and project work.

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, and taken 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.

Soft Skills (I, II, III & IV Semesters)

Self-Study (Compulsory) Course (III Semester)

Environmental Studies (IV Semester)

Value Education (V Semester)

Summer Internship (After IV 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.

COURSE STRUCTURE

The UG programme consists of 15-19 Core courses with 3-4 credits for each paper, 3 Elective courses and 4 Allied courses with 4-5 credits for each paper in addition to 4 Soft Skill courses with two credits each. Internship as a compulsory component carries 2 credits. The B.Com. (Hons) course has 31 core courses of 4 credits each and project with 8 credits.

The MBA programme has 15 core courses including project work with 4 credits, 6 elective courses with 3 credits, 2 extra disciplinary courses with 3 credits, Four Soft Skill courses with two credits each.

The MCA programme has 15 core courses of 2-4 credits, 5 Elective courses of 3 credits, 2 Extra-disciplinary courses of 3 credits and a project work of 17 credits.

The M.Sc. Computer Science with Artificial Intelligence programme has 14 core courses of 4 credits, 6 Elective courses of 3 credits, 4 Skill Enhancement courses of 2 credits and a project work of 13 credits.

Internship training is a compulsory component for all the UG & PG programmes.

The details of the course structure are given in the following table:

M.Sc. Computer Science and Artificial Intelligence
Credit distribution for each semester

Semester I		Subject	Hrs. /Week	Credit	Marks		Total
Course Component					Internals	External s	
Part III	Core - I	Analysis and Design of Algorithms	5	4	50	50	100
	Core - II	Artificial Intelligence and Expert Systems	5	4	50	50	100
	Core - III	Advanced Java Programming	5	4	50	50	100
	Elective - I	Mathematics for Computer Science/Discrete Mathematics	5	3	50	50	100
	Core - IV	Practical - I: Algorithm Lab	4	3	50	50	100
	Core - V	Practical - II: Advanced Java Programming Lab	4	3	50	50	100
Part IV	Skill Enhancement Course SEC - I	Communication and Presentation Skill	2	2	50	50	100
	Total		30	23			

Semester II		Subject	Hrs. /Week	Credit	Marks		Total
Course Component					Internals	External s	
Part III	Core - VI	Machine Learning with Python	5	4	50	50	100
	Core - VII	Data Science Analytics	5	4	50	50	100
	Elective - II	Advanced Operating Systems/ Social Network Analysis using AI / Blockchain Technology	5	3	50	50	100
	Elective - III	Probability and Statistics / Statistics for Artificial Intelligence	5	3	50	50	100

	Core - VIII	Practical - III: Machine Learning Lab	4	3	50	50	100
	Core - IX	Practical - IV: Data Science Analytics Lab	4	3	50	50	100
Part IV	Skill Enhancement Course SEC - II	Quantitative Aptitude	2	2	50	50	100
	Internship	During I year summer vacation 4 to 6 weeks – Evaluation will be at the end of the third semester	-	2			
	Total		30	24			

Semester III		Subject	Hrs. /Week	Credit	Marks		Total
Course Component					Internals	Externals	
Part III	Core - X	Deep Learning	4	4	50	50	100
	Core - XI	Natural Language Processing	4	4	50	50	100
	Core - XII	Full Stack Development	4	4	50	50	100
	Elective - IV	AI in Healthcare/ AI in Economics and Finance/ AI in Agriculture	4	3	50	50	100
	Elective - V	Network Security and Cryptography /AI in Cloud Computing/ Robotic Process Automation	4	3	50	50	100
	Core - XIII	Practical - V: Deep Learning Lab	4	3	50	50	100
	Core - XIV	Practical - VI: Natural Language Processing Lab	4	3	50	50	100
Part IV	Skill Enhancement Course SEC - III	Research Work /MOOC Course	2	2	50	50	100
	Total		30	26			

Semester IV		Subject	Hrs. /Week	Credit	Marks		Total
Course Component					Internals	Externals	
Part III	Elective - VI	Artificial Intelligence Ethics/IT Cognition/Agile Software Engineering	4	3	50	50	100
	Core - XV	Project and Viva Voce	24	13	50	50	100
Part IV	Skill Enhancement Course SEC - IV	Role of AI for Environmental Sustainability	2	2	50	50	100
	Total		30	18			
TOTAL CREDITS			91				

Total credit distribution for all the 2 years

	No. of Paper	Credits
Core (Including Practical)	14	50
Elective	6	18
Soft Skills	4	8
Internship	1	2
Project	1	13
Total		91

EXAMINATION

Continuous Internal Assessment (CIA) will be for 50 percent and
End Semester Examination (ESE) will be for 50 percent.

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 80 working days in each semester. For the courses coming under Part IV, ESE will be conducted in MCQ pattern. 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	60%
Model Examination	After 80 working days of the Semester	95%

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

Internal Components			
Assessment Type	Nature	Maximum Marks	% of Weightage
CIA	Mid Semester Examination	50	10
Model	Model Examination	100	10
	Assignment		10
	Class activities		15
	Attendance		5
Total			50

The class activity relates to a programme of accepted innovative techniques such as Seminar, Quiz, Portfolio creation, PowerPoint presentation, Objective tests, Role play, Group discussion, Case Study etc. The mode of evaluation of the class activity will be fixed before the commencement of the semester and an approval will be obtained from the Head of the programme/wing. The students will be informed of the various methods of evaluation once the semester begins.

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:

% 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 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 of 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 combine 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 an 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: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - I
COURSE NAME: Analysis and Design of Algorithms	COURSE CODE:
SEMESTER: I	MARKS:100
CREDITS: 4	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVE:

To introduce students to fundamental data structures and algorithm design techniques for efficient problem-solving.

COURSE OUTCOMES:

1. Understand algorithms and analyze their time complexity; apply divide and conquer techniques for search and sort problems
2. Demonstrate the use of the greedy method in solving simple optimization problems.
3. Apply dynamic programming techniques to solve graph-related problems.
4. Use backtracking and branch-and-bound techniques to solve problems.
5. Apply traversal and searching techniques on trees and graphs.

UNIT I 15 HOURS

Introduction: - Algorithm Definition and Specification – Space complexity-Time Complexity- Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree - Binary Search Tree - Heap – Heapsort- Graph.

UNIT II 15 HOURS

Basic Traversal And Search Techniques: Techniques for Binary Trees-Techniques for Graphs -Divide and Conquer: - General Method – Binary Search – Merge Sort – Quick Sort.

UNIT III 15 HOURS

The Greedy Method:-General Method–Knapsack Problem–Minimum Cost Spanning Tree – Single Source Shortest Path.

UNIT-IV 15 HOURS

Dynamic Programming - General Method – Multistage Graphs– All Pair Shortest Path – Optimal Binary Search Trees – 0/1 Knapsacks – Traveling Salesman Problem – Flow Shop Scheduling.

UNIT-V 15 HOURS

Backtracking: - General Method–8-Queens Problem–Sum Of Subsets–Graph Coloring– Hamiltonian Cycles – Branch and Bound: - The Method – Traveling Salesperson.

PRESCRIBED BOOKS:

1. Ellis Horowitz, Satraj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Universities Press, Second Edition, Reprint 2009.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, *"Data Structures and Algorithms"*.

REFERENCE BOOKS:

1. Michael T. Goodrich, *"Data Structures & Algorithms in Java"*, Wiley, 3rd Edition.
Steven S. Skiena, *"The Algorithm Design Manual"*, Second Edition, Springer, 2008.
2. Anany Levitin, *"Introduction to the Design and Analysis of Algorithms"*, Pearson Education Asia, 2003
3. Robert Sedgewick, Philippe Flajolet, *"An Introduction to the Analysis of Algorithms"*, Addison-Wesley Publishing Company, 1996.
4. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, *"Data Structures and Algorithms"*.

E-LEARNING RESOURCES:

1. <https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/>
2. <https://www.codechef.com/learn/course/college-design-analysis-algorithms>

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBER S	MARKS	TOTAL
A	Answer all the questions	1-10	2	20
B	Answer any 5 out of 7 questions	11-17	7	35
C	Answer any 3 out of 5 questions(each in 1200 words)	18-22	15	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B - 7	SECTION C - 5

PSO – CO MAPPING

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

PSO - CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand algorithms and analyze their time complexity; apply divide and conquer techniques for search and sort problems.	PSO 1 TO PSO 5	K1 TO K6
CO2	Demonstrate the use of the greedy method in solving simple optimization problems.	PSO 1 TO PSO 5	K1 TO K6
CO3	Apply dynamic programming techniques to solve graph-related problems.	PSO 1 TO PSO 5	K1 TO K6
CO4	Use backtracking and branch-and-bound techniques to solve problems.	PSO 1 TO PSO 5	K1 TO K6
CO5	Apply traversal and searching techniques on trees and graphs.	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - II
COURSE NAME: Artificial Intelligence and Expert Systems	COURSE CODE:
SEMESTER: I	MARKS:100
CREDITS: 4	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVES

To provide students with a foundational understanding of core AI concepts, techniques, and problem-solving methods, while developing proficiency in search algorithms, optimization strategies, and the design and creation of expert systems to address real-world challenges.

COURSE OUTCOMES

1. Understand and apply fundamental AI concepts and approaches
2. Demonstrate proficiency in problem-solving using search algorithms
3. Utilize heuristic methods and informed search strategies for complex problem-solving
4. Design and develop expert systems using knowledge representation and inference techniques
5. Analyze and apply expert system tools and address challenges in AI applications

UNIT I

15 HOURS

Introduction: AI Problems - AI techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems - Problem Characteristics - Issues in design of Search.

UNIT II

15 HOURS

Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis. Knowledge representation issues: Representations and mappings -Approaches to Knowledge representations - Issues in Knowledge representations - Frame Problem.

UNIT III

15 HOURS

Using Predicate logic: Representing simple facts in logic - Representing Instance and Isa relationships - Computable functions and predicates - Resolution - Natural deduction. Representing knowledge using rules: ProceduralVs Declarative knowledge- Logic programming - Forward Vs Backward Reasoning - Matching - Control knowledge.

UNIT IV

15 HOURS

Expert systems: Key components - knowledge base, inference engine, and user interface;
Knowledge representation: Rules, Frames, and Semantic networks; Inference process - Forward chaining and Backward chaining; Expert system development life cycle - Problem definition, Knowledge acquisition, Design, and Testing.

UNIT V**15 HOURS**

Applications: Medical diagnosis, Engineering, Finance, and Customer support; Tools: CLIPS, PROLOG, and Jess, along with hybrid expert systems that incorporate machine learning; Challenges: Knowledge acquisition and uncertainty handling using fuzzy logic and probabilistic reasoning. Advanced topics: Case-based reasoning and Adaptive expert systems, with a look at the integration of modern AI techniques.

PRESCRIBED BOOKS:

1. E. Rich and K. Knight, Artificial Intelligence, Tata McGraw Hill.
2. S. Russell, P. Norvig, Artificial Intelligence: A Modern Approach, Pearson Education.

REFERENCE BOOKS:

1. "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", by George F. Luger, (2002), Addison-Wesley, Chapter 1- 16, pages 1- 743.
2. "AI: A New Synthesis", by Nils J. Nilsson, (1998), Morgan Kaufmann Inc., Chapter 1- 25, Page 1-493.
3. "Computational Intelligence: A Logical Approach", by David Poole, Alan Mackworth, and Randy Goebel, (1998), Oxford University Press, Chapter 1-12, pages 1-608.
4. Eugene Charniak, Drew Mc Dermot, 'Introduction to Artificial intelligence', Addison Wesley Longman Inc., 2009
5. 4. George. F, William. A. Stubblefield, 'Artificial intelligence and the design of expert systems', The Benjamin Cummins Publishing Co., Inc 2nd Edition, 1992.
6. 5. Robert J Schalkoff, 'Artificial intelligence An Engineering Approach', McGraw Hill International Edition, 1990

E-LEARNING RESOURCES

1. <https://www.ibm.com/downloads/cas/GB8ZMQZ3>
2. <https://www.javatpoint.com/artificial-intelligence-tutorial>
3. <https://nptel.ac.in/courses/106/105/106105077/>

GUIDELINES TO THE QUESTION PAPER SETTERS**QUESTION PAPER PATTERN**

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer all the questions	1-10	2	20
B	Answer any 5 out of 7 questions	11-17	7	35
C	Answer any 3 out of 5 questions(each in 1200 words)	18-22	15	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B – 7	SECTION C - 5

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
AVG	3	3	3	3	3

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand and apply fundamental AI concepts and approaches	PSO 1 TO PSO 5	K1 TO K6
CO2	Demonstrate proficiency in problem-solving using search algorithms	PSO 1 TO PSO 5	K1 TO K6
CO3	Utilize heuristic methods and informed search strategies for complex problem-solving	PSO 1 TO PSO 5	K1 TO K6
CO4	Design and develop expert systems using knowledge representation and inference techniques	PSO 1 TO PSO 5	K1 TO K6
CO5	Analyze and apply expert system tools and address challenges in AI applications	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - III
COURSE NAME: Advanced Java Programming	COURSE CODE:
SEMESTER: I	MARKS:100
CREDITS: 4	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVE

To enable students to understand advanced Java programming concepts, including distributed application architecture, JDBC, Servlets, JQuery, JSP, and JAR file format.

COURSE OUTCOMES

1. Understand the advanced concepts of Java Programming.
2. Understand and apply JDBC and RMI concepts.
3. Apply and analyze Java in Database.
4. Handle different event in java using the delegation event model, event listener and class.
5. Design interactive applications using Java Servlet, JSP and JDBC.

UNIT I

15 HOURS

Overview of Core Java: Classes, Objects, Methods, Constructors, Parameterized Constructor-Creating Multilevel Inheritance- Packages- importing packages- Interfaces. Exception Handling- Exception types- Exception handling using try, catch, throw, throws and finally.

UNIT II

15 HOURS

Multithreaded Programming -The Java Thread Model- The Main Thread- Creating a Thread- Creating Multiple Threads- Thread Priorities- Synchronization- Interthread Communication.

Java Database Connectivity : JDBC Architecture, Types of JDBC Drivers, Introduction to major JDBC Classes and Interface, Creating simple JDBC Application, Types of Statement (Statement Interface, Prepared Statement, Callable Statement), Exploring Result Set Operations.

UNIT III

15 HOURS

Servlets – Servlet Architecture- Servlet Life Cycle - Types of Servlet Handling Form Data -Passing Parameter to Servlet, Server Side Includes- Servlet chaining and Filters- Database Connectivity using Servlet, Session Tracking: using Cookies, HttpSession, Hidden Form Fields and URL Rewriting

UNIT-IV

15 HOURS

Java Server Pages: Introduction to JSP, Comparison with Servlet, JSP Architecture, JSP Life Cycle, JSP Processing, Scripting Elements, Directives, Action Tags, Implicit Objects, Expression Language(EL), JSP Standard Tag Libraries(JSTL), JSP Database Access.

UNIT-V**15 HOURS**

Hibernate: Overview of Hibernate, Hibernate Architecture, Hibernate Mapping Types, Hibernate O/R Mapping, Hibernate Annotation, Hibernate Query Language.

Spring: Introduction, Architecture, Spring MVC Module.

PRESCRIBED BOOKS:

1. Herbert Schildt - The Complete Reference Java - Tata McGraw Hill Publishing Company Limited Edition 11, 2018.
2. Uttam K.Roy, Advanced Java programming, Oxford University Press, 2015.

REFERENCE BOOKS:

1. Black Book “Java server programming” J2EE, 1st ed., Dream Tech Publishers, 2008. Kathy walrath”
2. J2EE the Complete Reference, First Edition by Jim Keogh, Tata McGraw Hill, 2012.
3. Professional Java Server Programming by Subrahmanyam Allamaraju, Cedric Buest Wiley Publication

E-LEARNING RESOURCES:

1. <https://www.javatpoint.com/java-tutorial>
2. <https://docs.oracle.com/javase/tutorial/>
3. <https://www.roseindia.net/java/>

GUIDELINES TO THE QUESTION PAPER SETTERS**QUESTION PAPER PATTERN**

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer all the questions</i>	<i>1-10</i>	<i>2</i>	<i>20</i>
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C	<i>Answer any 3 out of 5 questions(each in 1200 words)</i>	<i>18-22</i>	<i>15</i>	<i>45</i>
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B - 7	SECTION C - 5

PSO – CO MAPPING

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

PSO-CO QUESTIO PAPER MAPPING

CO No	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand the advanced concepts of Java Programming.	PSO 1 TO PSO 5	K1 TO K6
CO2	Understand and apply JDBC and RMI concepts.	PSO 1 TO PSO 5	K1 TO K6
CO3	Apply and analyze Java in Database.	PSO 1 TO PSO 5	K1 TO K6
CO4	Handle different event in java using the delegation event model, event listener and class.	PSO 1 TO PSO 5	K1 TO K6
CO5	Design interactive applications using JavaServlet, JSP and JDBC.	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE - I
COURSE NAME: Mathematics for Computer Science	COURSE CODE:
SEMESTER: I	MARKS:100
CREDITS: 3	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVE:

To understand the concepts of Set theory, linear algebra, Laplace transform, Fourier integral and Fourier Integrals and Sturm-Liouville.

COURSE OUTCOMES:

1. To introduce the concepts of sets, relations and functions.
2. Describe the concepts of vector space and operations in a basis, eigen values and eigen vectors.
3. Discuss the applications of Laplace transform.
4. Understand concepts of Fourier integrals and Transforms
5. Implement the essential ideas of Sturm-Liouville Theorem.

UNIT I: Set theory:

15 HOURS

Operations on sets – Basic set identities – Relations and orderings –Functions.

UNIT II: Linear algebra:

15 HOURS

Linear vector spaces - Linear operators – vectors in n-dimensions – matrix representation of vectors and operators in a basis – linear independence, dimension – inner product – Schwarz inequality – Orthonormal basis – Gram-Schmidt process – Eigenvalues and eigenfunctions of operators/matrices — Cayley Hamilton theorem – Eigen basis, Diagonalizing matrix – Quadratic forms – Complex matrices and forms- Hermitian and Unitary operators/matrices.

UNIT III: Laplace transforms:

15 HOURS

Laplace Transforms – Convolution theorem – Solution of linear differential equations with constant coefficients – Unit step function and Dirac delta function.

UNIT IV: Fourier Integrals and Transforms:

15 HOURS

Fourier series - Fourier integral – Fourier sine and cosine transforms – Fourier transform- convolution theorem - Discrete Fourier transform and Fast Fourier transform.

UNIT V: Sturm-Liouville theory:**15 HOURS**

Second order linear differential equations – Sturm-Liouville theory – Orthogonality of eigenfunctions – Illustration with Legendre, Laguerre, Hermite, Chebyshev differential equations - expansion of polynomials.

PRESCRIBED BOOKS

1. B Kolman, R C Busby, and S* C Ross, *Discrete Mathematical Structures*, 6th Edition (Pearson Prentice-Hall, New Delhi, 2009).
2. E Kreyszig, *Advanced Engineering Mathematics*, 10th Edition (Wiley, NY, 2011).
3. M D Greenberg, *Advanced Engineering Mathematics*, 2nd Edition, International Edition (Prentice-Hall International, NJ, 1998; Pearson Education Asia, New Delhi, 2002).
4. J P Tremblay and R Manohar, *Discrete Mathematical Structures with Applications to Computer Science*, International Edition (McGraw-Hill, Singapore, 1987; Tata McGraw-Hill, New Delhi, 1997).

REFERENCE BOOKS

1. E R Scheinerman, *Mathematics: A Discrete Introduction* (Brooks/Cole/Thomson Asia, Singapore, 2001).
2. S Lipschutz, M L Lipson, and V* H Patil, *Discrete Mathematics*, 2nd Edition (Tata McGraw-Hill, New Delhi, 2006).
3. L A Pipes and L R Harvill, *Applied Mathematics for Engineers and Physicists*, 3rd Edition. a. (McGraw-Hill, NY, 1971).

E-LEARNING RESOURCES

1. https://onlinecourses.nptel.ac.in/noc24_ma42/preview
2. <https://archive.nptel.ac.in/courses/111/106/111106051/>
3. <https://archive.nptel.ac.in/courses/111/106/111106100/#>
4. <https://archive.nptel.ac.in/courses/111/106/111106139/>
5. <https://archive.nptel.ac.in/courses/111/106/111106046/>

GUIDELINES TO THE QUESTION PAPER SETTERS**QUESTION PAPER PATTERN**

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer all the questions	1-10	2	20
B	Answer any 5 out of 7 questions	11-17	7	35
C	Answer any 3 out of 5 questions(each in 1200 words)	18-22	15	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B - 7	SECTION C - 5

PSO – CO MAPPING

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

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To introduce the concepts of sets, relations and functions.	PSO 1 TO PSO 5	K1 TO K6
CO2	Describe the concepts of vector space and operations in a basis, eigen values and eigen vectors.	PSO 1 TO PSO 5	K1 TO K6
CO3	Discuss the applications of Laplace transform.	PSO 1 TO PSO 5	K1 TO K6
CO4	Understand concepts of Fourier integrals and Transforms	PSO 1 TO PSO 5	K1 TO K6
CO5	Implement the essential ideas of Sturm-Liouville Theorem.	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE - I
COURSE NAME: Discrete Mathematics	COURSE CODE:
SEMESTER: II	MARKS:100
CREDITS: 3	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVE:

To understand the concepts of logics, predicate logic, sets, basic graphs and planar graphs.

COURSE OUTCOMES:

1. Understand the basic terminologies and logics.
2. Attain knowledge in the concepts of predicate logics.
3. Implement the essential ideas of Sets and relations.
4. Obtain knowledge of discrete structures involving graphs.
5. Analyse the planar graphs, Euler's graphs and Hamiltonian graphs.

UNIT I

15 HOURS

MATHEMATICAL LOGIC

Lectures Statements, Connectives, Statement formulas, Truth functional rules, Interpretation of formulas, Tautologies, Equivalence, Functionally complete set of connectives, Normal forms, Inference, Theory of statement calculus, Consistency of premises.

UNIT II

15 HOURS

PREDICATE LOGIC

Lectures Predicates, statement functions, Quantification, Interpretation of predicate formulas, Inference theory for predicate calculus, Informal & formal proofs.

UNIT III

15 HOURS

SET THEORY

Basics of set theory, Properties of relations, equivalence & compatibility relation, Representation of relations, Reflective, symmetric & transitive closures, Characteristic functions of a set and its properties, Principle of inclusion and exclusion, its applications.

UNIT IV

15 HOURS

GRAPH THEORY

Lectures Definition Simple digraphs, Matrix representations, Paths, Distances, Connectedness of digraphs, Path and reachability matrices, Boolean sum and product of bit matrices, Warshall's algorithm for transitive closure of relations.

UNIT V

15 HOURS

PLANAR GRAPHS

Planarity of graphs, Planar graphs Stereographic projection and embedding on a sphere Kurtowski's two graphs, Euler's formula, Hamiltonian graphs, Detection of planarity and elementary reduction.

PRESCRIBED BOOKS:

1. T.Veerarajan, "Discrete Mathematics" Tata McGraw Hill Pub. Co. Ltd., New Delhi,
2. Frank Harary, "Graph theory" Addison Wesley publishing company.

REFERENCE BOOKS:

2. Rosen Kenneth: Discrete mathematics and its applications. McGraw hill- New Delhi.
3. Stanat and McAlister: Discrete Mathematics for Computer Science, PHI
4. Narsingh Deo: Graph Theory with Applications to Engineering and Computer Science, PHI, 1974
5. J.P. Tremblay and Manohar: Discrete mathematical structures with application to Computer Science, McGraw hill- New Delhi.

E-LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs123/preview
2. <https://archive.nptel.ac.in/courses/106/108/106108227/>

GUIDELINES TO THE QUESTION PAPER SETTERS**QUESTION PAPER PATTERN**

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer all the questions</i>	<i>1-10</i>	<i>2</i>	<i>20</i>
B	<i>Answer any 5 out of 7 questions</i>	<i>11-17</i>	<i>7</i>	<i>35</i>
C	<i>Answer any 3 out of 5 questions(each in 1200 words)</i>	<i>18-22</i>	<i>15</i>	<i>45</i>
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B - 7	SECTION C - 5

PSO – CO MAPPING

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

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand the basic terminologies and logics.	PSO 1 TO PSO 5	K1 TO K6
CO2	Attain knowledge in the concepts of predicate logics.	PSO 1 TO PSO 5	K1 TO K6
CO3	Implement the essential ideas of Sets and relations.	PSO 1 TO PSO 5	K1 TO K6
CO4	Obtain knowledge of discrete structures involving graphs.	PSO 1 TO PSO 5	K1 TO K6
CO5	Analyse the planar graphs, Euler's graphs and Hamiltonian graphs.	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - IV
COURSE NAME: Practical - I: Algorithm Lab	COURSE CODE:
SEMESTER: I	MARKS: 100
CREDITS: 3	TOTAL HOURS: 60
PRACTICAL	

COURSE OBJECTIVE

To learn effective problem-solving in computing applications and analyze the algorithmic procedure to determine the computational complexity.

COURSE OUTCOMES

1. Understand and solve complex problems and Select an appropriate algorithm for the problem
2. Evolve as a competent programmer capable of designing and analyzing algorithms and
3. data structures for different kinds of problems
4. Classify problems into complexity classes like P and NP.
5. Analyze graphs and determine shortest path

EXERCISES

Prolog:

1. Write Prolog program to implement A* algorithm.
2. Write Prolog program to implement MinMax search
3. Write Prolog program to solve water jug problem
4. Write Prolog program to implement TicTacToe
5. Write Prolog program to implement alpha-beta pruning
6. Write Prolog program to solve 4 Queen problem C++
7. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n.
8. Write a program to obtain the topological ordering of vertices in a given digraph.
9. Implement travelling salesman problem.
10. Find minimum cost spanning tree of a given undirected path using a Prim's algorithm.
11. From a given vertex in a weighted connected graph, find shortest paths to other vertices using
12. Dijkstra's algorithm.
13. Solve N queen problem

PSO – CO MAPPING

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - V
COURSE NAME: Practical - II: Advanced Java Programming Lab	COURSE CODE:
SEMESTER: I	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
PRACTICAL	

COURSE OBJECTIVE

To enable students to develop basic Java web applications using JSP, Servlets, and JDBC.

COURSE OUTCOMES

1. Understand and implement the concepts of Java using HTML forms, JSP, and JAR.
2. Must be capable of implementing JDBC and RMI concepts.
3. Able to write Applets with event handling mechanisms.
4. To create interactive web-based applications using Servlets and JSP.
5. Able to develop simple client-server applications using Java networking concepts.

EXERCISES:

1. Display a welcome message using a Java Servlet.
2. Design a purchase order form using HTML and process it with a Servlet.
3. Develop a program to calculate the percentage of marks of a student using JSP.
4. Design a purchase order form using HTML and JSP for data processing.
5. Prepare an employee payslip using JSP.
6. Write a program using JDBC to create a table, insert records, delete records, and list all records.
7. Write a Java Servlet program to handle and display submitted form data.
8. Write a simple Servlet program to display all received HTTP headers and their values in a table.
9. Write a JSP program that uses the session object to store and retrieve data.
10. Write a program to build a simple client-server application using Java RMI.
11. Create a calculator application using Java Applet.
12. Write a socket programming-based application to send and receive text messages between two systems.

PSO- CO MAPPING

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

SEMESTER II

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - VI
COURSE NAME: Machine Learning with Python	COURSE CODE:
SEMESTER: II	MARKS:100
CREDITS: 4	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVE

To understand the different types, steps and algorithms involved in Machine Learning Process.

COURSE OUTCOMES

1. Describe the data, essential steps for creating a typical ML model and the fundamentals of pattern classification.
2. Able to examine different ML algorithms and unprocessed data and features.
3. Implement the essential techniques to reduce the number of features in a dataset and test the performance of predictive models.
4. Select multiple algorithms, combine and produce ensembles, discuss the essential techniques for modeling linear relations.
5. Discuss the clustering algorithms, develop a Web application embedding a ML model.

UNIT I

15 HOURS

Data Analytics with pandas and NumPy - NumPy and basic stats - Matrices - pandas library - Working with data - Null Values - Creating statistical graphs Giving Computers the ability to learn from data - Introduction - Building intelligent systems to transform data into knowledge - The three different types of Machine Learning (ML) - Introduction to basic terminology and notations - A roadmap for building ML systems - Using Python for ML Training Simple ML Algorithms for Classification - Early History of ML - Implementing a Perceptron learning algorithm - Adaptive linear neurons and the convergence of learning.

UNIT II

15 HOURS

ML Classifiers using scikit-learn - Choosing a classification algorithm - Training a perceptron - Modeling class probabilities via logistic regression - Maximum margin classification with support vector machines (SVM) - Solving nonlinear problems using a kernel SVM - Decision tree learning - K- nearest neighbours: a lazy learning algorithm.

Data Preprocessing - Missing data - Categorical data - Partitioning a dataset into separate training and test datasets - Bringing features onto the same scale - Selecting meaningful features - Assessing feature importance with random forests.

UNIT III

15 HOURS

Compressing Data via Dimensionality Reduction - Unsupervised dimensionality reduction via principal component analysis - Supervised data compression via linear discriminant analysis - Using kernel principal component analysis for nonlinear mappings.

Learning Best Practices for Model Evaluation and Hyperparameter Tuning -- Streamlining workflows with pipelines - Using k-fold cross-validation to assess model performance - Debugging algorithms with learning and validation curves - Fine-tuning ML models via grid search - Looking at different performance evaluation metrics.

UNIT-IV

15 HOURS

Combining different models for ensemble learning - Learning with ensembles - Combining classifiers via majority vote - Bagging: building an ensemble of classifiers from bootstrap samples - Leveraging weak learners via adaptive boosting.

Predicting Continuous Target Variables with Regression Analysis - Introducing Linear regression - Implementing an ordinary least squares linear regression model - Fitting a robust regression model using RANSAC - Evaluating the performance of linear regression models - Using regularised methods for regression - Turning a linear regression model into a curve - polynomial regression - Dealing with nonlinear relationships using random forests.

UNIT-V

15 HOURS

Working with Unlabeled Data – Grouping objects by similarity using k-means - Organising clusters as a hierarchical tree - Locating regions of high density via DBSCAN .

Introduction to Embedding a ML model into a Web Application - Serialising fitted scikit-learn estimators - Setting up an SQLite database for data storage - Developing a web application with Flask - Turning any classifier into a web application - Deploying the web application to a public server.

PRESCRIBED BOOKS

1. Corey Wade et al, Vahid Mirjalili, The Python Workshop, 2nd Edition, packs publishing, 2022
2. Sebastian Raschka and Vahid Mirjalili, Python Machine Learning, 3rd Edition, packt publishing, 2019

REFERENCE BOOKS

1. Andreas C. Mueller, Sarah Guido. Introduction to Machine Learning with Python. O'Reilly Media, Inc., 2016.
2. Ethem Alpaydin, Introduction to Machine Learning, 2nd Edition, <http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=12012>, 2010
3. Wes McKinney. Python for Data Analysis. O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, second edition, 2018

E-LEARNING RESOURCES

1. <https://data-flair.training/blogs/machine-learning-tutorial/>
2. <https://www.geeksforgeeks.org/machine-learning/>

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
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BREAK UP OF QUESTIONS

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	SECTION A - 10	SECTION B - 7	SECTION C - 5

PSO – CO MAPPING

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

PSO-CO QUESTION PAPER MAPPING

CO No	COURSE OUTCOME	PSOs Addressed	COGNITIVE LEVEL (K1 to K6)
CO1	Describe the data, essential steps for creating a typical ML model and the fundamentals of pattern classification	PSO 1 TO PSO 5	K1 TO K6
CO2	Able to examine different ML algorithms and unprocessed data and features	PSO 1 TO PSO 5	K1 TO K6
CO3	Implement the essential techniques to reduce the number of features in a dataset and test the performance of predictive models	PSO 1 TO PSO 5	K1 TO K6
CO4	Select multiple algorithms, combine and produce ensembles, discuss the essential techniques for modeling linear relations	PSO 1 TO PSO 5	K1 TO K6
CO5	Discuss the clustering algorithms, develop a Web application embedding a ML model	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - VII
COURSE NAME: Data Science Analytics	COURSE CODE:
SEMESTER: II	MARKS:100
CREDITS: 4	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVES

To provide the basics of Big Data, including its types and uses. Understand NoSQL databases for storing large data and develop skills to analyze and visualize data to make better decisions.

COURSE OUTCOMES

1. Understand the concept of data science and its techniques.
2. Review data analytics.
3. Apply and determine appropriate data mining techniques using R to real-time applications.
4. Analyze on clustering algorithms.
5. Analyze on regression methods in AI.

UNIT I:

15 HOURS

Introduction of Data Science: Data science and big data – facets of data – data science process – ecosystem – the data science process – six steps – machine learning.

UNIT II:

15 HOURS

Data Analytics lifecycle – review of data analytics – advanced data analytics – technology and tools.

UNIT III:

15 HOURS

Basic Data Analytics using R: R Graphical User Interfaces – Data Import and Export – Attribute and Data Types – Descriptive Statistics – Exploratory Data Analysis – Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – Data Exploration Versus Presentation.

UNIT IV:

15 HOURS

Overview of Clustering: K-means – Use Cases – Overview of the Method – Perform a K-means Analysis using R – Classification – Decision Trees – Overview of a Decision Tree – DecisionTree Algorithms – Evaluating a Decision Tree – Decision Tree in R – Bayes' Theorem – Naïve Bayes Classifier – Smoothing – Naïve Bayes in R.

UNIT V:

15 HOURS

Artificial Intelligence: Machine learning and deep learning in data science – clustering, association rules. Linear regression – logistic regression – additional regression methods.

PRESCRIBED BOOKS

1. Introducing Data Science, Big Data, Machine Learning, and more using Python tools 2016. PDF.
2. Data science in big data analytics - Wiley 2015, John Wiley & Sons.
3. R Programming for Data Science - Roger D. Peng, 2015, Lean Publication.

REFERENCE BOOKS

1. A Simple Introduction to Data Science - Lars Nielson, 2015.
2. Introducing Data Science - Davy Cielen, Arno D.B. Meysman, Mohamed Ali, 2016, Manning Publication.
3. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data.

E-LEARNING RESOURCES

1. https://www.tutorialspoint.com/python_data_science/index.htm
2. <https://www.javatpoint.com/data-science>
3. <https://nptel.ac.in/courses/106/106/106106179/>

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer all the questions	1-10	2	20
B	Answer any 5 out of 7 questions	11-17	7	35
C	Answer any 3 out of 5 questions(each in 1200 words)	18-22	15	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	1	1
III	2	2	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B - 7	SECTION C - 5

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
AVG	3	3	3	3	3

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand the concept of data science and its techniques.	PSO 1 TO PSO 5	K1 TO K6
CO2	Review data analytics.	PSO 1 TO PSO 5	K1 TO K6
CO3	Apply and determine appropriate data mining techniques using R to real-time applications.	PSO 1 TO PSO 5	K1 TO K6
CO4	Analyze on clustering algorithms.	PSO 1 TO PSO 5	K1 TO K6
CO5	Analyze on regression methods in AI.	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE - II
COURSE NAME: Advanced Operating Systems	COURSE CODE:
SEMESTER: II	MARKS:100
CREDITS: 3	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVES

To provide students with in-depth knowledge of advanced operating system concepts, including process management, distributed systems, real-time and mobile OS, and practical insights through Linux-based case studies.

COURSE OUTCOMES

1. Understand the design issues associated with operating systems
2. Master various process management concepts including scheduling, deadlocks and distributed file systems
3. Prepare Real Time Task Scheduling
4. Analyze Operating Systems for Handheld Systems
5. Analyze Operating Systems like LINUX and iOS

UNIT-I

15 HOURS

Basics of Operating Systems: What is an Operating System? – Main frame Systems – Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems –Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments -Process Scheduling – Cooperating Processes – Inter Process Communication- Deadlocks –Prevention – Avoidance – Detection – Recovery.

UNIT- II

15 HOURS

Distributed Operating Systems: Issues – Communication Primitives – Lamport's Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues – Case studies – The Sun Network File System-Coda.

UNIT – III

15 HOURS

Realtime Operating Systems : Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling.

UNIT – IV

15 HOURS

Operating Systems Handheld Systems: Requirements – Technology Overview – Handheld Operating Systems – Palm OS – Symbian Operating System – Android – Architecture of Android – Securing Handheld Systems.

UNIT – V

15 HOURS

Case Studies : Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS : Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

PRESCRIBED BOOKS

1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System Concepts”, Seventh Edition, John Wiley & Sons, 2004.
2. Mukesh Singhal and Niranjana G. Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw-Hill, 2001.

REFERENCE BOOKS

1. Rajib Mall, “Real-Time Systems: Theory and Practice”, Pearson Education India, 2006.
2. Pramod Chandra P. Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.
3. Daniel .P. Bovet & Marco Cesati, “Understanding the Linux kernel”, 3rd edition, O’Reilly, 2005
4. Neil Smyth, “iPhone/iOS 4 Development Essentials – Xcode”, Fourth Edition, Payload media, 2011.

E-LEARNING RESOURCES

1. https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2. <https://www.dacity.com/course/advanced-operating-systems--ud189>
3. <https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf>

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer all the questions</i>	<i>1-10</i>	<i>2</i>	<i>20</i>
B	<i>Answer any 5 out of 7 questions</i>	<i>11-17</i>	<i>7</i>	<i>35</i>
C	<i>Answer any 3 out of 5 questions (each in 1200 words)</i>	<i>18-22</i>	<i>15</i>	<i>45</i>
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	1	1
III	2	2	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B - 7	SECTION C - 5

PO-CO MAPPING

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

PSO - CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand the design issues associated with operating systems	PSO 1 TO PSO 5	K1 TO K6
CO2	Understand the design issues associated with operating systems	PSO 1 TO PSO 5	K1 TO K6
CO3	Prepare Real Time Task Scheduling	PSO 1 TO PSO 5	K1 TO K6
CO4	Analyze Operating Systems for Handheld Systems	PSO 1 TO PSO 5	K1 TO K6
CO5	Analyze Operating Systems like LINUX and iOS	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE - II
COURSE NAME: Social Network Analysis using AI	COURSE CODE:
SEMESTER: II	MARKS:100
CREDITS: 3	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVES

To enable students to understand and apply AI techniques to analyze social networks and their data, while also learning about important ethical issues.

COURSE OUTCOMES

1. Understand Social Networks and AI.
2. Application of Graph Theory and Machine Learning.
3. Proficiency in Advanced AI Techniques for Social Network Analysis.
4. Apply AI to Social Network Problems.
5. Ethical Awareness and Regulatory Understanding.

UNIT I: Introduction to Social Network Analysis and AI **15 HOURS**

Introduction to social networks: Nodes, edges, graphs - Basic concepts of social network analysis (SNA) - Role of AI in social network analysis.

UNIT II: Graph Theory and Machine Learning Basics **15 HOURS**

Graph theory fundamentals: Vertices, edges, adjacency matrices - Basic machine learning algorithms used in SNA (e.g., classification, clustering).

UNIT III: Advanced Techniques in Social Network Analysis **15 HOURS**

Introduction to Graph Neural Networks (GNNs) - Applications of GNNs in social network analysis - Community detection, influence propagation, and recommendations.

UNIT IV: Practical Applications of AI in Social Networks **15 HOURS**

Fake news detection, user behavior prediction - Social media data analysis (e.g., Twitter, Facebook) - Recommendation systems and personalized content.

UNIT V: Ethical Issues in Social Network Analysis **15 HOURS**

Privacy, security, and consent in social network analysis - Bias and fairness in AI models for social networks - Ethical implications and regulatory concerns (e.g., GDPR).

PREScribed BOOKS

1. "Social Network Analysis: Methods and Applications" by Wasserman & Faust
2. "Graph Representation Learning" by William L. Hamilton

REFERENCE BOOKS

1. "Mining the Social Web" by Matthew A. Russell
2. "Social Network Analysis: Methods and Applications"
By Stanley Wasserman and Katherine Faust

E-LEARNING RESOURCES

1. <https://www.coursera.org/learn/social-network-analysis>
2. <https://graph-neural-networks.github.io/>
3. <https://www.coursera.org/learn/artificial-intelligence-social-media-analytics>

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer all the questions	1-10	2	20
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C	Answer any 3 out of 5 questions(each in 1200 words)	18-22	15	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

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I	2	2	1
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PSO – CO Mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	2	2	2	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	2
AVG	3	2.8	2.8	2.8	2.8

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand Social Networks and AI	PSO 1 TO PSO 5	K1 TO K6
CO2	Application of Graph Theory and Machine Learning	PSO 1 TO PSO 5	K1 TO K6
CO3	Proficiency in Advanced AI Techniques for Social Network Analysis	PSO 1 TO PSO 5	K1 TO K6
CO4	Apply AI to Social Network Problems	PSO 1 TO PSO 5	K1 TO K6
CO5	Ethical Awareness and Regulatory Understanding	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE - II
COURSE NAME: Blockchain Technology	COURSE CODE:
SEMESTER: II	MARKS:100
CREDITS: 3	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVE:

To empower students with an introduction to blockchain technology, cryptocurrency security, types of cryptocurrency, smart contracts, ICOs, applications, and key aspects of blockchain security.

COURSE OUTCOMES:

1. Understand the fundamentals of blockchain technology and its role in cryptocurrency security.
2. Identify and differentiate between various types of cryptocurrencies and their use cases.
3. Analyze the concepts of smart contracts, ICOs, and their applications in the blockchain ecosystem.
4. Evaluate the key aspects of blockchain security and its importance in maintaining trust and transparency.
5. Develop the ability to assess and mitigate potential security risks in blockchain networks.

UNIT I

15 HOURS

Origin of Blockchain – Blockchain solution – Components of Blockchain – Block in a Blockchain – Technology and Future – Blockchain Types and Consensus Mechanism: Decentralization and Distribution – Types of Blockchain – Consensus Protocol – Cryptocurrency.

UNIT II

15 HOURS

Bitcoin, Altcoin and Token: Bitcoin and the Cryptocurrency – Cryptocurrency Basics – Types of Cryptocurrencies – Cryptocurrency usage – Public Blockchain System: Public Blockchain – The Bitcoin Blockchain – Ethereum Blockchain.

UNIT III

15 HOURS

Smart Contracts: Smart Contract – Characteristics of Smart Contract – Types of Smart Contracts – Types of Oracles – Smart Contracts in Ethereum – Private Blockchain System: Key characteristics – Private Blockchain and Open Source – State Machine – PAXOS, RAFT, Byzantine Fault – Multichain.

UNIT-IV

15 HOURS

Initial Coin Offering: Blockchain Fundraising Methods – Launching an ICO – Investing in an ICO – Pros and Cons of ICO – Evolution of ICO – ICO platforms – Security in Blockchain: Security Aspects – Security and Privacy challenges – Performance and Scalability – Identity Management and Authentication

UNIT-V

15 HOURS

Applications of Blockchain: Blockchain in Banking and Finance – Blockchain in Education – Blockchain in Energy – Blockchain in Healthcare – Blockchain in Real-estate – Blockchain

and IoT – Limitations and Challenges of Blockchain.

PRESCRIBED BOOKS

1.Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan, “Blockchain Technology”, Universities Press, 2020

REFERENCE BOOKS

1. Kumar Saurabh, Ashutosh Saxena “Blockchain Technology Concepts and Applications”, Wiley, 2020.
2. Don Tapscott, Alex Tapscott, “Blockchain Revolution” Paperback, 1st Edition, 2018

E-LEARNING RESOURCES

1. <https://www.javatpoint.com/blockchain-tutorial>
2. <https://www.tutorialspoint.com/blockchain/index.htm>

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
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TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
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TOTAL	10	7	5
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PSO – CO MAPPING

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CO 4	3	3	3	3	3
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PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand the fundamentals of blockchain technology and its role in cryptocurrency security.	PSO 1 TO PSO 5	K1 TO K6
CO2	Identify and differentiate between various types of cryptocurrencies and their use cases.	PSO 1 TO PSO 5	K1 TO K6
CO3	Analyze the concepts of smart contracts, ICOs, and their applications in the blockchain ecosystem.	PSO 1 TO PSO 5	K1 TO K6
CO4	Evaluate the key aspects of blockchain security and its importance in maintaining trust and transparency.	PSO 1 TO PSO 5	K1 TO K6
CO5	Develop the ability to assess and mitigate potential security risks in blockchain networks.	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE - III
COURSE NAME: Probability and Statistics	COURSE CODE:
SEMESTER: II	MARKS:100
CREDITS: 3	TOTAL HOURS: 75
THEORY	

COURSE OBJECTIVE:

To understand the concepts of Probability one dimensional, two dimensional random variables and testing hypothesis, multivariable analysis.

COURSE OUTCOMES:

1. To introduce the concepts of probability, one dimensional random variable and theoretical distributions.
2. Describe the concepts of two-dimensional random variables.
3. Implement the essential ideas of estimation theory and lines of regressions.
4. Understand different sampling methods and testing hypotheses.
5. Discuss the multivariate analysis of random vectors and matrices.

UNIT I

15 HOURS

PROBABILITY AND RANDOM VARIABLES

Probability – Axioms of probability – Conditional probability – Baye’s theorem – Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

UNIT II

15 HOURS

TWO DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Functions of two-dimensional random variables – Regression curve – Correlation.

UNIT III

15 HOURS

ESTIMATION THEORY CORRELATION AND LINES OF REGRESSION

Regression Curve – Correlation. Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines.

UNIT IV

15 HOURS

TESTING OF HYPOTHESIS

Sampling distributions – Type I and Type II errors – Small and Large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean, variance and proportions – Tests for independence of attributes and goodness of fit.

UNIT V

15 HOURS

MULTIVARIATE ANALYSIS

Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components – Population principal components – Principal components from standardized variables.

PRESCRIBED BOOKS

1. Treatment and content as in “Statistical Methods” – S.P. Gupta, Sultan Chand & Sons 45th Edition(2017).
2. Dallas E. Johnson, —Applied Multivariate Methods for Data Analysis

REFERENCE BOOKS

1. New Mathematical statistics - Sanjay Arora & Bansilal (2002), Meerat Publications, New Delhi
2. Fundamentals of Mathematical Statistics - Gupta, S.C. and Kapoor, V.K.(2000): 10/e, Sultan Chand & Sons
3. Basic Statistics - 3/Agarwal .B.L (1996): e ,New Age International(P) Ltd.,
4. Statistics for Business and Economics - Hooda.R.P.(2003): 3/e, MacMillan.
5. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers ", Pearson Education, Asia, 8th Edition, 2015.

E-LEARNING RESOURCES:

1. <https://nptel.ac.in/courses/111105090>
2. <https://nptel.ac.in/courses/110104440>
3. <https://nptel.ac.in/courses/111105091>

GUIDELINES TO THE QUESTION PAPER

SETTERS QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer all the questions</i>	<i>1-10</i>	<i>2</i>	<i>20</i>
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TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B - 7	SECTION C - 5

PSO – CO MAPPING

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CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	3

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To introduce the concepts of probability, one dimensional random variable and theoretical distributions.	PSO 1 TO PSO 5	K1 TO K6
CO2	Describe the concepts of two-dimensional random variables.	PSO 1 TO PSO 5	K1 TO K6
CO3	Implement the essential ideas of estimation theory and lines of regressions.	PSO 1 TO PSO 5	K1 TO K6
CO4	Understand different sampling methods and testing hypotheses.	PSO 1 TO PSO 5	K1 TO K6
CO5	Discuss the multivariate analysis of random vectors and matrices.	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE - III
COURSE NAME: Statistics for Artificial Intelligence	COURSE CODE:
SEMESTER: II	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

To equip students with fundamental statistical concepts and techniques essential for data-driven decision-making in artificial intelligence.

COURSE OUTCOMES:

1. Understand and summarize data using descriptive statistical measures.
2. Apply probability theory to model and analyze uncertain events.
3. Perform statistical inference through estimation and hypothesis testing.
4. Analyze relationships between variables using regression techniques.
5. Utilize Bayesian methods for reasoning under uncertainty in AI systems.

UNIT I

15 HOURS

Types of Data – Central Tendency (Mean, Median, Mode) – Dispersion (Range, Variance, Standard Deviation, IQR) – Data Visualization (Histogram, Boxplot, Heatmap) – Data Preprocessing.

UNIT II

15 HOURS

Probability Rules – Conditional Probability – Bayes' Theorem – Discrete Distributions (Binomial, Poisson) – Continuous Distributions (Normal, Exponential) – Expected Value – Variance – Central Limit Theorem.

UNIT III

15 HOURS

Sampling – Point Estimation – Confidence Intervals – Hypothesis Testing (z-test, t-test, chi-square test, ANOVA) – p-value – Confidence Level – Type I and Type II Errors.

UNIT IV

15 HOURS

Correlation – Simple Linear Regression – Multiple Linear Regression – Model Assumptions – Multicollinearity – Residual Analysis – Cross-Validation – Model Evaluation (MSE, RMSE, R²).

UNIT V

15 HOURS

Bayesian vs Frequentist – Prior – Likelihood – Posterior – Bayesian Inference – Bayesian Networks – Probabilistic Graphical Models – Naive Bayes – Applications in AI.

PRESCRIBED BOOKS

1. All of Statistics – Larry Wasserman
2. An Introduction to Statistical Learning – Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani
3. Bayesian Reasoning and Machine Learning – David Barber

REFERENCE BOOKS

1. All of Statistics: A Concise Course in Statistical Inference – Larry Wasserman
2. An Introduction to Statistical Learning – Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani
3. Pattern Recognition and Machine Learning – Christopher M. Bishop

E-LEARNING RESOURCES

1. StatQuest with Josh Starmer (YouTube)
2. Khan Academy – Statistics and Probability
3. MIT OpenCourseWare – Introduction to Probability and Statistics

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
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BREAK UP OF QUESTIONS

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PSO – CO mapping

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

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand and summarize data using descriptive statistical measures.	PSO 1 TO PSO 5	K1 TO K6
CO2	Apply probability theory to model and analyze uncertain events.	PSO 1 TO PSO 5	K1 TO K6
CO3	Perform statistical inference through estimation and hypothesis testing.	PSO 1 TO PSO 5	K1 TO K6
CO4	Analyze relationships between variables using regression techniques.	PSO 1 TO PSO 5	K1 TO K6
CO5	Utilize Bayesian methods for reasoning under uncertainty in AI systems	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - VIII
COURSE NAME: Practical - IV: Machine Learning Lab	COURSE CODE:
SEMESTER: II	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
PRACTICAL	

COURSE OBJECTIVE:

To preprocess the data and build ML models using appropriate techniques and evaluate the model

COURSE OUTCOMES:

1. Apply pandas, NumPy and Matplotlib to read in, process and visualize data, implement linear classification algorithms
2. Compare classifiers with linear and non-linear decision boundaries, select relevant features for the model construction
3. Apply data compression and best practices for model evaluation and hyper parameter tuning
4. Select appropriate algorithms and ensemble
5. Apply clustering algorithms on unlabeled data, construct a web application embedding a ML model

EXERCISES

UNIT-I

1. Programs using NumPy and pandas
2. Visualising using graphs
3. Perceptron learning algorithm
4. Adaline

UNIT-II

5. Training a perceptron
6. Modeling class probabilities via logistic regression
7. Maximum margin classification with support vector machines(SVM)
8. Solving nonlinear problems using a kernel SVM
9. Decision tree

UNIT-III

10. Unsupervised dimensionality reduction via principal component analysis
11. Supervised data compression via linear discriminant analysis
12. Using k-fold cross-validation to assess model performance
13. Debugging algorithms with learning and validation curves
14. Fine-tuning ML models via grid search
15. Implementing different performance evaluation metrics

UNIT-IV:

16. Ensemble Learning
17. Ordinary least squares linear regression model
18. Evaluating the performance of linear regression models
19. Regularised methods for regression
20. Nonlinear relationships using random forests

UNIT-V

21. Grouping objects by similarity using k-means
22. Organising clusters as a hierarchical tree
23. Locating regions of high density via DBSCAN
24. Embedding a ML model into a Web Application

PSO- CO Mapping

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

E-LEARNING RESOURCES:

1. <https://machinelearningmastery.com/machine-learning-in-python-step-by-step/>
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. <https://pythonprogramming.net/machine-learning-tutorial-python-introduction/>

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - IX
COURSE NAME: Practical V: Data Science Analytics Lab	COURSE CODE:
SEMESTER: II	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
PRACTICAL	

COURSE OBJECTIVES

To provide hands-on experience in data science concepts and techniques using R, including data handling, visualization, machine learning models, and association rule mining.

COURSE OUTCOMES

1. Understand different types of data and understand basic data science tools and roles.
2. Apply the steps of the data analytics process.
3. Use R to import, clean, and visualize data.
4. Build simple machine learning models like clustering, classification, and regression in R.
5. Analyse useful patterns in data using association rule mining.

LAB EXERCISES

1. Read a dataset and classify each column based on data types such as numeric, categorical, text, or logical.
2. Create and display a list of common roles and tools used in the data science ecosystem, showing their interrelation.
3. Illustrate each phase of the data analytics lifecycle and demonstrate them briefly using a sample dataset.
4. Import a CSV dataset in R, generate a statistical summary, and visualize selected columns using a histogram and bar plot.
5. Load data from an Excel file in R using the readxl package, inspect its structure, and export it as a CSV file.
6. Identify and handle missing or dirty data in R using is.na(), and apply mean or median imputation.
7. Visualize a single variable using histogram and boxplot in R, and explore relationships between variables using a scatter plot.

8. Apply K-Means clustering in R on a numeric dataset and visualize the clusters using the facto extra package.
9. Construct a decision tree in R using the Robotic Process Automationrt package and plot it using Robatic Process Automationrt.plot.
10. Implement the Naïve Bayes classifier in R using the e1071 package and evaluate its performance with a confusion matrix.
11. Develop linear and logistic regression models in R using the mtcars dataset and compare their outputs.
12. Perform association rule mining in R using the arules package and visualize the top rules with arulesViz.

PRESCRIBED TEXT BOOKS

1. Introducing Data Science, Big Data, Machine Learning, and more using Python tools 2016. PDF.
2. Data science in big data analytics - Wiley 2015, John Wiley & Sons.
3. R Programming for Data Science - Roger D. Peng, 2015, Lean Publication.

REFERENCE BOOKS

1. A Simple Introduction to Data Science - Lars Nielson, 2015.
2. Introducing Data Science - Davy Cielen, Arno D.B. Meysman, Mohamed Ali, 2016, Manning Publication.
3. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data.

E-REFERENCE

1. https://www.tutorialspoint.com/python_data_science/index.htm
2. <https://www.javatpoint.com/data-science>
3. <https://nptel.ac.in/courses/106/106/106106179/>

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
AVG	3	3	3	3	3

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: IV	COURSE COMPONENT: INTERNSHIP
COURSE NAME: Internship	COURSE CODE:
SEMESTER: II	MARKS:
CREDITS: 2	TOTAL HOURS:
INTERNSHIP	

COURSE OBJECTIVES

To make students aware of practices that are followed in the corporate environment

COURSE OUTCOMES

1. Discuss about the Real-world business operations in the industry about work culture in the real world.
2. Explain the working style and responsibilities of an end user or Client.
3. Analyze the day-to-day activities and problems faced by the end user or client
4. Design solutions to client's problems and improvements to be made in the application utilized by them.
5. Interpret and report the finding.

Internship Program:

- Internships must be supervised, structured learning experiences in a professional setting, that allow you to gain valuable work experience in a chosen field of study.
- Internships must be under the Direct supervision of a professional(s) with relevant expertise and educational and/or professional experience who can provide productive feedback, guidance, and the resources and equipment necessary to complete the internship.
- During the summer vacation of the First year, each student should undergo training in software or software-related registered organization for 25 working days (typically, at least 10 hours per week during summer).
- Every student must present their learning experience as a report soon after the college is reopened.

PSO- CO MAPPING

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

SEMESTER III

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - X
COURSE NAME: Deep Learning	COURSE CODE:
SEMESTER: III	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

To understand the fundamentals and applications of Deep Learning techniques, including CNN, RNN, LSTM, GANs, and Auto-encoders, and their use in solving real-world problems.

COURSE OUTCOMES

1. Understand the basic concepts and techniques of Deep Learning and the need of Deep Learning techniques in real-world problems.
2. Understand CNN algorithms and the way to evaluate performance of the CNN architectures.
3. Apply RNN and LSTM to learn, predict and classify the real-world problems in the paradigms of Deep Learning.
4. Understand, learn and design GANs for the selected problems.
5. Understand the concept of Auto-encoders and enhancing GANs using auto-encoders.

UNIT I

12 HOURS

INTRODUCTION TO DEEP LEARNING: Historical Trends in Deep Learning, Why DL is Growing, Artificial Neural Network, Non-linear classification example using Neural Networks: XOR/XNOR, Single/Multiple Layer Perceptron, Feed Forward Network, Deep Feed- forward networks, Stochastic Gradient-Based learning, Hidden Units, Architecture Design, Back-Propagation, Deep learning frameworks and libraries (e.g., TensorFlow/Keras, PyTorch).

UNIT II

12 HOURS

CONVOLUTION NEURAL NETWORK (CNNd: Introduction to CNNs and their applications in computer vision, CNN basic architecture, Activation functions-sigmoid, tanh, ReLU, Softmax layer, Types of pooling layers, Training of CNN in TensorFlow, various popular CNN architectures: VGG, Google Net, ResNet etc, Dropout, Normalization, Data augmentation

UNIT III

12 HOURS

RECURRENT NEURALNETWORK(RNN): Introduction to RNNs and their applications in sequential data analysis, Back propagation through time (BPTT), Vanishing Gradient Problem, gradient clipping Long Short Term Memory (LSTM) Networks, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.

UNIT-IV

12 HOURS

GENERATIVE ADVERSARIAL NETWORKS (GANS): Generative models, Concept and principles of GANs, Architecture of GANs (generator and discriminator networks), Comparison

between discriminative and generative models, Generative Adversarial Networks (GANs), Applications of GANs.

UNIT-V

12 HOURS

AUTO-ENCODERS: Auto-encoders, Architecture and components of autoencoders (encoder and decoder), Training an auto-encoder for data compression and reconstruction, Relationship between Autoencoders and GANs, Hybrid Models: Encoder- Decoder GANs.

PRESCRIBED BOOKS

1. Deep Learning: An MIT Press Book by Ian Goodfellow and Yoshua Bengio Aaron Courville.
2. Michael Nielson, Neural Networks and Deep Learning, Determiation Press,2015.
3. Satishkumar, Neural networks: A classroom Approach, Tata McGraw-Hill Education,2004

REFERENCE BOOKS

1. Deep Learning with Python, Francois Chollet, Manning publications 2018
2. Advanced Deep Learning with Keras, Rowel Atienza, PACKT Publications 2018

E-LEARNING RESOURCES

1. [Deep Learning Specialization – Andrew Ng \(Coursera\)](#)
2. [Fast.ai Practical Deep Learning for Coders](#)
3. [Deep Learning with Python – GitHub \(François Chollet\)](#)

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer all the questions	1-10	2	20
B	Answer any 5 out of 7 questions	11-17	7	35
C	Answer any 3 out of 5 questions(each in 1200 words)	18-22	15	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	1	1
III	2	2	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5

PSO – CO MAPPING

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

PSO-CO QUESTION PAPER MAPPING

CO No	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand the basic concepts and techniques of Deep Learning and the need of Deep Learning techniques in real-world problems.	PSO 1 TO PSO 5	K1 TO K6
CO2	Understand CNN algorithms and the way to evaluate performance of the CNN architectures.	PSO 1 TO PSO 5	K1 TO K6
CO3	Apply RNN and LSTM to learn, predict and classify the real-world problems in the paradigms of Deep Learning.	PSO 1 TO PSO 5	K1 TO K6
CO4	Understand, learn and design GANs for the selected problems.	PSO 1 TO PSO 5	K1 TO K6
CO5	Understand the concept of Auto-encoders and enhancing GANs using auto-encoders.	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - XI
COURSE NAME: Natural Language Processing	COURSE CODE:
SEMESTER: III	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE

To understand algorithms for processing linguistic information, gain knowledge in morphological, syntactic, and semantic NLP tasks, familiarize with NLP tools and datasets, develop systems for NLP problems, and learn to create machine learning models and generative AI.

COURSE OUTCOMES

1. Understand the basics of language like word formation, grammar, and meaning used in NLP.
2. Learn how to apply statistical and machine learning techniques in NLP tasks.
3. Identify important features from text to help computers process and understand language.
4. Use methods to understand word meanings and explore how AI generates and understands text.
5. Develop simple NLP applications like translators, chatbots, and text summarizers.

UNIT I

12 HOURS

INTRODUCTION: Introduction - NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity. The role of machine learning. Brief history of the field - N-gram Language Models - The role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models.

UNIT II

12 HOURS

BASIC NLP TECHNIQUES: Part Of Speech Tagging and Sequence Labeling - Lexical syntax. Hidden Markov Models (Forward and Viterbi algorithms and EM training) - Basic Neural Networks. Any basic introduction to perceptron and back propagation.

UNIT III

12 HOURS

PARSING & SEMANTIC ANALYSIS: LSTM Recurrent Neural Networks -Syntactic parsing - Grammar formalisms and treebanks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Lexicalized PCFGs. Neural shift-reduce dependency parsing - Lexical semantics and word-sense disambiguation. Compositional semantics. Semantic Role Labelling and Semantic Parsing.

UNIT-IV

12 HOURS

GENERATIVE AI USES, APPLICATIONS AND TOOLS: Introduction to Generative AI – Generative AI capabilities – Generative AI uses and applications across industries – Generative text and speech models – Generative image models – Generative AI models - Generative Adversarial Networks (GANs) - Variational auto encoders (VAEs).

UNIT-V**12 HOURS**

MACHINE TRANSLATION: Information Extraction (IE) - Named entity recognition and relation extraction. IE using sequence labelling. -Machine Translation (MT) Basic issues in MT. Statistical translation, word alignment, phrase-based translation, and synchronous grammars.

PRESCRIBED BOOKS

1. Jurafsky Dan and Martin James H. "Speech and Language Processing" ,3rd Edition, 2018.
2. Learn Python Generative AI: Journey from autoencoders to transformers to large language models, Zonunfeli Ralte, Indrajit Kar, BPB Publications, 2024

REFERENCE BOOKS

1. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana, Practical Natural Language Processing, 2020.
2. Steven Bird, Ewan Klein, Edward Loper, Natural Language Processing with Python, 2009.
3. Joseph Babcock, Raghav Bali, Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models, Packt publishing, 2021.

E-LEARNING RESOURCES

1. https://onlinecourses.nptel.ac.in/noc19_cs56/preview
2. <https://www.edx.org/learn/natural-language-processing>
3. <https://www.coursera.org/specializations/natural-language-processing>
4. https://www.tutorialspoint.com/natural_language_processing/index.htm
5. <https://www.geeksforgeeks.org/generative-ai-models/>

GUIDELINES TO THE QUESTION PAPER SETTERS**QUESTION PAPER PATTERN**

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer all the questions	1-10	2	20
B	Answer any 5 out of 7 questions	11-17	7	35
C	Answer any 3 out of 5 Questions (each in 1200 words)	18-22	15	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B – 7	SECTION C - 5

PSO – CO MAPPING

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

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand the basics of language like word formation, grammar, and meaning used in NLP.	PSO 1 TO PSO 5	K1 TO K6
CO2	Learn how to apply statistical and machine learning techniques in NLP tasks.	PSO 1 TO PSO 5	K1 TO K6
CO3	Identify important features from text to help computers process and understand language.	PSO 1 TO PSO 5	K1 TO K6
CO4	Use methods to understand word meanings and explore how AI generates and understands text.	PSO 1 TO PSO 5	K1 TO K6
CO5	Develop simple NLP applications like translators, chatbots, and text summarizers.	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - XII
COURSE NAME: Full Stack Development	COURSE CODE:
SEMESTER: III	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVES

To provide extensive skill to build, deploy, and secure full-stack web applications using React.js for the front-end, Node.js for the back-end, cloud platforms for deployment, Docker for consistency, and implement best practices for testing and authentication.

COURSE OUTCOMES

1. Able to build Full-Stack Web Applications
2. Deploy and Automate Applications
3. Implement Secure Coding Practices
4. Perform Testing Across Layers
5. Monitor and Debug Applications

UNIT I: Introduction to Full Stack Development & Front-End Development 12 HOURS

Overview of Full Stack Development: Role of Front-end, Back-end, and Database in web applications - Understanding modern web stacks (MEAN, MERN) - Setting up the Development Environment - Installing Node.js, npm (Node Package Manager) - Using version control with Git and GitHub - Introduction to development tools and IDEs (VS Code, Postman, etc.) Basics of Web Development - HTML5 and CSS3 fundamentals - HTML5 & CSS3 for Web Design - Structuring pages with HTML5 (forms, tables, multimedia) - Advanced CSS techniques (Flexbox, Grid, animations, and transitions).

UNIT II: Front-End Development 12 HOURS

JavaScript fundamentals (variables, loops, functions) - JavaScript and DOM Manipulation (selecting, updating elements) - Event handling and user input validation - React.js (for MERN Stack) - Introduction to React.js: Components, JSX, Props, and State- React Hooks: useState, useEffect - React Router for navigating between pages - Managing global state with Redux or React Context API - Managing global state with React.

UNIT III: Back-End Development 12 HOURS

Node.js Fundamentals – Definition of Node.js –Working as a JavaScript runtime for server-side development - Handling HTTP requests and responses in Node.js - Introduction to asynchronous programming in Node.js: Callbacks, Promises, and async/await; Express.js for Building APIs - Setting up a Node.js server using Express.js - Building RESTful APIs: Understanding GET, POST, PUT, and DELETE requests - Using Express middleware for tasks like error handling, logging, and authentication - Working with MongoDB: Introduction - Performing CRUD operations (Create, Read, Update, Delete) with MongoDB - Using Mongoose, an ODM (Object Data Modeling) library, to work with MongoDB - User Authentication; Introduction to JWT (JSON Web Tokens) for user authentication and managing secure access - Implementing login and registration systems using JWT - Securing routes and API endpoints to ensure only authorized users can access them.

UNIT IV: Advanced Concepts and Tools

12 HOURS

Microservices Architecture – Introduction to **Microservices**: Breaking down a large application into smaller, independent services - Communication between microservices using **APIs** and **message queues** - Benefits of microservices for scaling and maintaining large applications; **Docker for Containerization** - Introduction to **Docker** - **Dockerizing** full-stack applications – Wrapping back-end and front-end in containers - **Docker Compose** for defining and running multi-container applications; **Performance Optimization - Techniques** - **Redis** for caching data to reduce database load - Optimizing React applications with **lazy loading** and **code splitting**; **Scalability** - Techniques to scale application, such as **load balancing**, **clustering**, and **horizontal**.

UNIT V: Deployment, Testing, and Security

12 HOURS

Deployment: Deploying full-stack application on cloud platforms like **Heroku**, **AWS**, or **DigitalOcean** - Setting up **CI/CD pipelines** for automated testing and deployment - Using **Docker** for consistent deployment across environments (development, staging, production); **Testing Applications: Unit Testing, Integration Testing, and End-to-End Testing** - Testing **Node.js APIs** using **Jest** - Testing **React applications** with **Jest** and **React Testing Library**; **Security**: Protecting from common security vulnerabilities (e.g., **Cross-Site Scripting (XSS)**, **SQL Injection**, **Cross-Site Request Forgery (CSRF)**) - Using **HTTPS** and **SSL** certificates for secure communication - Implementing **user authentication** securely using **JWT** and **OAuth**; **Monitoring and Logging**: Monitoring application with tools like **PM2** - Setting up logging for errors and debugging using tools like **Morgan**.

PRESCRIBED BOOKS

1. "Full Stack JavaScript Development with MEAN" by Colin J. Ihrig
2. "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node" by Vasan Subramanian
3. "Learning JavaScript Design Patterns" by Addy Osmani
4. "Node.js Design Patterns" by Mario Casciaro
5. "Docker Deep Dive" by Nigel Poulton

REFERENCE BOOKS

1. "You Don't Know JS" (Series) by Kyle Simpson
2. "JavaScript: The Good Parts" by Douglas Crockford
3. "Learning React" by Alex Banks and Eve Porcello
4. "Eloquent JavaScript" by Marijn Haverbeke
5. "Node.js Design Patterns" by Mario Casciaro

E-LEARNING RESOURCES

1. <https://fullstackopen.com/en/>
2. <https://www.coursera.org/specializations/mern-stack-front-to-back>
3. <https://www.codecademy.com/learn/paths/full-stack-engineer-career-path>

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer all the questions	1-10	2	20
B	Answer any 5 out of 7 questions	11-17	7	35
C	Answer any 3 out of 5 questions(each in 1200 words)	18-22	15	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B - 7	SECTION C - 5

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
AVG	3	3	3	3	3

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Able to build Full-Stack Web Applications	PSO 1 TO PSO 5	K1 TO K6
CO2	Deploy and Automate Applications	PSO 1 TO PSO 5	K1 TO K6
CO3	Implement Secure Coding Practices	PSO 1 TO PSO 5	K1 TO K6
CO4	Perform Testing Across Layers	PSO 1 TO PSO 5	K1 TO K6
CO5	Monitor and Debug Applications	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE -IV
COURSE NAME: AI in Healthcare	COURSE CODE:
SEMESTER: III	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

To explore the significance of AI and ML in healthcare, study advanced algorithms, computational intelligence techniques, and NLP applications. Additionally, understand evaluation metrics, ethics, and the future scope of AI/ML in healthcare innovations.

COURSE OUTCOMES

1. Understand the role of AI and ML for handling Healthcare data.
2. Apply Advanced AI algorithms for Healthcare Problems
3. Learn and Apply various Computational Intelligence techniques for Healthcare Application.
4. Develop NLP applications for healthcare using various NLP Techniques.
5. Apply AI and ML algorithms for building Healthcare Applications.

UNIT I

12 HOURS

Introduction: Overview of AI , ML and DL ,A Multifaceted Discipline, Applications of AI in Healthcare - Prediction, Diagnosis, personalized treatment and behavior modification, drug discovery, followup care etc, Realizing potential of AI in healthcare, Healthcare Data - Use Cases.

UNIT II

12 HOURS

AI, ML, Deep Learning and Data Mining Methods for Healthcare: Knowledge discovery and Data Mining, ML, Multi classifier Decision Fusion, Ensemble Learning, Meta-Learning and other Abstract Methods. Evolutionary Algorithms, Illustrative Medical Application-Multiagent Infectious Disease Propagation and Outbreak Prediction, Automated Amblyopia Screening System etc. Computational Intelligence Techniques, Deep Learning, Unsupervised learning, dimensionality reduction algorithms.

UNIT III

12 HOURS

Evaluating learning for Intelligence: Model development and workflow, evaluation metrics, Parameters and Hyperbatic Process Automation parameters, Hyperbatic Process Automation parameter tuning algorithms, multivariate testing, Ethics of Intelligence.

UNIT-IV

12 HOURS

Natural Language Processing in Healthcare: NLP tasks in Medicine, Low-level NLP components, High level NLP components, NLP Methods, Clinical NLP resources and Tools, NLP Applications in Healthcare. Model Interpretability using Explainable AI for NLP applications.

UNIT-V**12 HOURS**

Future of Healthcare using AI: Evidence based medicine, Personalized Medicine, Connected Medicine, Digital Health and Therapeutics, Conversational AI, Virtual and Augmented Reality, Blockchain for verifying supply chain, patient record access, Robot - Assisted Surgery, Smart Hospitals, Case Studies on use of AI and ML for Disease Risk Diagnosis from patient data, Augmented reality applications for Junior doctors.

PRESCRIBED BOOKS:

1. Arjun Panesar, "Machine Learning and AI for Healthcare", A Press.
2. Arvin Agah, "Medical applications of Artificial Systems ", CRC Press

REFERENCE BOOKS:

1. Erik R. Ranschaert Sergey Morozov Paul R. Algra, "Artificial Intelligence in medical Imaging Opportunities, Applications and Risks", Springer.
2. Sergio Consoli Diego Reforgiato Recupero Milan Petković, "Data Science for Healthcare- Methodologies and Applications", Springer
3. Dac-Nhuong Le, Chung Van Le, Jolanda G. Tromp, Gia Nhu Nguyen, "Emerging technologies for health and medicine", Wiley.
4. Ton J. Cleophas • Aeilko H. Zwinderman, "Machine Learning in Medicine- Complete Overview", Springer

E-LEARNING RESOURCES

1. **Stanford AI in Healthcare (Coursera):**
<https://www.coursera.org/specializations/ai-healthcare>
2. **Harvard Data Science for Health (edX):**
<https://online-learning.harvard.edu/course/data-science-health-informatics>
3. **MIT Deep Learning for Healthcare (YouTube):**
https://www.youtube.com/playlist?list=PLkFD6_40KJIwEiwbWx7tX9w9bWCvjy-Gc

GUIDELINES TO THE QUESTION PAPER**SETTERS QUESTION PAPER PATTERN**

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer all the questions	1-10	2	20
B	Answer any 5 out of 7 questions	11-17	7	35
C	Answer any 3 out of 5 questions(each in 1200 words)	18-22	1 5	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B – 7	SECTION C - 5

PSO – CO MAPPING

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

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand the role of AI and ML for handling Healthcare data.	PSO 1 TO PSO 5	K1 TO K6
CO2	Apply Advanced AI algorithms for Healthcare Problems	PSO 1 TO PSO 5	K1 TO K6
CO3	Learn and Apply various Computational Intelligence techniques for Healthcare Application.	PSO 1 TO PSO 5	K1 TO K6
CO4	Develop NLP applications for healthcare using various NLP Techniques.	PSO 1 TO PSO 5	K1 TO K6
CO5	Apply AI and ML algorithms for building Healthcare Applications	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE - IV
COURSE NAME: AI for Economics and Finance	COURSE CODE:
SEMESTER: III	MARKS:100
CREDITS: 4	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVES

To skill the students to apply AI/ML techniques for financial prediction, risk management, fraud detection, and economic forecasting.

COURSE OUTCOMES

1. Attain proficiency in Machine Learning Applications.
2. Acquire AI-Driven Risk Management Skills.
3. Perform Integration of Econometrics and AI.
4. Gain Ethical Awareness in AI Applications.
5. Implement Real-World AI Solutions in Finance.

UNIT I

12 HOURS

Introduction to AI and Machine Learning: Introduction to AI and ML - Supervised vs unsupervised learning - Common ML algorithms: Linear regression, decision trees, clustering - Data preprocessing, feature engineering, and model evaluation

UNIT II

12 HOURS

Machine Learning in Finance and Economic Data Analysis Time series analysis: ARIMA and LSTM models - Stock price prediction and market forecasting using machine learning - Portfolio optimization with machine learning - Economic modelling using machine learning.

UNIT III

12 HOURS

AI in Risk Management and Fraud Detection Risk modelling with AI: Value-at-risk (VaR) and credit risk prediction - Detecting fraud and anomalies using machine learning - Derivatives pricing and options modelling using ML - Stress testing portfolios with AI.

UNIT IV

12 HOURS

Integrating Econometrics and AI: Econometrics basics: Ordinary Least Squares (OLS), Generalized Method of Moments (GMM) - Integrating econometrics with machine learning - Macroeconomic forecasting using AI - Causal inference using machine learning.

UNIT V

12 HOURS

Ethical Considerations and Real-World Applications: Ethical concerns in AI: Bias, fairness, transparency - AI in algorithmic trading, robo-advisors, and RegTech - Regulatory aspects and the future of AI in finance.

TEXT BOOKS

1. "Artificial Intelligence: A Modern Approach" by Stuart Russell & Peter Norvig
2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron
3. "Machine Learning for Asset Managers" by Marcos López de Prado
4. "Econometrics and Data Analysis for Developing Countries" by Thomas L. Friedman
5. "Hands-On Machine Learning for Algorithmic Trading" by Stefan Jansen

REFERENCE BOOKS

1. Advances in Financial Machine Learning – Marcos López de Prado.
2. The Elements of Statistical Learning – Trevor Hastie, Robert Tibshirani, Jerome Friedman.
3. Econometric Analysis – William H. Greene

E-LEARNING RESOURCES

1. **AI For Everyone in Finance – Coursera (by Andrew Ng & DeepLearning.AI)**
<https://www.coursera.org/learn/ai-for-everyone-in-finance>
2. **Financial Engineering and Risk Management – Columbia University (Coursera)**
<https://www.coursera.org/specializations/financial-engineering-risk-management>
3. **Machine Learning for Trading – Udacity (by Georgia Tech)**
<https://www.udacity.com/course/machine-learning-for-trading--ud501>

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer all the questions	1-10	2	20
B	Answer any 5 out of 7 questions	11-17	7	35
C	Answer any 3 out of 5 questions(each in 1200 words)	18-22	15	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B - 7	SECTION C - 5

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
AVG	3	3	3	3	3

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Attain proficiency in Machine Learning applications	PSO 1 TO PSO 5	K1 TO K6
CO2	Acquire AI-Driven Risk Management	PSO 1 TO PSO 5	K1 TO K6
CO3	AI-Driven Risk Management Skills	PSO 1 TO PSO 5	K1 TO K6
CO4	Perform Integration of Econometrics and Implement Real-World AI Solutions in Finance AI	PSO 1 TO PSO 5	K1 TO K6
CO5	Ethical Awareness in AI Applications	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE- IV
COURSE NAME: AI in Agriculture	COURSE CODE:
SEMESTER: III	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE

To educate the applications of AI in agriculture, including machine learning, data collection, precision farming, automation, ethical issues, and sustainable practices to solve real-world challenges.

COURSE OUTCOMES

1. Understand AI applications
2. Demonstrate proficiency in using AI-based tools and technologies
3. Apply machine learning techniques to solve agricultural problems
4. Design and implement AI-driven automation systems for tasks
5. Evaluate ethical issues and the environmental impact of AI in agriculture

UNIT I: Introduction to AI and Agriculture

12 HOURS

AI role in agriculture - AI concepts - machine learning - deep learning - computer vision - crop prediction - resource management – sustainability.

UNIT II: Data Collection and Sensing Technologies in Agriculture

12 HOURS

Data collection - sensing technologies - sensor data - satellite imagery - IoT devices - precision agriculture - drones - remote sensing - GPS - environmental sensors.

UNIT III: Machine Learning and AI Models in Agriculture

12 HOURS

Machine learning - AI models - supervised learning - unsupervised learning - crop prediction - yield forecasting - plant disease detection - pest detection - soil analysis.

UNIT IV: AI-Driven Automation in Agricultural Practices

12 HOURS

AI-driven automation - autonomous machinery - drones - tractors - harvesters - Robotic systems - weeding - planting - harvesting - precision irrigation - livestock monitoring.

UNIT V: Ethical, Environmental & Future Perspectives of AI in Agriculture

12 HOURS

Ethical issues - data privacy - bias - decision-making transparency - environmental impact - sustainable farming practices - climate change mitigation - future trends - smart farming - vertical farming.

TEXT BOOKS

1. "Artificial Intelligence for Agriculture" by Sandeep Kumar
2. "AI in Agriculture: The Next Generation of Farming" by Rajeev K. Bali
3. "Precision Agriculture Technology for Crop Farming" by Qamar Zaman
4. "Data Science for Agriculture" by Johan G. G. D. M. S.
5. "Machine Learning and Data Science in Agriculture" by Rajendra Prasad and Jatinder Singh

REFERENCE BOOKS

1. "Artificial Intelligence in Agriculture" by M.A. Ganaie, N.A. Ahmad
2. "Handbook of Research on Machine Learning Applications and Trends: Algorithms, Methods, and Techniques" by Chowdhury, M. A. Z.
3. "AI for Earth: A Guide for Leveraging Artificial Intelligence for Environmental and Agricultural Sustainability" by Microsoft AI for Earth
4. "Smart Farming: AI Applications in Agriculture" by Luis E. M. & Fernando I. A.

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer all the questions	1-10	2	20
B	Answer any 5 out of 7 questions	11-17	7	35
C	Answer any 3 out of 5 questions(each in 1200 words)	18-22	15	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B - 7	SECTION C - 5

PSO – CO MAPPING

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

PSO-CO QUESITON PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand AI applications	PSO 1 TO PSO 5	K1 TO K6
CO2	Demonstrate proficiency in using AI-based tools and technologies	PSO 1 TO PSO 5	K1 TO K6
CO3	Apply machine learning techniques to solve agricultural problems	PSO 1 TO PSO 5	K1 TO K6
CO4	Design and implement AI-driven automation systems for tasks	PSO 1 TO PSO 5	K1 TO K6
CO5	Evaluate ethical issues and the environmental impact of AI in agriculture	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE - V
COURSE NAME: Network Security and Cryptography	COURSE CODE:
SEMESTER: III	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE

To provide foundational knowledge of cryptographic techniques, network and system security, digital forensics, and cyber laws to ensure data privacy and secure communication.

COURSE OUTCOMES

1. Attain proficiency in Digital Forensics and Cybercrime Investigation
2. Acquire In-depth Knowledge of Cybersecurity Principles and Risk Management
3. Gain competence in Legal and Ethical Aspects of Cybersecurity
4. Attain skill in Handling and Securing Digital Evidence
5. Analysis in advance emerging Cyber Threats and Legal Challenges

UNIT I

12 HOURS

Introduction to Cryptography – Security Attacks – Security Services –Security Algorithm-Stream cipher and Block cipher - Symmetric and Asymmetric-key Cryptosystem Symmetric Key Algorithms: Introduction – DES – Triple DES – AES – IDEA – Blowfish – RC5.

UNIT II

12 HOURS

Computer Forensics Systems and Evidence Collection - Public-key Cryptosystem Introduction to Number Theory – RSA Algorithm – Key Management – Diffie-Hellman Key Exchange – Elliptic Curve Cryptography Message Authentication and Hash Functions – Hash and MAC Algorithm – Digital Signatures and Authentication Protocol. Cyber Law, Data Privacy, and Security.

UNIT III

12 HOURS

Network Security Practice: Authentication Applications – Kerberos – X.509 Authentication services and Encryption Techniques. E-mail Security – PGP – S / MIME – IP Security.

UNIT IV

12 HOURS

Web Security – Secure Socket Layer –Secure Electronic Transaction. System Security - Intruders and Viruses – Firewalls – Password Security.

UNIT V

12 HOURS

Case Study: Implementation of Cryptographic Algorithms – RSA – DSA – ECC(C/JAVA Programming). Network Forensic – Security Audit - Other Security Mechanism: Introduction to: Stenography – Quantum Cryptography – Water Marking - DNA Cryptography.

PRESCRIBED BOOKS

1. William Stallings, “Cryptography and Network Security”, PHI/Pearson Education.
2. Bruce Schneir, “Applied Cryptography”, CRC Press.

REFERENCE BOOKS

1. A.Menezes, P Van Oorschot and S.Vanstone, “Hand Book ofApplied Cryptography”, CRC Press, 1997
2. AnkitFadia,”NetworkSecurity”,MacMillan.

E-LEARNING RESOURCES

1. <https://nptel.ac.in/courses/106/105/106105031/>
2. <http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html>
3. <https://www.tutorialspoint.com/cryptography/index.htm>

GUIDELINES TO THE QUESTION PAPER

SETTERS QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
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C	Answer any 3 out of 5 questions(each in 1200 words)	18-22	15	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B – 7	SECTION C - 5

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
AVG	3	3	3	3	3

PSO – CO QUESTION PAPER MAPPING

CO No	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Attain proficiency in Digital Forensics and Cybercrime Investigation	PSO 1 TO PSO 5	K1 TO K6
CO2	Acquire In-depth Knowledge of Cybersecurity Principles and Risk Management	PSO 1 TO PSO 5	K1 TO K6
CO3	Gain competence in Legal and Ethical Aspects of Cybersecurity	PSO 1 TO PSO 5	K1 TO K6
CO4	Attain skill in Handling and Securing Digital Evidence	PSO 1 TO PSO 5	K1 TO K6
CO5	Analyse in advance emerging Cyber Threats and Legal Challenges	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELCTIVE - V
COURSE NAME: AI in Cloud Computing	COURSE CODE:
SEMESTER: III	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE

To equip students with foundational knowledge of cloud computing and practical skills to deploy, manage, and scale AI models using cloud infrastructure.

COURSE OUTCOMES

1. Understand cloud computing concepts
2. Comprehend cloud infrastructure for AI
3. Deploy and manage AI models on cloud platforms
4. Implement advanced AI applications in the cloud
5. Recognize ethical and legal challenges in AI and cloud computing

UNIT I

12 HOURS

Introduction to Cloud Computing and AI, Cloud Computing Concepts: Cloud service models - IaaS, PaaS, SaaS; Deployment models: Public, Private, Hybrid, Community Cloud; Virtualization and containerization - Cloud providers: AWS, Google Cloud, Microsoft Azure – Integration of AI and Cloud: Cloud infrastructure for AI models - AI offerings for deploying and managing AI models - Benefits of combining AI with Cloud Computing.

UNIT II

12 HOURS

Cloud Computing Infrastructure for AI, AI Workloads in Cloud: Cloud computing resources for AI: CPU, GPU, TPU - Performance and scalability of AI workloads - Cloud platforms supporting AI: AWS, Google Cloud, Azure AI.

UNIT III

12 HOURS

Machine Learning Models and AI in Cloud Environments, Machine Learning Concepts: Supervised, Unsupervised, Reinforcement Learning - Deep Learning: Neural Networks, CNNs, RNNs, GANs - Deploying ML Models in Cloud: Cloud-based tools and platforms for ML model deployment (AWS Sage Maker, Google AI, Azure ML) Serverless AI deployment (AWS Lambda, Google Cloud Functions) - AI Model Management: Model tracking, versioning, monitoring, and retraining - CI/CD practices for AI model deployment.

UNIT IV

12 HOURS

Advanced AI Applications in Cloud Computing, Cloud Resource Management with AI: Intelligent load balancing, provisioning, and auto-scaling - Cost optimization using AI-driven scheduling. AI for Cloud Security: Anomaly detection, intrusion detection, and encryption in cloud environments. AI and IoT in Cloud: Edge computing for AI in IoT devices - Cloud-based AI solutions for IoT platforms (AWS IoT, Google Cloud IoT).

UNIT V**12 HOURS**

Future of AI in Cloud and Ethical Considerations, Emerging Trends in AI and Cloud: Quantum computing for AI enhancement in cloud environments - Federated Learning for decentralized AI training. Ethical Issues in AI: Bias, fairness, transparency, and accountability in AI models - Ethical frameworks for AI deployment. Legal and Regulatory Aspects: Data privacy laws: GDPR, CCPA - Intellectual property and AI liability in cloud environments.

PRESCRIBED BOOKS

1. "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl
2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron

REFERENCE BOOKS

1. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig
2. "Cloud Native Infrastructure: Patterns for Scalable Infrastructure and Applications in a Dynamic Environment" by Justin Garrison and Kris Nova
3. "Cloud Computing for Machine Learning and AI" by Adnan Masood
4. "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis

E-LEARNING RESOURCES

1. AWS AI and Machine Learning : <https://aws.amazon.com/machine-learning/>
2. Google Cloud AI and Machine Learning: <https://cloud.google.com/products/ai>
3. Microsoft Azure AI: <https://azure.microsoft.com/en-us/overview/ai-platform/>
4. IBM Cloud for AI: <https://www.ibm.com/cloud/ai>
5. Cloud Academy - AI in Cloud Computing: <https://cloudacademy.com/>
6. Cloud Computing and AI Integration – ResearchGate: <https://www.researchgate.net/>

GUIDELINES TO THE QUESTION PAPER SETTERS**QUESTION PAPER PATTERN**

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
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TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	1	1
III	2	2	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	2	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
AVG	3	2.8	3	3	3

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand cloud computing concepts	PSO 1 TO PSO 5	K1 TO K6
CO2	Comprehend cloud infrastructure for AI	PSO 1 TO PSO 5	K1 TO K6
CO3	Deploy and manage AI models on cloud platforms	PSO 1 TO PSO 5	K1 TO K6
CO4	Implement advanced AI applications in the cloud	PSO 1 TO PSO 5	K1 TO K6
CO5	Recognize ethical and legal challenges in AI and cloud computing	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Science	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE - V
COURSE NAME: Robotic Process Automation	COURSE CODE:
SEMESTER: III	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE:

To teach students how to automate business functionalities using Robotic Process Automation and create desktop automation scripts without coding knowledge.

COURSE OUTCOMES:

1. Understand the scope, techniques, benefits, and applications of Robotic Process Automation (ROBATIC PROCESS AUTOMATION).
2. Describe key aspects of Robotic Process Automation projects, including user interface, advanced UI interactions, methods, output methods, and activity sequencing using flowcharts.
3. Analyze and apply sequence control flow, delay, and break activities in Robotic Process Automation.
4. Demonstrate data manipulation techniques such as arrays, data scraping, file management, and data tables in Robotic Process Automation.
5. Understand and implement control handling and exception management in Robotic Process Automation processes.

UNIT I

12 HOURS

Robotic Process Automation concepts : History of Automation – Robotic Process Automation vs Automation - Processes & Flowcharts - Programming Constructs in ROBOTIC PROCESS AUTOMATION- What Processes can be Automated - Types of Bots - Workloads which can be automated – Robotic Process Automation advanced Concepts - Standardization of processes – Robotic Process Automation development methodologies - Difference from SDLC - Robotic control flow architecture – Robotic Process Automation business case - Robotic Process Automation Team - Process Design Document/Solution Design Document - Industries best suited for Robotic Process Automation - Risks & Challenges with Robotic Process Automation

UNIT II

12 HOURS

Robotic Process Automation **Tool Introduction and basics:** Introduction to Robotic Process Automation Tool - The User Interface - Variables, Data Types - Sequence, Activities, using activities with workflows, What Flowcharts are and when to use them, Control Flow – Types of Control flow Activities: The Assign activity, The Delay activity, The Break activity, The While activity, The Do While activity, The For each activity, The If activity, The Switch activity.

UNIT III

12 HOURS

Data Manipulation: Variables and scope ,Collections, Arguments – Purpose and use , Data table usage with examples, Building a data table, Building a data table using data scraping, Clipboard management, File operations : Read cell, Write cell, Read Range, Write Range, Append Range, CSV/Excel to data table and vice versa- Taking Control of the Controls: Finding and attaching windows, Finding the control, Act on controls, mouse and keyboard activities, Working with Ui Explorer- Handling Events

UNIT-IV

12 HOURS

Recording –Data Scraping-Screen Scraping - When to use OCR, Types of OCR available, How to use OCR. Selectors - Image, Text - Excel Data Tables & PDF - Extracting Data from PDF - Anchors - Handling User Events & Assistant Bots –Plugins: Java Plugin-PDF Plugin –Excel and Word Plugin-Credential Management-Web Integration.

UNIT-V

12 HOURS

Email Automation: Email Automation, Incoming Email automation, Sending Email automation. Database Automation – Database Connection-Query -Exception Handling - Triggers – Debugging- Deploying And Maintaining The Bot -Publishing - Creation of Server - Using Server to control the bots - Connecting a Robot to Server - Deploy the Robot to Server - Managing packages.

PRESCRIBED BOOKS

1. Alok Mani Tripath, “Learning Robotic Process Automation”, 2018 Packt Publishing

REFERENCE BOOKS

1. Tom Taulli, 2020. The Robotic Process Automation Handbook: A Guide to Implementing ROBOTIC PROCESS AUTOMATION Systems, O'Reilly.
2. Gerardus Blokdyk, 2020. Robotic Process Automation ROBOTIC PROCESS AUTOMATION– A complete guide, Kindle edition.

E-LEARNING RESOURCES:

1. <https://academy.uipath.com/>
2. <https://www.automationanywhere.com/Robatic Process Automation/Robotic -process-automation>
3. <https://enterprisersproject.com/article/2019/5/Robatic Process Automation-Robotic -process-automation-how-explain>
4. <https://www.cio.com/article/227908/what-is-Robatic Process Automation-Robotic -process-automation-explained.html>

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer all the questions</i>	<i>1-10</i>	<i>2</i>	<i>20</i>
B	<i>Answer any 5 out of 7 questions</i>	<i>11-17</i>	<i>7</i>	<i>35</i>
C	<i>Answer any 3 out of 5 questions(each in 1200 words)</i>	<i>18-22</i>	<i>15</i>	<i>45</i>
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5

PSO – CO MAPPING

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

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand the scope, techniques, benefits, and applications of Robotic Process Automation (ROBATIC PROCESS AUTOMATION).	PSO 1 TO PSO 5	K1 TO K6
CO2	Describe key aspects of ROBOTIC PROCESS AUTOMATION projects, including user interface, advanced UI interactions, methods, output methods, and activity sequencing using flowcharts.	PSO 1 TO PSO 5	K1 TO K6
CO3	Analyze and apply sequence control flow, delay, and break activities in ROBOTIC PROCESS AUTOMATION automation.	PSO 1 TO PSO 5	K1 TO K6
CO4	Demonstrate data manipulation techniques such as arrays, data scraping, file management, and data tables in ROBATIC PROCESS AUTOMATION.	PSO 1 TO PSO 5	K1 TO K6
CO5	Understand and implement control handling and exception management in ROBOTIC PROCESS AUTOMATIONprocesses.	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE – XIII
COURSE NAME: PRACTICAL- VI: Deep Learning Lab	COURSE CODE:
SEMESTER: III	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
PRACTICAL	

COURSE OBJECTIVE

To understand the fundamentals and applications of Deep Learning techniques, including CNN, RNN, LSTM, GANs, and Auto-encoders, and their use in solving real-world problems.

COURSE OUTCOMES

1. Understand the basic concepts and techniques of Deep Learning and the need of Deep Learning techniques in real-world problems.
2. Understand CNN algorithms and the way to evaluate performance of the CNN architectures.
3. Apply RNN and LSTM to learn, predict and classify the real-world problems in the paradigms of Deep Learning.
4. Understand, learn and design GANs for the selected problems.
5. Understand the concept of Auto-encoders and enhancing GANs using auto-encoders.

Exercises:

1. Implement a single-layer perceptron to classify AND, OR, and XOR logic gates.
2. Build a Multi-Layer Perceptron (MLP) using Keras for MNIST digit classification.
3. Implement the backpropagation algorithm from scratch for a small dataset.
4. Design a basic CNN with two convolutional layers to classify Fashion MNIST images.
5. Apply data augmentation using Keras and train a CNN on the CIFAR-10 dataset.
6. Use pretrained VGG16 and ResNet models to classify CIFAR-10 images and compare their performance.
7. Implement a basic RNN for sentiment analysis using the IMDB movie review dataset.
8. Build an LSTM-based model and compare its performance with a basic RNN on the same dataset.
9. Extend the LSTM model using Bidirectional LSTM and evaluate its performance.

10. Implement a simple Generative Adversarial Network (GAN) to generate handwritten digits using the MNIST dataset.
11. Train a basic autoencoder on MNIST to perform image compression and reconstruction.
12. Implement a denoising autoencoder to clean noisy MNIST images.

PSO- CO MAPPING

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

PROGRAMME: M.Sc Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - XIV
COURSE NAME: PRACTICAL – VI Natural Language Processing Lab	COURSE CODE:
SEMESTER: III	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
PRACTICAL	

COURSE OBJECTIVE:

To learn how computers understand and process language using algorithms, tools, and AI models.

COURSE OUTCOMES:

1. Describe the concepts of morphology, syntax, semantics, discourse, and pragmatics in natural language processing.
2. Demonstrate an understanding of the relationship between NLP, statistics, and machine learning techniques.
3. Identify and extract linguistic and statistical features for NLP tasks and demonstrate semantic analysis and word sense disambiguation.
4. Understand and demonstrate the application of Generative AI techniques in NLP.
5. Explain the components of the machine translation process and develop models for NLP-based applications.

List of Programs:

1. Illustrate part of speech tagging.
 - a. POS tagging and chunking of user defined text.
 - b. Named Entity recognition of user defined text.
 - c. Named Entity recognition with diagram using NLTK corpus – Treebank.
2. Implement word Tokenizer, Sentence and Paragraph Tokenizers.
3. Write a program to implement TF-IDF for any corpus.
4. Implement the various stemmers such as Porter Stemmer, Lancaster Stemmer, Regexp Stemmer, Snow ball Stemmer, Word NetL emmatizer, etc.
5. Write a program to implement both user-defined and pre-defined functions to generate
 - (a) Uni-grams (b) Bi-grams (c) Tri-grams (d) N-grams
6. Implement N-gram Language model to classify the text into class labels.

7. Implement LSA and Topic model.
8. Implementation text classification using Naïve Bayes, SVM.
9. Implementation of K-means Clustering algorithm on text.
10. Convert the given text to speech and speech to Text. Extract the important features from it.

PSO-CO MAPPING

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

SEMESTER IV

PROGRAMME: M.Sc Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE - VI
COURSE NAME: Artificial Intelligence Ethics	COURSE CODE:
SEMESTER: IV	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE

To gain knowledge in building ethical machines, understand ethical issues in AI algorithms, analyze current AI policies, and apply ethical principles in AI applications.

COURSE OUTCOMES:

1. Understand the reasons for an ethical analysis applied to AI
2. Identify the ethical and social impacts and implications of AI.
3. Discuss about the normative ethics
4. Analyse the policies of AI
5. Apply critical skills in clarifying and ethically analyzing AI in different domains of life.

UNIT I

12 HOURS

BUILDING ETHICS TO MACHINES: Ethical learning, natural and artificial - use and abuse of the trolley problems self-driving cars, medical treatments, and the distribution of harm -moral psychology of AI and the ethical opt out problem modeling and reasoning computational law, symbolic discourse and the AI constitution.

UNIT II

12 HOURS

ETHICS OF INFORMATION &AI: Ethical issues for different strengths/grades of AI and AI algorithms - Medium to strong AI: the moral relevance and effects of its ontological differences, Ethics of AI on the Web and in Web based applications.

UNIT II

12 HOURS

NORMATIVE ETHICS: Rule consequentialism -Deontological approaches - Care ethics - Virtue Ethics - Problems with implementation-Problems with uptake and enforcement Software qualities and normative ethics- Interpretability, transparency and normative ethics - Interpretability, transparency and policy making- Extensibility, usability, and communicability.

UNIT IV

12 HOURS

AI SAFETY, ETHICS, AND POLICY: AI policy and Regulation-Economic effects of AI-Fairness bias and Inequality -Predictive policing-concrete AI safety - Rights and moral consideration for AI and robots- Ethics and AI: teaching machines to be moral- AI and National Security.

UNIT-V**12 HOURS**

Use Cases: Military robots and Autonomous Weapon Systems- Self-driving cars- Expert systems: COMPAS, Watson, Aviation and Air Traffic Management- Machine artistic creativity (The Next Rembrandt, Obvious Art, Shimon) AI Ethics in Healthcare

PRESCRIBED BOOKS

1. Matthew Liao (2020), Ethics of Artificial Intelligence, Oxford university Press

REFERENCE BOOKS

1. Etzioni A (2017), Incorporating ethics into Artificial Intelligence, Journal of Ethics
2. Hooker, J., & Hooker, J. (2018). Ethics of Artificial Intelligence. In Taking Ethics Seriously

E-LEARNING RESOURCES

1. Bauer, W. A. (2020). Virtuous vs. utilitarian artificial moral agents. AI and Society. <https://doi.org/10.1007/s00146-018-0871-3>

GUIDELINES TO THE QUESTION PAPER SETTERS**QUESTION PAPER PATTERN**

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer all the questions	1-10	2	20
B	Answer any 5 out of 7 questions	11-17	7	35
C	Answer any 3 out of 5 questions(each in 1200 words)	18-22	15	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B - 7	SECTION C - 5

PSO – CO MAPPING

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

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand the reasons for an ethical analysis applied to AI	PSO 1 TO PSO 5	K1 TO K6
CO2	Identify the ethical and social impacts and implications of AI.	PSO 1 TO PSO 5	K1 TO K6
CO3	Discuss about the normative ethics Analyse the policies of AI	PSO 1 TO PSO 5	K1 TO K6
CO4	Analyse the policies of AI	PSO 1 TO PSO 5	K1 TO K6
CO5	Apply critical skills in clarifying and ethically analyzing AI in different domains of life.	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE - VI
COURSE NAME: It Cognition	COURSE CODE:
SEMESTER: IV	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE

To gain insights into cognitive systems, apply cognitive techniques to problem-solving, integrate computer science principles in designing cognitive systems, and evaluate their performance.

COURSE OUTCOMES

1. Understand key theories and approaches in cognitive psychology.
2. Analyze perceptual processes, including object recognition, attention, and multisensory integration.
3. Master working memory, long-term memory, and meta-cognitive strategies.
4. Apply problem-solving, reasoning, and decision-making techniques, considering cognitive biases
5. Develop future-oriented skills in critical thinking, adaptive thinking, and design thinking.

UNIT I

12 HOURS

Introduction to Cognition: Meaning cognitive processes, Development of cognitive psychology: Structuralism, Functionalism, Behaviorism, Memory Research, Gestalt psychology, Emergence of cognitive psychology, Information Processing, Connectionism, Alternate approaches to cognitive psychology, Research Methods in Cognitive Psychology.

UNIT II

12 HOURS

Perceptual Processes: Object Recognition- theories of object recognition, Bottom-Up and Top-Down Processing, Face Perception, Change Blindness. **Attention:** Divided attention, Selective: Varieties, Subliminal Perception. **Visual Perception-**Perceptual Organizational -Processes, Multisensory interaction and Integration – Synthesis, Comparing the senses, Perception and Action.

UNIT III

12 HOURS

Memory- Working Memory: Research on Working Memory, Factors affecting the capacity of working Memory, Baddeley's Working Memory Approach. **Long Term Memory:** Encoding and Retrieval in Long Term Memory, Autobiographical Memory. **Memory Strategies:** Practice, Mnemonics using Imagery, Mnemonics using

organization, The Multimodal Approach, Improving Prospective Memory. Meta cognition: Meta memory, TOT, Meta comprehension.

UNIT-IV

12 HOURS

Problem Solving, Reasoning and Decision Making:VUCA World Problem Solving– Types of problem, Understanding the problem, Problem-Solving Approaches, Factors that influence Problem Solving, creativity, Reasoning – Inductive and Deductive Reasoning Decision Making – Heuristics in decision making – representativeness, availability and anchoring and adjustment. The Framing effect, Overconfidence in decisions, The Hindsight Bias.

UNIT-V

12 HOURS

Future Skills: Critical thinking, Adaptive thinking, Cognitive Load Management, Design thinking, Virtual Collaboration and Cultural Sensitivity.

PRESCRIBED BOOKS

1. Matlin M.W. (2003) ‘Cognition’ 5th Edition, Wiley Publication
2. Riegler, B.R., Reigler, G.L. (2008), Cognitive Psychology – Applying the Science of Mind. 2nd Edition, Pearson Education.

REFERENCE BOOKS

1. Benjafield J G (2007). ‘Cognition’ 3rd Edition. Oxford University Press
2. Goldstein B.E.(2008) ‘Cognitive Psychology’ 2nd Edition, Wadsworth.

E-LEARNING RESOURCES

4. <https://www.engati.com/glossary/cognitive-science>
5. <https://www.psychologicalscience.org/observer/cognition-and-perception-is-there-really-a-distinction>
6. <https://pubmed.ncbi.nlm.nih.gov/9496622/>

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	<i>Answer all the questions</i>	<i>1-10</i>	<i>2</i>	<i>20</i>
B	<i>Answer any 5 out of 7 questions</i>	<i>11-17</i>	<i>7</i>	<i>35</i>
C	<i>Answer any 3 out of 5 questions(each in 1200 words)</i>	<i>18-22</i>	<i>15</i>	<i>45</i>
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5
	SECTION A - 10	SECTION B - 7	SECTION C - 5

PSO – CO MAPPING

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

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand key theories and approaches in cognitive psychology.	PSO 1 TO PSO 5	K1 TO K6
CO2	Analyze perceptual processes, including object recognition, attention, and multisensory integration.	PSO 1 TO PSO 5	K1 TO K6
CO3	Master working memory, long-term memory, and meta-cognitive strategies.	PSO 1 TO PSO 5	K1 TO K6
CO4	Apply problem-solving, reasoning, and decision-making techniques, considering cognitive biases.	PSO 1 TO PSO 5	K1 TO K6
CO5	Develop future-oriented skills in critical thinking, adaptive thinking, and design thinking	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: ELECTIVE- VI
COURSE NAME: Agile Software Engineering	COURSE CODE:
SEMESTER: IV	MARKS:100
CREDITS: 3	TOTAL HOURS: 60
THEORY	

COURSE OBJECTIVE

To provide a comprehensive understanding of Agile methodologies, comparing them with traditional models, and equipping students with the skills to establish, mentor, and apply Agile principles and practices for effective software development.

COURSE OUTCOMES:

1. Understand the key principles and practices of Agile methods like Scrum, Kanban, and Extreme Programming.
2. Compare Agile development with traditional methods, recognizing their benefits and drawbacks.
3. Learn to build, lead, and support effective Agile teams.
4. Agile values and principles in software development projects.
5. Identify and address challenges when using Agile practices in different projects.

UNIT I

12 HOURS

Fundamentals of Agile Process: Introduction and background, Agile Manifesto and Principles, Stakeholders and Challenges, Overview of Agile Development Models: Scrum, Extreme Programming, Feature Driven Development, Crystal, Kanban, and Lean Software Development.

UNIT II

12 HOURS

Agile Projects: Planning for Agile Teams: Scrum Teams, XP Teams, General Agile Teams, Team Distribution; Agile Project Lifecycles: Typical Agile Project Lifecycles, Phase Activities, Product Vision, Release Planning: Creating the Product Backlog, User Stories, Prioritizing and Estimating, Creating the Release Plan; Monitoring and Adapting: Managing Risks and Issues, Retrospectives.

UNIT III

12 HOURS

Introduction to Scrum: Agile Scrum Framework, Scrum Artifacts, Meetings, Activities and Roles, Scrum Team Simulation, Scrum Planning Principles, Product and Release Planning, Sprinting: Planning, Execution, Review and Retrospective; User story definition and Characteristics, Acceptance tests and Verifying stories, Burn down chart, Daily scrum, Scrum Case Study.

UNIT-IV**12 HOURS**

Introduction to Extreme Programming (XP): XP Lifecycle, The XP Team, XP Concepts: Refactoring, Technical Debt, Timeboxing, Stories, Velocity; Adopting XP: Pre-requisites, Challenges; Applying XP: Thinking- Pair Programming, Collaborating, Release, Planning, Development; XP Case Study.

UNIT-V**12 HOURS**

Agile Software Design and Development: Agile design practices, Role of design Principles, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control; Agility and Quality Assurance: Agile Interaction Design, Agile approach to Quality Assurance, Test Driven Development, Pair programming: Issues and Challenges.

PRESCRIBED BOOKS

1. Robert C. Martin, Agile Software Development- Principles, Patterns and Practices, Prentice Hall, 2013.
2. Kenneth S. Rubin, Essential Scrum: A Practical Guide to the Most Popular Agile Process, AddisonWesley, 2012.

REFERENCE BOOKS

1. James Shore and Shane Warden, The Art of Agile Development, O'Reilly Media, 2007.
2. Craig Larman, —Agile and Iterative Development: A manager's Guide, Addison-Wesley, 2004.
3. Ken Schawber, Mike Beedle, Agile Software Development with Scrum, Pearson, 2001.
4. Cohn, Mike, Agile Estimating and Planning, Pearson Education, 2006.
5. Cohn, Mike, User Stories Applied: For Agile Software Development Addison Wisley, 2004.

GUIDELINES TO THE QUESTION PAPER SETTERS**QUESTION PAPER PATTERN**

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer all the questions	1-10	2	20
B	Answer any 5 out of 7 questions	11-17	7	35
C	Answer any 3 out of 5 Questions (each in 1200 words)	18-22	15	45
TOTAL MARKS				100

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	2	1	1
IV	2	1	1
V	2	1	1
TOTAL	10	7	5

PSO – CO MAPPING

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

PSO-CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand the key principles and practices of Agile methods like Scrum, Kanban, and Extreme Programming.	PSO 1 TO PSO 5	K1 TO K6
CO2	Compare Agile development with traditional methods, recognizing their benefits and drawbacks.	PSO 1 TO PSO 5	K1 TO K6
CO3	Learn to build, lead, and support effective Agile teams.	PSO 1 TO PSO 5	K1 TO K6
CO4	Apply Agile values and principles in software development projects.	PSO 1 TO PSO 5	K1 TO K6
CO5	Identify and address challenges when using Agile practices in different projects	PSO 1 TO PSO 5	K1 TO K6

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

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: CORE - XV
COURSE NAME: Project with Viva-Voce	COURSE CODE:
SEMESTER: IV	MARKS:100
CREDITS: 13	TOTAL HOURS:
MAJOR PROJECT	

COURSE OBJECTIVE:

To enable students to develop a unique project by defining the problem, designing and implementing it using available software development tools/programming, and preparing a report.

COURSE OUTCOMES:

1. Problem Definition: Students will be able to clearly define and analyze a project problem statement.
2. Project Design: Students will be able to design a project using appropriate software tools and methodologies.
3. Implementation Skills: Students will be capable of implementing the project solution using relevant techniques and technologies.
4. Technical Proficiency: Students will develop the ability to apply software development techniques effectively to address the defined problem.
5. Report Preparation: Students will be able to prepare a comprehensive report documenting the project development process and outcomes.

Major Project Guidelines:

Mode of Major Project: Individual Project

Nature of Major Project: Every student must choose a unique project title (novel concept, idea, system, or a small research problem) approved by their guide and then design and implement it using available software development tools or programming languages.

Guide: Each Student shall be allotted under the Guidance of one **Department faculty member by the Head of the Department.**

Continuous Assessment: Based on periodic reviews (Three reviews during the Semester. Tentative review dates are decided by the department and to be intimated to the students at the beginning of the fourth Semester)

Evaluation criteria

Each student is evaluated by the Internal Examiner (Guide) continuously during the respective semester. External Examination will be conducted at the end of the respective semester.

Passing Criteria

Student shall secure a minimum of **50 % marks in the external** evaluation and shall secure a **minimum of 50 % marks in combined Internal and External evaluation.**

(There is no passing minimum for the internal evaluation)

Internal (50 Marks)		External (50 Marks)	
Review I (Problem identification, Title & Abstract submission, The novelty of the idea proposed outcomes, issues in existing methods, tools to be used)	15 Marks	Both Internal and External Examiner Shall evaluate the student based on the following criteria at the end of the semester: (Guide or any other department faculty decided by the HOD shall be the Internal Examiner. External Examiner will be appointed by the COE)	
Review II System Design / Database Design /Methodology/ Algorithms and Techniques / detailed Implementation plan	15 Marks	Internal Examiner Project Report	20 Marks
Review III SystemImplementation status, Testing, outcomes and report writing	20 Marks	External Examiner shall evaluate under the following criteria ● Presentation of the Project ● Demonstration of the working project ● Viva -voce	10 Marks 10 Marks 10 Marks
Total	50 Marks		50 Marks

SKILL ENHANCEMENT COURSE

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: IV	COURSE COMPONENT: SEC- I
COURSE NAME: Communication and Presentation Skills	COURSE CODE:
SEMESTER: I	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

COURSE OBJECTIVE:

To build communication skills for personal and professional development.

COURSE OUTCOMES:

1. Explain and demonstrate the ability to listen to others actively, understand diverse perspectives, and paraphrase key points accurately, enhancing their comprehension skills in various personal and professional contexts.
2. Explain and articulate thoughts, ideas, and information clearly and concisely, using appropriate language and structure to convey messages effectively in both written and verbal communication.
3. Demonstrate confidence in expressing opinions, asserting boundaries, and advocating for themselves and others, enhancing self-assurance and effectiveness in interpersonal and group communication.
4. Demonstrate knowledge and adapt 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. Demonstrate knowledge in acquiring 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

6 HOURS

Essentials of Effective Communication: Communication Skills-LSRW- Characteristic features of LSRW-Consequences of Ineffective Communication-Impact of Technology on Communication

UNIT II

6 HOURS

Types of Communication: Verbal Communication – Non-verbal Communication- Visual Communication - Written Communication-Group Communication-Digital Communication- Formal and Informal Communication-Vertical-Horizontal-Diagonal Grapevine

UNIT III

6 HOURS

Barriers in Communication: Physical Barriers - Language Barriers - Social and Cultural Barriers - Psychological Barriers - Semantic Barriers - Interpersonal Barriers - Technological Barriers- Means to overcome the various barriers to Communication

UNIT IV

6 HOURS

Etiquettes and Ethical Practices in Communication: Active Listening - Clarity and Conciseness - Professional Tone - Timeliness - Constructive Feedback-Transparency- Professionalism-Accountability-Confidentiality-Cultural Sensitivity- Emotional Intelligence-Empathy-Social Intelligence-Social Etiquettes- Appreciation and Gratitude.

UNIT V

6 HOURS

Presentation Skills : Types of Presentation- Preparing a presentation-Do's and Don'ts while giving a presentation- Managing tools for presentation-Using Prompts-Making effective uses of Audio/Visual aids during presentation-Dealing with Questions, Interruptions and Pauses- Practical: Participating in Mock presentations

PRESCRIBED BOOKS

1. Monippally, Matthukutty, M. Business Communication Strategies. New Delhi: Tata McGraw-Hill Publishing Company Ltd., 2001.
2. Peter, Francis. (2012) Soft Skills and Professional Communication. New Delhi: TataMcGraw Hill.
3. Raman, Meenakshi & Prakash Singh (2012) Business Communication Oxford University Press

REFERENCE BOOKS

1. Gallo, Maria. D (2018) Stop Lecturing Start Communicating: The Public Speaking Survival Guide for Business Kindle Edition
2. Hasson, Gill. (2012) Brilliant Communication Skills. Great Britain: Pearson Education.
3. Patil, Shailesh (2020) Handbook on Public Speaking, Presentation & Communication Skills: Principles & Practices to create high impact presentations & meaningful conversations, Chennai, Notion Press Media Pvt Ltd.

E-LEARNING RESOURCES

1. <https://uwaterloo.ca/centre-for-teaching-excellence/catalogs/tip-sheets/effective-communication-barriers-and-strategies>
2. <https://www.coursera.org/articles/presentation-skills>
3. <https://positivepsychology.com/how-to-improve-communication-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	SECTION A - 7	SECTION B - 6	SECTION C - 4

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: IV	COURSE COMPONENT: SEC - II
COURSE NAME: Quantitative Aptitude	COURSE CODE:
SEMESTER: II	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

SKILL ENHANCEMENT COURSE

COURSE OBJECTIVE

To improve the Quantitative Aptitude skills of the Students.

COURSE OUTCOMES:

1. Examine and evaluate problems based on mathematical concepts like Numbers, HCF, LCM, Decimal Fractions, Simplification, Square Roots, Cube roots, Averages
2. Examine and evaluate problems based on numbers and ages, Surds, Indices, Percentages, Profit and Loss, Ratio and Proportion, Partnership, Chain Rule.
3. Examine and evaluate problems based on Time and Work, Pipes and Distances. Time and distance, Problems on Trains.
4. Examine and evaluate problems based on Boats and Streams, Alligation, Simple Interest, Compound Interest, Logarithms, Area, Volume and Surface Area.
5. Analyze the given problem related to Quantitative Aptitude and solve it efficiently.

UNIT I

6 HOURS

Numbers, HCF, LCM, Decimal Fractions, Simplification, Square Roots, Cube roots, Averages.

UNIT II

6 HOURS

Problems in numbers and ages, Surds, Indices, Percentages, Profit and Loss, Ratio and Proportion, Partnership, Chain Rule.

UNIT III:

6 HOURS

Time and Work, Pipes and Distances. Time and distance, Problems on Trains.

UNIT IV

6 HOURS

Boats and Streams, Alligation, Simple Interest, Compound Interest, Logarithms, Area, Volume and Surface Area.

UNIT V

6 HOURS

Races and Games of Skill, Calendar, Clocks, Stocks and Shares, Permutation and Combination, Probability, True discount, Banker's Discount, Height and Distances, Old man out and Series,

Tabulation, Bar graphs, Pie charts, Line Graphs.

PRESCRIBED BOOKS:

1. R.S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", Seventh Revised Edition, S. Chand and Co. Ltd., New Delhi, 2005. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.

REFERENCE BOOKS:

1. Barron's Guide for GMAT, Galgotia Publications, New Delhi, 2006. Excellent General English-R.B. Varshney, R.K. Bansal, Mittal Book Depot, Malhotra

The end semester exam will have a written exam for 100 marks (50 MCQs will be given).

SKILL ENHANCEMENT COURSE

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: IV	COURSE COMPONENT: SEC - III
COURSE NAME: Research Work/ MOOC Course	COURSE CODE:
SEMESTER: III	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

MOOC Course:

Students will be permitted to do Massive Open Online courses (MOOC) of maximum three credits during the fourth semester, with the prior approval from the Head of the Department. On successful completion of the course, the candidate has to submit the copy of the certificate to the Head of the Department. The Head of the Department can form a team of faculty members to recommend the grade to be awarded to the candidate by mapping the score earned by the students and the results can be sent to the Controller of Examinations after the approval of the Head of the Department.

(OR)

Research Work:

Sr. No.	Guidelines for Research Work
1	Each student must submit a detailed project proposal outlining the research problem, objectives, methodology, and expected outcomes.
2	A guide will be assigned by head of the department to each group of students to provide guidance and support throughout the research process as well as to do internal assessment.
3	Students are required to conduct a thorough literature review to understand the current state of research in their chosen area.
4	Students should execute the research plan outlined in their proposal, adhering to ethical guidelines and academic standards.
5	Proper documentation of the research process, including experimental setup, data collection methods, and analysis techniques, should be maintained
6	Upon completion of the research work, students must present their research work in reputed journals or at conferences
8	The evaluation of the research-based learning course will be divided into two components: the student's research findings and the published research article

SKILL ENHANCEMENT COURSE

PROGRAMME: M.Sc. Computer Science with Artificial Intelligence	BATCH: 2025-27
PART: III	COURSE COMPONENT: SEC - IV
COURSE NAME: Role of AI for Environmental Sustainability	COURSE CODE:
SEMESTER: IV	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

COURSE OBJECTIVE

To explore the applications of AI in promoting environmental sustainability, focusing on areas like climate change mitigation, resource management, sustainable agriculture, and pollution control.

UNIT I

6 HOURS

Introduction to AI and Environmental Sustainability: Overview of AI - role of AI in sustainability - environmental challenges - climate change - energy consumption - sustainable practices - AI for natural resource management.

UNIT II

6 HOURS

AI in Climate Change Mitigation and Adaptation: AI for climate prediction - modeling climate change impacts - renewable energy optimization - carbon emission reduction - AI-based climate solutions - adaptation strategies.

UNIT III

6 HOURS

AI for Biodiversity Conservation and Ecosystem Management: AI in wildlife monitoring - species protection - habitat restoration - detecting poaching - AI for ecosystem health - machine learning in conservation efforts.

UNIT IV

6 HOURS

AI in Sustainable Agriculture: Precision farming - crop monitoring with AI - resource-efficient irrigation - soil health monitoring - pest detection - AI in agriculture to reduce environmental impact.

UNIT V

6 HOURS

AI in Waste Management and Pollution Control : AI for waste sorting - recycling automation - pollution monitoring - air and water quality analysis - AI for reducing waste and pollution - optimizing resource use.

TEXT BOOKS

1. "Artificial Intelligence for Earth Systems" by Debajyoti Ghosh, Sudhir K. R.
2. "AI in Environmental Science" by Anil K. Bera