BOARD OF STUDIES (BoS) PROCEEDING
of
CENTRE FOR ARTIFICIAL INTELLIGENCE
[under the Madhav Institute of Technology & Science-Deemed University (MITS-DU)]

(Meeting Dated - 2nd December, 2025)

Summary of BoS Meeting

Courses where revision was carried out							
Course name	**Course Code**	**Year/ Date of introduction**	**Year/ Date of revision**	**Percentage of content added or replaced**	**Agenda Item No.**	**Page No.**	**Link of relevant documents/ minutes**
Data Structures	31251204/ 24251204/ 27251204/ 28251204	2021	Dec., 2025	2.5%	3	1	https://web.mitsgwalior.in/board-of-studies-bos-cai
Basic Electrical & Electronics Engineering	31251205/ 27251205/ 28251205	2021	Dec., 2025	6.67%	3	1	https://web.mitsgwalior.in/board-of-studies-bos-cai
Software Engineering	31242203/ 24242204/ 27242203/ 28242203	2021	Dec., 2025	10%	6	2	https://web.mitsgwalior.in/board-of-studies-bos-cai
Network and Web Security	31242204/ 24242202/ 27242204/ 28242204	2022	Dec., 2025	6.25%	6	2	https://web.mitsgwalior.in/board-of-studies-bos-cai

New Courses added					
Course name	**Course Code**	**Activities/contents which have a bearing on increasing skill and employability**	**Agenda Item No.**	**Page No.**	**Link of relevant documents/ minutes**
Foundations of Cryptography	H24042803	Analyze cryptographic protocols and vulnerabilities. Mini-project: secure messaging / digital signatures.	8	2	https://web.mitsgwalior.in/board-of-studies-bos-cai
Foundations of Cyber Physical Systems	H24042805	Sensor–actuator interfacing on Arduino/Raspberry Pi. Build a small CPS prototype (e.g., smart home or robot controller).	8	2	https://web.mitsgwalior.in/board-of-studies-bos-cai
Embedded Systems Design	H24042806	Program microcontrollers (ARM/ESP32/Arduino). Interfacing sensors and communication modules. Mini embedded product design project.	8	2	https://web.mitsgwalior.in/board-of-studies-bos-cai
Basics of Computational Complexity	H24042807	Real-world case studies on NP-hard optimization. Small study project on reductions or approximation algorithms.	8	2	https://web.mitsgwalior.in/board-of-studies-bos-cai
Advanced Computer Architecture	H24042808	Cache/memory hierarchy simulations. Mini-project: simple processor or subsystem simulation.	8	2	https://web.mitsgwalior.in/board-of-studies-bos-cai

Centre for Artificial Intelligence

Date: 03.12.2025

Minutes of Meeting of Board of Studies (BoS)
in
Centre for Artificial Intelligence
[under the Madhav Institute of Technology & Science-Deemed University (MITS-DU)]

The meeting of the Board of Studies (BoS) in the Centre for Artificial Intelligence (under MITS-DU) was held on 02 Dec., 2025 at 04:30 PM in offline mode (in room no.: M104). The following deliberation took place in the meeting:

Agenda Item 1	To confirm the minutes of previous BoS meeting held in the month of June 2025 **The minutes of the previous BoS meeting held on 06 June, 2025 were presented, discussed and confirmed.**
Agenda Item 2	To review and finalize the scheme structure of B.Tech./B.Arch. II semester for the Batch admitted in 2025-26 academic session under the Madhav Institute of Technology & Science-Deemed University (MITS-DU) structure **The scheme structure of B. Tech. II Semester in Artificial Intelligence/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning, batch admitted in academic session 2025 – 26, was analyzed, discussed and recommended. The scheme structure of II semester for each branch is annexed as Annexure-I.**
Agenda Item 3	To review and finalize the syllabi of all courses of UG programmes - B. Tech. and B.Arch. II Semester (for batch admitted in 2025-26) along with their COs and CO-PO/PSO matrix. **The syllabi along with the course outcomes of each course of B. Tech. II Semester in Artificial Intelligence/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning, batch admitted in academic session 2025 – 26, was analyzed, discussed and recommended. The syllabus of all the courses of II semester in each branch is annexed as Annexure-II.**
Agenda Item 4	To review and finalize the Experiment list/ Lab manual and project list under Micro Project-II for all the Laboratory Courses to be offered in UG programmes – B.Tech. and B.Arch. II Semester (for batch admitted in 2025-26) along with their COs and CO-PO/PSO matrix. **The Experiment list/ Lab manual for all the Laboratory Courses and Micro Project-II of B. Tech. II Semester in Artificial Intelligence/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning, batch admitted in academic session 2025 – 26, was discussed and recommended. The experiment list/Lab manual and Micro Project-II list is annexed as Annexure-III.**
Agenda Item 5	To review and finalize the scheme structure of B.Tech./B.Arch. IV semester for the Batch admitted in 2024-25 academic session under the Madhav Institute of Technology & Science-Deemed University (MITS-DU) structure **The scheme structure of B. Tech. IV Semester in Artificial Intelligence/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning, batch admitted in academic session 2024 – 25, was analyzed, discussed and recommended. The scheme structure of II semester for each branch is annexed as Annexure-IV.**
Agenda Item 6	To review and finalize the syllabi of all courses of UG programmes - B. Tech. and B.Arch. IV Semester (for batch admitted in 2024-25) along with their COs and CO-PO/PSO matrix.

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	The syllabi along with the course outcomes of each course of B. Tech. IV Semester in Artificial Intelligence/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning, batch admitted in academic session 2024 – 25, was analyzed, discussed and recommended. The syllabus of all the courses of IV semester in each branch is annexed as Annexure-V.
Agenda Item 7	To review and finalize the Experiment list/ Lab manual and project list under Macro Project-II for all the Laboratory Courses to be offered in UG programmes – B.Tech. and B.Arch. IV Semester (for batch admitted in 2024-25) along with their COs and CO-PO/PSO matrix. **The Experiment list/ Lab manual for all the Laboratory Courses and Macro Project-II of B. Tech. IV Semester in Artificial Intelligence/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning, batch admitted in academic session 2024 – 25, was discussed and recommended. The experiment list/Lab manual and Macro Project-II list is annexed as Annexure-VI.**
Agenda Item 8	To review and finalize the list of additional courses for Honours/Minors to be offered from SWAYAM/NPTEL/Institute MOOC based platform for UG programmes – B.Tech. and B.Arch., IV Semester (for batch admitted in 2024-25). **The List of additional courses for Honours/Minors to be offered from SWAYAM/NPTEL/MOOC based platform for B. Tech. IV Semester in Artificial Intelligence/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning, batch admitted in academic session 2024 – 25, was discussed and recommended. The same is annexed as Annexure-VII.**
Agenda Item 9	To propose/update the list of professional certification platforms and relating certifications with specific domain/areas of certification. {representative list to be prepared} **The proposed list of professional certification platforms and relating certifications with specific domain/areas of certification was presented and recommended in the meeting. The same is annexed as Annexure - VIII.**
Agenda Item 10	To review and finalize the scheme structure & syllabi of PG Programmes, II semester (admitted in 2025-26 session) along with their COs. **NA**
Agenda Item 11	To review and finalize the syllabus/module content for Classified Novel Engaging Courses to be offered in PG programmes, II semester (2025-26 admitted batch). **NA**
Agenda Item 12	To review and finalize the courses and syllabi for all courses of PG Programmes including the System Development Projects (MCA/MBA), IV semester (2024-25 admitted batch) along with their Course Outcomes (COs). **NA**
Agenda Item 13	To review the CO attainments, identify gaps and suggest corrective measures for the improvement in CO attainment levels for the courses taught in second semester, January-June 2025 Session. **The CO attainments, gap analysis and corrective measures taken (for the courses taught during Jan.-June 2025 Session) were presented, reviewed and analysed during the meeting. The same is annexed as Annexure - IX.**

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Agenda Item 14	To consider and review the curriculum feedback from various stakeholders, its analysis and impact report. **The curriculum feedback from various stakeholders, its analysis and impact report (for the courses taught during Jan.-June 2025 Session) in Artificial Intelligence (AI)/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning was presented, reviewed and analysed during the meeting. The same is annexed as Annexure - X.**
Agenda Item 15	BoS Agenda under RGPV Structure. **The BoS meeting was also extended for RGPV structure, where discussion on each agenda item was held and the proceeding of the meeting is available as a separate document.**

The meeting ended with the vote of thanks to all the members.

Dr. Pawan Dubey **Dr. Tej Singh**

Dr. Rajni Ranjan Singh
Head, Centre for Artificial Intelligence [Chairperson, BoS]

ANNEXURE - I

Scheme structure of
B.Tech.
[Artificial Intelligence (AI)/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]
II semester
for the Batch admitted in 2025-26

Centre for Artificial Intelligence

Scheme of Evaluation

B. Tech. II Semester *(Artificial Intelligence (AI))*

(for batch admitted in academic session 2025-26)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation								
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional			L	T	P				
1.	31251201	BSC	Discrete Structures	25	25	20	30	-	-	100	3	-	-	3	Face to Face	MCQ	2 Hrs
2.	31251202	DC	Modern Computer Architecture	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
3.	31251203	DC	Object Oriented Programming	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	31251204	DC	Data Structures	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
5.	31251205	ESC	Basic Electrical & Electronics Engineering	25	25	20	30	-	-	100	2	-	-	2	Face to Face	MCQ	2 Hrs
6.	31251206	DLC	Object Oriented Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	31251207	DLC	Data Structures Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	31251208	DLC	Basic Electrical & Electronics Engineering Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	31251209	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	31251210	PBL	Micro Project-II[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	NECXXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
12.	SIP1XXXX	SIP	Skill Internship Program (Soft Skill)	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
Total				**125**	**125**	**100**	**150**	**440**	**120**	**1060**	**11**	**04**	**10**	**22**	-	-	-
13.	31251211	MAC	Sustainability & Environmental Science	-	-	-	-	100	-	100	-	2	-	GRADE	Blended	SO	-
14.	31251212	MWS	Mandatory Workshop on Career Planning & Goal Setting at Department Level											GRADE	Interactive	MCQ	-

Summer Semester of six-eight week duration will be conducted for makeup of I & II semester examination.

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

MCQ: Multiple Choice Question **AO:** Assignment + Oral **PP:** Pen Paper **SO:** Submission + Oral **OB:** Open Book

**These credits will be transferred from the Skill Internship Program (Soft Skill).

[#]Micro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	1	1	3	0	0	0	3	1	1	0	0	0	1	1	1

Mode of Learning					Mode of Examination					Total Credits
Face to Face	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	
15	1	0	3	3	7	3	7	0	5	22
68	4	0	14	14	31.82	13.63	31.82	0	22.73	Credits %

Recommended in the Board of Studies Meeting of Centre for Artificial Intelligence held on 2nd Dec., 2025

Centre for Artificial Intelligence

Scheme of Evaluation

B. Tech. II Semester *(Information Technology (Artificial Intelligence and Robotics))*

(for batch admitted in academic session 2025-26)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation								
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional			L	T	P				
1.	24251201	BSC	Discrete Structures	25	25	20	30	-	-	100	3	-	-	3	Face to Face	MCQ	2 Hrs
2.	24251202	DC	Modern Computer Architecture	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
3.	24251203	DC	Object Oriented Programming	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	24251204	DC	Data Structures	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
5.	24251205	DC	Sensors and Actuators	25	25	20	30	-	-	100	2	-	-	2	Face to Face	MCQ	2 Hrs
6.	24251206	DLC	Object Oriented Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	24251207	DLC	Data Structures Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	24251208	DLC	Sensors and Actuators Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	24251209	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	24251210	PBL	Micro Project-II[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	NECXXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
12.	SIP1XXXX	SIP	Skill Internship Program (Soft Skill)	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
Total				**125**	**125**	**100**	**150**	**440**	**120**	**1060**	**11**	**04**	**10**	**22**	**-**	**-**	**-**
13.	24251211	MAC	Sustainability & Environmental Science	-	-	-	-	100	-	100	-	2	-	GRADE	Blended	SO	-
14.	24251212	MWS	Mandatory Workshop on Career Planning & Goal Setting at Department Level											GRADE	Interactive	MCQ	-

Summer Semester of six-eight week duration will be conducted for makeup of I & II semester examination.

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

MCQ: Multiple Choice Question **AO:** Assignment + Oral **PP:** Pen Paper **SO:** Submission + Oral **OB:** Open Book

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[#]Micro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	1	0	4	0	0	0	3	1	1	0	0	0	1	1	1

Mode of Learning					Mode of Examination					Total Credits
Face to Face	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	
15	1	0	3	3	7	3	7	0	5	22
68	4	0	14	14	31.82	13.63	31.82	0	22.73	Credits %

Recommended in the Board of Studies Meeting of Centre for Artificial Intelligence held on 2nd Dec., 2025

Centre for Artificial Intelligence

Scheme of Evaluation

B. Tech. II Semester *(Artificial Intelligence (AI) and Data Science)*

(for batch admitted in academic session 2025-26)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation								
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional			L	T	P				
1.	27251201	BSC	Discrete Structures	25	25	20	30	-	-	100	3	-	-	3	Face to Face	MCQ	2 Hrs
2.	27251202	DC	Modern Computer Architecture	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
3.	27251203	DC	Object Oriented Programming	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	27251204	DC	Data Structures	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
5.	27251205	ESC	Basic Electrical & Electronics Engineering	25	25	20	30	-	-	100	2	-	-	2	Face to Face	MCQ	2 Hrs
6.	27251206	DLC	Object Oriented Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	27251207	DLC	Data Structures Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	27251208	DLC	Basic Electrical & Electronics Engineering Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	27251209	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	27251210	PBL	Micro Project-II[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	NECXXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
12.	SIP1XXXX	SIP	Skill Internship Program (Soft Skill)	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
Total				**125**	**125**	**100**	**150**	**440**	**120**	**1060**	**11**	**04**	**10**	**22**	**-**	**-**	**-**
13.	27251211	MAC	Sustainability & Environmental Science	-	-	-	-	100	-	100	-	2	-	GRADE	Blended	SO	-
14.	27251212	MWS	Mandatory Workshop on Career Planning & Goal Setting at Department Level											GRADE	Interactive	MCQ	-

Summer Semester of six-eight week duration will be conducted for makeup of I & II semester examination.

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MCQ: Multiple Choice Question **AO:** Assignment + Oral **PP:** Pen Paper **SO:** Submission + Oral **OB:** Open Book

**These credits will be transferred from the Skill Internship Program (Soft Skill).

[#]Micro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	1	0	3	0	0	0	3	1	1	0	0	0	1	1	1

Mode of Learning					Mode of Examination					Total Credits
Face to Face	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	
15	1	0	3	3	7	3	7	0	5	22
68	4	0	14	14	31.82	13.63	31.82	0	22.73	Credits %

Recommended in the Board of Studies Meeting of Centre for Artificial Intelligence held on 2nd Dec., 2025

Centre for Artificial Intelligence

Scheme of Evaluation

B. Tech. II Semester *(Artificial Intelligence (AI) and Machine Learning)*

(for batch admitted in academic session 2025-26)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation								
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional			L	T	P				
1.	28251201	BSC	Discrete Structures	25	25	20	30	-	-	100	3	-	-	3	Face to Face	MCQ	2 Hrs
2.	28251202	DC	Modern Computer Architecture	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
3.	28251203	DC	Object Oriented Programming	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	28251204	DC	Data Structures	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
5.	28251205	ESC	Basic Electrical & Electronics Engineering	25	25	20	30	-	-	100	2	-	-	2	Face to Face	MCQ	2 Hrs
6.	28251206	DLC	Object Oriented Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	28251207	DLC	Data Structures Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	28251208	DLC	Basic Electrical & Electronics Engineering Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	28251209	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	28251210	PBL	Micro Project-II[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	NECXXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
12.	SIP1XXXX	SIP	Skill Internship Program (Soft Skill)	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
Total				**125**	**125**	**100**	**150**	**440**	**120**	**1060**	**11**	**04**	**10**	**22**	**-**	**-**	**-**
13.	28251211	MAC	Sustainability & Environmental Science	-	-	-	-	100	-	100	-	2	-	GRADE	Blended	SO	-
14.	28251212	MWS	Mandatory Workshop on Career Planning & Goal Setting at Department Level											GRADE	Interactive	MCQ	-

Summer Semester of six-eight week duration will be conducted for makeup of I & II semester examination.

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MCQ: Multiple Choice Question **AO:** Assignment + Oral **PP:** Pen Paper **SO:** Submission + Oral **OB:** Open Book

**These credits will be transferred from the Skill Internship Program (Soft Skill).

[#]Micro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	1	1	3	0	0	0	3	1	1	0	0	0	1	1	1

Mode of Learning					Mode of Examination					Total Credits
Face to Face	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	
15	1	0	3	3	7	3	7	0	5	22
68	4	0	14	14	31.82	13.63	31.82	0	22.73	Credits %

Recommended in the Board of Studies Meeting of Centre for Artificial Intelligence held on 2nd Dec., 2025

ANNEXURE - II

Syllabi of all courses of UG programmes
B. Tech.
[Artificial Intelligence (AI)/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]
II Semester
for batch admitted in 2025-26

Centre for Artificial Intelligence
DISCRETE STRUCTURES
(31251201/ 24251201/ 27251201/ 28251201)

COURSE OBJECTIVES

- To perceive the knowledge of basic algebra and propositional logic
- To know about the graph theory and its application in computer engineering
- To familiarize the discrete numeric function and generating function

UNIT-I: Finite and Infinite Sets, Mathematical Induction, Principles of Inclusion and Exclusion, Multisets, Functions and Relations, Binary Relations, Equivalence Relations and Partitions, Partial Ordering Relations and Lattices, Chains, Pigeonhole Principle.

UNIT-II: Propositional Logic, Syntax, Semantics of ATF (Atomic Formula), WFF (Well Formed Formulas),Validity and Satisfiability of WFF by Quine's Method, Normal and Closure Form of Propositional Calculus.

UNIT-III: Introduction and Basic Terminology of Graphs, Planar Graphs, Multigraphs and Weighted Graph, Shortest Path in Weighted Graph, Introduction to Eulerian Paths and Circuits, Hamiltonian Paths and Circuits. Introduction to Trees, Rooted Trees, Path Length in Rooted Trees, Spanning Trees and Cut Trees.

UNIT-IV: Introduction to Discrete Numeric Functions and Generating Functions, Introduction to Recurrence Relations and Recursive Algorithms, Linear Recurrence Relations With Constant Coefficients, Homogeneous Solutions, Particular Solutions and Total Solutions.

UNIT-V: Binary Group Codes, Communication system and its problems, Binary Symmetric Channel, Encoding and Decoding, Error detecting and correcting codes, Block codes, Distance between words, Matrix Encoding Technique, Groups codes, Construction of Decoding Table, Hamming codes.

RECOMMENDED BOOKS

1. J. Tremblay and Manohar: Discrete Mathematical Structures with Application to Computer science. Narsingh Deo: Graph Theory.
2. Kenneth Rosen: Discrete mathematics and its applications (6th edition), 2006. McGraw-Hill
3. C. Liu, D. Mohapatra: Elements of Discrete Mathematics. 2008. Tata McGraw-Hill.
4. T. Koshy: Discrete mathematics with applications, 2003. Academic Press.
5. J. Hein: Discrete structures, logic and computability, 2009. Jones & Bartlett Publishers.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	explain the concepts of set theory, propositional logic, graph theory, discrete numeric function and algebraic structure.
CO2	apply mathematical reasoning and logical thinking to solve problems
CO3	determine the solutions of problems pertaining to computer sciences using graph theory concepts.
CO4	solve counting and recursive problems using combinatorial analysis.
CO5	analyze error control coding techniques to enhance communication system reliability.

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CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	3	2	1		1	2	2	2	3	2	2
CO2	2	3	3	2	3	2	1		2	2	3	2	3	2
CO3	2	2	2	2	2	1			1	1	2	3	2	2
CO4	3	3	2	3	2	2			1	1	2	2	2	1
CO5	2	3	2	2	3	2		2	2	1	2	2	3	3

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MODERN COMPUTER ARCHITECTURE

(31251202/ 24251202/ 27251202/ 28251202)

COURSE OBJECTIVES

- To understand basic principles of Computer Systems.
- To understand various logic design techniques and their applications. They should be capable of using high performance computing architecture.

UNIT-I: Basic of Computer Architectures: Von Neumann Model, Various Subsystems, CPU, Memory, I/O, System Bus, Arithmetic Micro-Operation, Logic Micro Operation, Shift Micro-Operation, Register Transfer Micro Operations.

UNIT-II: Multi-core Architecture: Memory technologies, hierarchical memory systems, the locality principle and caching, direct- mapped caches, block size, cache conflicts, associative caches, write strategies, advanced optimizations, performance improvement techniques, DRAM – organization, access techniques, scheduling algorithms, and signal systems.

UNIT-III: Distributed Computing Systems and Concurrency: Relation to Parallel Multiprocessors/multicomputer Systems, Distributed and Concurrent Programs, Message Passing vs. Shared Memory Systems, Synchronous vs. Asynchronous Executions, Design Issues and Challenges, Distributed Computing Technologies, Clocks and Synchronization, Global State and Distributed Transactions.

UNIT-IV: High Performance Computing (HPC): HPC Architecture, Parallel Processing, Parallel Memory Models, Data vs. Task Parallelism, High Throughput Computing, Vectorization, Multithreading.

UNIT-V (DYNAMIC CONTENTS): High Performance Computing with CUDA: CUDA programming model, Basic principles of CUDA programming, Concepts of threads and blocks, GPU and CPU data exchange

RECOMMENDED BOOKS

1. M. Morris Mano, Computer System & Architecture, Prentice Hall of India, 2002.
2. John L. Hennessy and David A Patterson, Computer Architecture-A quantitative approach, Morgan Kaufmann/ Elsevier, 4th Edition, 2007.
3. Hayes. J.P, Computer architecture and organization by McGraw-Hill Companies, 1998
4. Parallel Computer Architecture: A Hardware/Software Approach David Culler and J.P. Singh with Anoop Gupta, Morgan Kaufmann, 1998.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	describe the organization of the Control unit, ALU, Memory and the I/O unit.
CO2	evaluate hierarchical memory systems, design effective caching strategies, and optimize memory performance using advanced techniques and scheduling algorithms.
CO3	compare distributed and parallel computing paradigms, address concurrency challenges, and implement synchronization techniques for distributed systems.
CO4	design parallel processing architectures and implement multithreading for high-performance computing applications.
CO5	develop parallel programs using the CUDA programming model, manage GPU-CPU data exchange, and optimize computations with threads and blocks.

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CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	1		1		1		2	1	2
CO2	3	3	3	3	3	2	2	2	1	1	2	3	2	2
CO3	3	3	3	3	3	2		1	1	1		3	1	1
CO4	3	3	3	3	3	3	3	2	3	1	3	3	3	2
CO5	3	3	3	3	3	3	3	2	3	2	3	3	3	3

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OBJECT ORIENTED PROGRAMMING
(31251203/ 24251203/ 27251203/ 28251203)

COURSE OBJECTIVES

- To study the concept of object oriented programming.
- To create programs that leverage the object oriented features of the C++ Language.
- To apply object oriented programming techniques for real world problem solving.

UNIT-I: Introduction to Object Oriented Programming: Unstructured & Structured Programming, Object Oriented Paradigm, features and comparison with Procedural Oriented Programming approach. Specification of Class, Abstract Data Types, Visibility Modes, Defining Member Functions, Object Creation, Characteristics of Object, Scope Resolution Operator, Static Data Member, Static Member Function.

UNIT-II: Constructors and Destructors: Introduction, Types of Constructors- Default Constructor, User Defined Constructor, Parameterized Constructor, Copy Constructor, Constructor with Default Arguments, Rules of Constructor Definition and Usage, Destructors. Array of Objects, Object as Arguments, Inline Function, Friend Function.

UNIT-III: Polymorphism: Introduction, Type of Polymorphism: Compile Time Polymorphism & Run Time Polymorphism, Function Overloading, Operator Overloading: Binary and Unary Operators, Rules for Operator Overloading, Pitfalls of Operator Overloading, Data Conversion, Type Casting.

UNIT-IV: Inheritance: Introduction to Code Reuse, Visibility Modes, Types of Inheritance: Single Level, Multilevel, Multiple, Hybrid, Multipath. this Pointer, Ambiguity in MultiLevel Inheritance, Constructors in Derived Classes, Virtual Functions, Virtual Base Classes, Abstract Classes and Pure Virtual Functions, Nesting of Classes, Overriding Member Function, Association, Type of Association.

UNIT-V (DYNAMIC CONTENTS): Templates and Exceptions: Function Templates, Function Templates with Multiple Arguments, Class Templates, Exception Syntax, Exceptions with Arguments. Standard Template Library: Containers, Algorithms, Iterators, Vectors and Lists.

RECOMMENDED BOOKS

1. Object Oriented Programming in C++, Robert Lafore, Sams.
2. C++ How to Program, H M Deitel and P J Deitel, Prentice Hall.
3. The Complete Reference in C++, Herbert Schildt, TMH.
4. Fundamentals of Programming C++, Richard L. Halterman.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	describe fundamental principles of object-oriented programming.
CO2	construct and manage object life cycles using various types of constructors and destructors, while employing inline and friend functions effectively in programming.
CO3	apply compile-time and runtime polymorphism using function and operator overloading, while addressing potential challenges of operator overloading and type casting.
CO4	develop well-structured, modular programs that leverage classes, objects, and inheritance to enhance code maintainability and reusability.
CO5	design reusable and generic code using function and class templates, handle runtime errors with exception handling, and utilize the Standard Template Library for efficient data manipulation.

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CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3						3	1	1
CO2	3	3	3	3	3	2	2					3	2	2
CO3	3	3	3	3	3	3	3					3	3	3
CO4	3	3	3	3	3	3	3	3	3	1	2	3	3	2
CO5	3	3	3	3	3	3	2	3	3	1	3	3	3	3

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DATA STRUCTURES

(31251204/ 24251204/ 27251204/ 28251204)

COURSE OBJECTIVES

- To be familiar with the use of data structures as the foundational base for computer solutions to problems.
- To understand various techniques of searching and sorting.
- To understand basic concepts about stacks, queues, lists, trees and graphs.

UNIT-I: Introduction to Data Structures: Algorithms & their characteristics, asymptotic notations. arrays and its representations, index to address translation. Link list: Introduction, implementation of linked list, operations, circular link list, doubly linked list, polynomial manipulation using linked list.

UNIT-II: Stacks: Concepts and implementation of stacks, operations on stack, conversion of infix to postfix notation, evaluation of postfix expression, recursion. Queues: Concepts and implementation, operations on queues, dequeue, priority queues, circular queues and application.

UNIT-III: Trees: Types, terminology, binary tree -representations, traversal, conversion of general tree to binary tree, binary search tree, threaded binary tree and height balanced tree. Heaps: binary heap, heap operations, heap sort.

UNIT-IV: Graphs: Background, graph theory terminologies, representation of graphs- sequential & linked representation, path matrix, graph traversals- BFS, DFS, spanning trees, applications of graph. Searching & Sorting: Linear search, binary search, bubble sort, selection sort, insertion sort, quick sort, merge sort.

UNIT-V (DYNAMIC CONTENTS): Hash tables: hash functions, collision resolution (chaining, open addressing) Load factor, rehashing, performance implications. Dynamic / Self-Adjusting Data Structures: Splay trees. Cache-Aware Data Structures: B-trees, van Emde Boas trees.

RECOMMENDED BOOKS

1. Data Structures, Algorithms and Applications in C++, Sartaj Sahni, 2nd Edition.
2. An Introduction to Data Structures with Applications, Jean-Paul Tremblay, Mcgraw hill.
3. Data Structures & Algorithms, Aho, Hopcroft & Ullman, original edition, Pearson Publication.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	analyze algorithms using asymptotic notations and perform operations on arrays and linked lists.
CO2	construct stacks and queues, and use them to solve real world problems.
CO3	distinguish between different types of trees and identify the application of each.
CO4	apply graph based and sorting-searching algorithms.
CO5	compare various hashing techniques and advanced data structures

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CO-PO Mapping Matrix													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	1							1	1	1
CO2	3	3	3	3	2				1			2	2	2
CO3	3	3	3	3	2		1		1	1		2	2	2
CO4	3	3	3	3	2	1	1	1	1	1	1	2	2	2
CO5	3	3	3	3	2	1			1	1		2	2	2

Centre for Artificial Intelligence

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(31251205/ 27251205/ 28251205)

COURSE OBJECTIVES

- To introduce the fundamental principles of electrical circuits and electronics.
- To provide insights into basic semiconductor devices, including diodes, transistors, and their applications.
- To demonstrate the practical use of electrical and electronic components in real-world systems.

UNIT-I: Basic Concepts of Electrical Engineering-Electrical Circuit Elements: Resistors, Capacitors, and Inductors, Ohm's Law, Kirchhoff's laws, Series and Parallel Circuits, star-delta circuits, charging and discharging of capacitor, series-parallel magnetic circuits, comparison between electric and magnetic circuit, Concept of induced EMFs..

UNIT-II: Single-phase AC Circuits-Generation of alternating emf, instantaneous, rms, peak, average values and related other terms, vector representation of AC quantities, Steady state analysis of R, L, C series and parallel circuits, power triangle. Three-phase AC Circuits-Generation of three-phase emf, star connection, delta connection, relationship between line and phase quantities

UNIT-III: Single Phase Transformer-Principle of Transformers: Construction and Working, Types of transformer, EMF equation of transformer, Transformation ratio, Applications of transformer.

UNIT-IV: Basic Electronics-Overview of Semiconductor Physics, PN Junction Diodes: Characteristics and Applications, Zener Diodes: Voltage Regulation, Half and full wave rectifiers, special purpose diodes.

UNIT-V (DYNAMIC CONTENTS): Smart Electrical Components & Digital Twin technology, smart grids, and high-efficiency power electronics. Wide-bandgap materials, high-frequency rectification and quantum electronic systems.

RECOMMENDED BOOKS

1. Basic Electrical Engineering, Authors: V.K. Mehta and Rohit Mehta, Publisher: S. Chand Publishing
2. Fundamentals of Electrical Engineering I, Author: Don H. Johnson, Publisher: Rice University (Free Online Resource)
3. Electrical Engineering 101: Everything You Should Have Learned in School...but Probably Didn't, Author: Darren Ashby, Publisher: Newnes (Elsevier), Edition: 3rd Edition
4. Principles of Electronics, Author: Colin Simpson, Publisher: Cengage Learning
5. Basic Electrical Engineering, Authors: D.P. Kothari and I.J. Nagrath, Publisher: McGraw Hill Education.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	analyze electrical and magnetic circuits to evaluate transient responses in capacitive and inductive circuits.
CO2	analyze single-phase and three-phase AC circuits, including power measurements and power factor correction.
CO3	explain the generation of three-phase EMFs
CO4	describe the construction and working principles of transformers, analyze their performance using EMF equations and phasor diagrams, and evaluate their efficiency and applications.
CO5	apply semiconductor physics principles to analyze PN junction and Zener diodes, design rectifiers, and identify the applications of special-purpose diodes in circuits.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	-	-	-	-	-	-	-	2	1	1
CO2	3	3	3	2	2	1	-	-	-	-	-	2	2	1
CO3	3	3	3	2	2	1	-	-	-	-	-	2	1	1
CO4	3	2	3	2	-	-	-	-	-	-	-	2	1	2
CO5	3	3	3	3	3	2	2	2	2	2	2	2	2	2

Centre for Artificial Intelligence
SENSORS AND ACTUATORS
(24251205)

COURSE OBJECTIVES

- Illustrate the working principles of transducers, sensors and actuators.
- Develop and exemplify basic programming skills in Virtual Instrumentation.
- Design and implement a system using sensor and instrumentation configuration.

UNIT-I: Introduction: Introduction, Input output configuration, generalized functional elements, advantages of electronic measurement, Errors in measurement, Gross errors and systematic errors, Absolute and relative errors, static characteristics, dynamic characteristics, calibration.

UNIT-II: Transducers: Introduction, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Capacitive transducers, Differential output transducers and LVDT. Piezoelectric transducer, photoelectric transducer, Photovoltaic transducer. Temperature transducers.

UNIT-III: Sensors: Introduction, principles, classification, characterization, Smart sensors: Introduction Primary sensors Information coding/ processing, Data communication, automation. Introduction to MEMS and Microsystems, Microsystems and Microelectronics Multidisciplinary nature of micro system design and manufacture applications of micro systems, Micro sensors, Humidity and Moisture Sensors.

UNIT-IV: Actuators: Functional components of an actuator, Performance Characteristics of Actuators, Thermo-mechanical Actuators, Optical Actuators, Electrical actuating systems: Solid-state switches, Solenoids, Electric Motors-D.C, AC motors; Piezoelectric Actuator. Magnetic Actuators, Capacitive Actuators,. Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators-Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.

UNIT-V (DYNAMIC CONTENTS): Design and fabrication process of Microsensors, Intelligent & Self sensing actuators, Smart Sensor Technologies: development trend, characteristics of smart sensors, application areas of smart sensors in IoT and Robotics. Sensors for Navigation and localization: LiDAR-SLAM (Simultaneous Localization and Mapping).

RECOMMENDED BOOKS

1. Patranabis.D, “Sensors and Transducers”, Wheeler publisher, 1994.
2. D.V.S. Murthy: “Transducers and Instrumentation”, 2nd Edition, PHI Ltd., 2014
3. Sergej Fatikow and Ulrich Rembold, “Microsystem Technology and Macrobiotics”, First edition, Springer –Verlag NEwyork, Inc, 1997.
4. Jacob Fraden, “Hand Book of Modern Sensors: Physics, Designs and Application” Fourth edition, Springer, 2010.

REFERENCE BOOKS

1. Robert H Bishop, “The Mechatronics Hand Book”, CRC Press, 2002.
2. Massood Tabib and Azar, “Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures”, First edition, Kluwer academic publishers, Springer, 1997.
3. Manfred Kohl, “Shape Memory Actuators”, first edition, Springer.

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COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	describe the functional elements of measurement systems, identify different types of errors, and evaluate the static and dynamic characteristics of measurement systems.
CO2	analyze various types of transducers for diverse measurement applications.
CO3	explain the principles and applications of sensors, characterize smart sensors, and analyze the design and operation of MEMS-based systems for multidisciplinary applications.
CO4	assess the performance and suitability of selected sensors and actuators for a specific control system.
CO5	apply the principles of micro-actuation, analyze the design and fabrication of microsensors and microactuators, and explore the integration of smart sensor technologies with IoT systems for innovative applications.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	2	1						2		1
CO2	3	2	3	3	2	1				1		2	1	
CO3	3	3	3	3	2	2	2		1		1	2	2	2
CO4	3	3	3	3	3	2	2	2	3	1	2	2		2
CO5	3	3	3	3	3	2	3	2	3	1	2	3	2	2

Centre for Artificial Intelligence

SUSTAINABILITY & ENVIRONMENTAL SCIENCE

(31251211/ 24251211/ 27251211/ 28251211)

COURSE OBJECTIVES

- To equip students with a comprehensive understanding of environmental science, pollution control, sustainability, and global frameworks, enabling them to analyze environmental challenges and contribute to sustainable solutions through informed decision-making and responsible practices.

UNIT-I: Introduction to Environmental Science: definition, importance and its components. Ecosystem and its components. Water cycle, carbon cycle, food chain, energy flow in the ecosystem. Current state of environment in India and world; Underlying reasons (root causes) of modern environmental degradation (social, psychological, cultural).

UNIT-II: Environmental Pollution and Management: air, water, noise, soil, thermal and radioactive. Causes, impacts, pollution control techniques and mitigation strategies. Solid waste management: Principles of waste management, different components of waste management system and introduction to management of hazardous waste like e-waste, plastic waste. Global environmental Issues: Climate change, global warming, ozone layer depletion.

UNIT-III: Environmental policies and laws in India: Environmental Protection Act, Water Act, Air Act. Overview of global environmental policies and frameworks: Kyoto protocol, Montreal protocol, COP summits. Introduction to clean development mechanism, carbon credit, carbon trading.

UNIT-IV: Sustainability concepts: definition, importance, pillars of sustainability (economic, environmental, and social). Sustainable development. Overview of UN Sustainable Development Goals (SDGs) and their global relevance. Concept of circular economy, resource efficiency, energy conservation, green buildings and sustainable manufacturing.

UNIT-V: Sustainable Energy solutions: New Energy Sources: Need of new sources. Different types of new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Introduction to sustainable transportation systems and sustainable water infrastructure.

RECOMMENDED BOOKS

1. D. K. Asthana, Meera Asthana, A Text Book of Environmental Studies, S Chand & Co., New Delhi.
2. S. K. Dhameja, Environmental Engineering & Management, S K Kataria & Sons, New Delhi
3. C. S. Rao, Environmental Pollution Control Engineering, C.S. Rao, New Age International Publishers
4. A. K. Gupta, Environmental Sustainability and Green Technologies, PHI Learning.

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COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Explain the fundamental concepts of environmental science, including ecosystems and the causes of environmental degradation.
CO2	Analyze the sources, causes, and impacts of air, water, and solid waste pollution and propose appropriate mitigation strategies.
CO3	Evaluate the effectiveness of environmental policies and global frameworks in addressing environmental challenges.
CO4	Explain the concepts of sustainability and sustainable development goals.
CO5	Apply various solutions for achieving sustainable development.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	-	1	-	-	-	-	1	-	-
CO2	2	2	2	-	-	-	3	-	-	-	-	2	-	-
CO3	-	-	1	-	-	2	2	-	-	-	-	2	2	2
CO4	-	-	-	-	-	-	2	-	-	-	-	2	-	-
CO5	2	2	2	-	-	1	3	-	-	-	-	2	2	2

ANNEXURE - III

Experiment list/ Lab manual and project list (Micro Project-II) of all the Laboratory Courses
B.Tech.
[Artificial Intelligence (AI)/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]
II Semester
for batch admitted in 2025-26

Centre for Artificial Intelligence

OBJECT ORIENTED PROGRAMMING LAB

(31251206/ 24251206/ 27251206/ 28251206)

List of Programs

1. Define a class representing a basic entity (e.g., a car, a person) with member variables and member functions. Create objects of the class and demonstrate their usage.
2. Implement a class with a constructor and destructor. Illustrate their roles and demonstrate how they are called during object creation and destruction.
3. Create a base class and a derived class. Demonstrate inheritance by inheriting properties and methods from the base class to the derived class using different types of inheritances.
4. Implement a polymorphic behavior using function overloading or overriding. Show how a function can behave differently based on the type of object.
5. Overload a few operators (e.g., +, -, *, =) for a custom class. Show how these operators can be used with objects of that class.
6. Implement a template class that can work with different data types. Demonstrate how to create objects of the template class with different data types.
7. Design a program that uses exception handling to catch and handle runtime errors, such as division by zero or array out-of-bounds.
8. Utilize STL containers like vectors or lists in a program. Perform basic operations like insertion, deletion, and iteration.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	apply the principles of object-oriented programming paradigm to programming problems.
CO2	use classes and objects to model real-world entities in a program.
CO3	apply the concepts of base classes, derived classes, and method overriding.
CO4	implement exception handling to manage errors and unexpected situations in a program.
CO5	create generic and reusable code using STL.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3							3	1	1
CO2	3	3	3	3	3							3	2	2
CO3	3	3	3	3	3						2	3	3	3
CO4	3	3	3	3	3	2	2	2	2	1	2	3	3	2
CO5	3	3	3	3	3	3	2	3	3	1	3	3	3	3

Centre for Artificial Intelligence

DATA STRUCTURES LAB

(31251207/ 24251207/ 27251207/ 28251207)

List of Programs

1. Implement Singly, Doubly and Circular Linked List.
2. Implement Stack and Queue using arrays.
3. Implement Stack and Queue using Singly linked lists.
4. Create a program which creates a Binary search tree and traverse it using Inorder, Pre-order and Post-order traversal techniques.
5. Write a program to implement Threaded Binary trees.
6. Implement a graph data structure using Adjacency matrix and list respectively.
7. Write a program which finds the spanning tree of a graph.
8. Implement BFS and DFS graph traversal techniques.
9. Implement following searching and sorting algorithms:
    a. Linear and Binary Search.
    b. Bubble sort.
    c. Selection sort
    d. Insertion sort
    e. Merge sort
    f. Quick sort
    g. Heap sort
10. Define function for performing insertion, deletion, searching, and traversal operations on B-tree and Splay tree.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	analyze the complexity of different data structures.
CO2	choose appropriate data structures for specific scenarios.
CO3	design solutions using tree and graph based data structures.
CO4	solve real world problems using appropriate data structures.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	1							1	1	1
CO2	3	3	3	3	2				1			2	2	2
CO3	3	3	3	3	2		1		1	1		2	2	2
CO4	3	3	3	3	2	1	1	1	1	1	1	2	2	2

Centre for Artificial Intelligence

BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB

(31251208/ 27251208/ 28251208)

List of Experiments

1. Verify Ohm's law by measuring current across different resistors with varying applied voltages.
2. Verify Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL) in a simple electrical circuit.
3. Analyze and measure the voltage and current in series and parallel resistor configurations
4. Solve the star-delta circuit using practical measurements on the breadboard.
5. Study the charging and discharging behavior of a capacitor.
6. Analyze the behavior of R, L, and C components in series and parallel combinations in AC circuits.
7. Verify the power triangle in an RLC circuit and measure power factor.
8. Observe the forward and reverse characteristics of a PN junction diode.
9. Study the voltage regulation characteristics of a Zener diode.
10. Study the behavior of LEDs and photodiodes.
11. Study a Zener diode shunt voltage regulator and observe how output voltage changes when the load current varies.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Apply the fundamental concepts of electrical engineering to analyze and solve basic electrical circuits.
CO2	Analyze and measure electrical parameters (voltage and current) in series and parallel configurations
CO3	Explain the concepts related to AC circuits, including the generation of alternating current, AC circuit analysis, power calculation, and resonance in RLC circuits.
CO4	Analyze the working of Bipolar Junction Transistors (BJT)
CO5	Design and construct basic electronic circuits on breadboards

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	2	1	1
CO2	3	3	3	2	2	1	-	-	-	-	-	2	2	1
CO3	3	3	3	2	2	1	-	-	-	-	-	2	1	1
CO4	3	3	3	2	2	1	-	-	-	-	-	2	2	1
CO5	3	3	3	3	3	2	2	2	2	2	2	2	2	2

Centre for Artificial Intelligence

SENSORS AND ACTUATORS LAB

(24251208)

List of Programs/Experiments

1. Study of static and dynamic characteristics of sensors.
2. Displacement measurement using LVDT.
3. Using a strain gauge transducer, strain is measured.
4. Displacement measurement with a potentiometer.
5. RTD is used to measure temperature, and its properties are shown.
6. Temperature measurement with a thermistor.
7. Pressure measurement with a load cell.
8. Speed measurement with a magnetic sensor.
9. Speed measurement with photoelectric sensors.
10. Use a pressure transducer to measure pressure.
11. Liquid level measurement with a capacitive sensor.
12. Interface of DC motors using H-bridge circuit
13. Implement and analyze speed control of a DC motor by varying the PWM duty cycle.
14. Understand the working of servo motors and control their position using PWM.
15. Study of AC Motor for wide range of speeds and loads
16. Working of stepper motor under speed and torque control.
17. Virtual demonstration of hydraulic and pneumatic actuators and their industrial applications.
18. Design and application of Micro actuators and micro valves.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	apply appropriate sensors and transducers to measure physical quantities.
CO2	design interfacing circuits for electromechanical actuators.
CO3	create application-oriented solutions integrating suitable sensors and actuators for industrial or automation scenarios.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	3	3			2		1		2		2
CO2	3	3	2	3			3	2					2	2
CO3	3	3	3	3	3	3			1	2	3	3	2	3

Centre for Artificial Intelligence
MICRO PROJECT-II
(31251210/ 24251210/ 27251210/ 28251210)

1. Develop a system to manage student information with classes for students, courses, and grades. Implement features like adding and removing students, enrolling in courses, and calculating GPA.
2. Create a system to manage inventory with classes for products, categories, and orders. Implement features like adding and removing products, updating stock levels, and processing orders.
3. Develop a system for managing hospital records with classes for patients, doctors, and appointments. Implement features like scheduling appointments, updating patient information, and generating reports.
4. Create a quiz game with classes for questions, quizzes, and players. Implement a scoring system, random question selection, and a leaderboard for tracking player performance.
5. Design a simple social media network with classes for users, posts, and comments. Implement features like creating posts, adding friends, and commenting on posts.
6. Develop a ticket booking system for a cinema or an event with classes for shows, venues, and tickets. Include features like booking tickets, checking seat availability, and generating tickets.
7. Use a heap to implement a priority queue.
8. Develop a basic hash table with collision resolution
9. Implement a program that can parse and evaluate mathematical expressions.
10. Use a stack to implement an expression evaluator.
11. Implement a Phone directory application using doubly linked lists.
12. Implement a flight reservation system using a combination of data structures like priority queues for seat reservations and graphs for flight connections.
13. Library Management System-Create classes for books, members, and transactions. Implement book issue/return, overdue fine calculation, and search by author/title.
14. Bank Account Management System-Include classes for accounts, customers, and transactions. Implement deposit, withdrawal, fund transfer, and mini-statement generation.
15. Restaurant Ordering System-Build classes for menu items, orders, and customers. Include order placement, bill generation, and applying discounts or taxes.
16. Hotel Room Booking System-Use classes for rooms, customers, and bookings. Implement check-in/check-out, room availability checks, and billing.
17. Online Shopping Cart System-Include classes for users, items, carts, and payments. Implement add/remove items from cart, order summary, and checkout.
18. Task Management Application-Build classes for tasks, users, and categories. Implement adding, editing, deleting tasks, deadlines, and reminders.
19. Expense Tracker Application-Include classes for expenses, categories, and users. Implement monthly summaries, filtering by category, and budget tracking.
20. Music Playlist Manager-Use classes for songs, playlists, and users. Implement adding/removing songs, sorting playlists, and shuffle mode.
21. Employee Payroll System-Create classes for employees, salaries, and attendance. Implement salary calculation, tax deduction, and payslip generation.
22. Weather Monitoring System-Include classes for sensors, readings, and alerts. Implement data logging, average computation, and extreme weather alerts.
23. Parking Lot Management System-Build classes for vehicles, parking slots, and tickets. Implement slot allocation, time-based fee calculation, and automatic exit logs.
24. Chat Application (Local Simulation)-Create classes for users, messages, and chats. Implement sending messages, chat logs, and user online/offline status.

25. Road Navigation System-Use graphs to represent cities/roads. Implement shortest path search (Dijkstra), route suggestions, and distance calculation.
26. Movie Recommendation System-Classes for users, movies, ratings. Implement similarity-based recommendations and generate top-rated lists.
27. File Compression Tool (Basic)-Implement Huffman Coding using trees and priority queues to compress and decompress text files.
28. Scheduling System Using Priority Queue-Create a CPU scheduling simulator with classes for processes. Implement FCFS, SJF, Priority Scheduling, and Round-Robin.
29. E-Voting System-Include classes for voters, candidates, and ballots. Implement voter authentication, vote casting, and result tallying.
30. Student Attendance Tracker-Create classes for students, subjects, and attendance records. Implement marking attendance, monthly reports, and attendance percentage calculation.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Explain the principles of OOP and their applications in solving real-world problems.
CO2	Develop and manipulate data structures like stacks and queues to solve problems.
CO3	Examine the relationships between OOP principles and data structure implementations in program design.
CO4	Design and develop a micro-project that integrates OOP concepts and appropriate data structures to solve a real-world problem.
CO5	Construct reusable and modular code using OOP principles for solving a complex programming challenge.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3					1	3	1	1
CO2	3	3	3	3	3	2					1	3	2	2
CO3	3	3	3	3	3	3					1	3	3	3
CO4	3	3	3	3	3	3	3	3	3	1	2	3	3	2
CO5	3	3	3	3	3	3	2	3	3	1	3	3	3	3

ANNEXURE - IV

Scheme structure of
B.Tech.
[Artificial Intelligence (AI)/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]
IV semester
for the Batch admitted in 2024-25

Centre for Artificial Intelligence

Scheme of Evaluation

B. Tech. IV Semester *(Artificial Intelligence (AI))*

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation								
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional			L	T	P				
1.	31242201	DC	Database Management System	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
2.	31242202	DC	Theory of Computation	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
3.	31242203	DC	Software Engineering	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	31242204	DC	Network and Web Security	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
5.	31242205	BSC	Calculus and optimization Techniques	25	25	20	30	-	-	100	3	-	-	3	Face to Face	MCQ	2 Hrs
6.	31242206	DLC	Database Management System Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	31242207	DLC	Java Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	31242208	DLC	Competitive Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	31242209	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	31242210	PBL	Macro Project-II[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	NECXXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
12.	SIP3XXXX	SIP	Skill Internship Program	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
Total				**125**	**125**	**100**	**150**	**440**	**120**	**1110**	**11**	**05**	**12**	**23**	-	-	-
13.	31242211	MAC	Project Management, Economics & Financing	-	-	-	-	100	-	100	-	2	-	GRADE	Blended	SO	-
14.	31242212	MWS	Mandatory Workshop on Intellectual Property Rights at Department Level											GRADE	Interactive	MCQ	-

Summer Semester of six-eight week duration will be conducted for makeup of previous semester examination.

Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

MCQ: Multiple Choice Question **AO:** Assignment + Oral **PP:** Pen Paper **SO:** Submission + Oral **OB:** Open Book

[#]Macro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee.

[**]These credits will be transferred from the Skill Internship Program.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	1	0	4	0	0	0	3	1	1	0	0	0	2	1	1

Mode of Learning					Mode of Examination					Total Credits
Face to Face	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	
16	1	0	3	3	7.5	3	7.5	0	5	23
70	4	0	13	13	32.61	13.04	32.61	0	21.74	Credits %

Scheme of Evaluation

Recommended in the Board of Studies Meeting of Centre for Artificial Intelligence held on 2nd Dec., 2025

Centre for Artificial Intelligence

B. Tech. IV Semester *(Information Technology (Artificial Intelligence and Robotics))*

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
1.	24242201	DC	Robot Kinematics	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
2.	24242202	DC	Network and Web Security	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
3.	24242203	DC	Database Management System	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	24242204	DC	Software Engineering	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
5.	24242205	BSC	Calculus and optimization Techniques	25	25	20	30	-	-	100	3	-	-	3	Face to Face	MCQ	2 Hrs
6.	24242206	DLC	Robot Kinematics Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	24242207	DLC	Database Management System Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	24242208	DLC	Competitive Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	24242209	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	24242210	PBL	Macro Project-II[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	NECXXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
12.	SIP3XXXX	SIP	Skill Internship Program	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
Total				**125**	**125**	**100**	**150**	**440**	**120**	**1060**	**11**	**05**	**12**	**23**	-	-	-
13.	24242211	MAC	Project Management, Economics & Financing	-	-	-	-	100	-	100	-	2	-	GRADE	Blended	SO	-
14.	24242212	MWS	Mandatory Workshop on Intellectual Property Rights at Department Level											GRADE	Interactive	MCQ	-
Summer Semester of six-eight week duration will be conducted for makeup of previous semester examination.																	
Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree																	

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

MCQ: Multiple Choice Question **AO:** Assignment + Oral **PP:** Pen Paper **SO:** Submission + Oral **OB:** Open Book

[#]Macro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee.

[**]These credits will be transferred from the Skill Internship Program.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	1	0	4	0	0	0	3	1	1	0	0	0	2	1	1

Mode of Learning					Mode of Examination					Total Credits
Face to Face	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	
16	1	0	3	3	7.5	3	7.5	0	5	23
70	4	0	13	13	32.61	13.04	32.61	0	21.74	Credits %

Scheme of Evaluation

Recommended in the Board of Studies Meeting of Centre for Artificial Intelligence held on 2nd Dec., 2025

Centre for Artificial Intelligence

B. Tech. IV Semester *(Artificial Intelligence (AI) and Data Science)*

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
1.	27242201	DC	Data Science	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
2.	27242202	DC	Theory of Computation	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
3.	27242203	DC	Software Engineering	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	27242204	DC	Network and Web Security	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
5.	27242205	BSC	Calculus and optimization Techniques	25	25	20	30	-	-	100	3	-	-	3	Face to Face	MCQ	2 Hrs
6.	27242206	DLC	Data Science Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	27242207	DLC	Java Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	27242208	DLC	Competitive Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	27242209	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	27242210	PBL	Macro Project-II[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	NECXXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
12.	SIP3XXXX	SIP	Skill Internship Program	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
Total				**125**	**125**	**100**	**150**	**440**	**120**	**1060**	**11**	**05**	**12**	**23**	-	-	-
13.	27242211	MAC	Project Management, Economics & Financing	-	-	-	-	100	-	100	-	2	-	GRADE	Blended	SO	-
14.	27242212	MWS	Mandatory Workshop on Intellectual Property Rights at Department Level											GRADE	Interactive	MCQ	-
Summer Semester of six-eight week duration will be conducted for makeup of previous semester examination.																	
Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree																	

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

MCQ: Multiple Choice Question **AO:** Assignment + Oral **PP:** Pen Paper **SO:** Submission + Oral **OB:** Open Book

[#]Macro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee.

[**]These credits will be transferred from the Skill Internship Program.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	1	0	4	0	0	0	3	1	1	0	0	0	2	1	1

Mode of Learning					Mode of Examination					Total Credits
Face to Face	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	
16	1	0	3	3	7.5	3	7.5	0	5	23
70	4	0	13	13	32.61	13.04	32.61	0	21.74	Credits %

Scheme of Evaluation

Recommended in the Board of Studies Meeting of Centre for Artificial Intelligence held on 2nd Dec., 2025

Centre for Artificial Intelligence

B. Tech. IV Semester *(Artificial Intelligence (AI) and Machine Learning)*

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
1.	28242201	DC	Machine Learning	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
2.	28242202	DC	Theory of Computation	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
3.	28242203	DC	Software Engineering	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	28242204	DC	Network and Web Security	25	25	20	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
5.	28242205	BSC	Calculus and optimization Techniques	25	25	20	30	-	-	100	3	-	-	3	Face to Face	MCQ	2 Hrs
6.	28242206	DLC	Machine Learning Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	28242207	DLC	Java Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	28242208	DLC	Competitive Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	28242209	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	28242210	PBL	Macro Project-II[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	NECXXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
12.	SIP3XXXX	SIP	Skill Internship Program	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
Total				**125**	**125**	**100**	**150**	**440**	**120**	**1060**	**11**	**05**	**12**	**23**	-	-	-
13.	28242211	MAC	Project Management, Economics & Financing	-	-	-	-	100	-	100	-	2	-	GRADE	Blended	SO	-
14.	28242212	MWS	Mandatory Workshop on Intellectual Property Rights at Department Level											GRADE	Interactive	MCQ	-
Summer Semester of six-eight week duration will be conducted for makeup of previous semester examination.																	
Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree																	

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

MCQ: Multiple Choice Question **AO:** Assignment + Oral **PP:** Pen Paper **SO:** Submission + Oral **OB:** Open Book

[#]Macro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee. [**]These credits will be transferred from the Skill Internship Program.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	1	0	4	0	0	0	3	1	1	0	0	0	2	1	1

Mode of Learning					Mode of Examination					Total Credits
Face to Face	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	
16	1	0	3	3	7.5	3	7.5	0	5	23
70	4	0	13	13	32.61	13.04	32.61	0	21.74	Credits %

Recommended in the Board of Studies Meeting of Centre for Artificial Intelligence held on 2nd Dec., 2025

ANNEXURE - V

Syllabi of all courses of UG programmes
B. Tech.
[Artificial Intelligence (AI)/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]
IV Semester
for batch admitted in 2024-25

Centre for Artificial Intelligence

DATABASE MANAGEMENT SYSTEM

(31242201/ 24242203)

COURSE OBJECTIVES

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modelling, relational, hierarchical and network models.
- To understand and use data manipulation language to query, update and manage a database.

UNIT-I: DBMS: Database Approach v/s Traditional File Approach, Advantages of Database System, Database Users and Administrator, Database System Environment, Application Architectures, Schemas, Instances, Data Independence, Data Models: Hierarchical Data Model, Network Data Model & Relational Data Model, Comparison between Models. Entities and Relationship Model: Entity types, Entity sets, Attributes and Keys, Relationship Types and Sets, Constraints, Design issue, E-R Diagram, Weak Entity Sets.

UNIT-II: Relational Model: Structure of Relational Databases: Relation, Attribute, Domain, Tuples, Degree, Cardinality, Views, Database Relations, Properties of Relations, Attributes, Keys, Attributes of Relation, Domain Constraints, Integrity Constraints. Relational Algebra: Concepts and Operations: Select, Project, Division, Intersection, Union, Division, Rename, Join etc.

UNIT-III: SQL: Purpose of SQL, Data Definition Language (DDL) Statements, Data Manipulation Language (DML) Statements Update Statements & Views in SQL, Data Control Language (DCL), Triggers. Relational Database Design: Purpose of Normalization, Data Redundancy and Update Anomalies, Functional Dependency, Process of Normalization, Various Normal Forms: 1NF, 2NF, 3NF, BCNF, Decomposition, Desirable Properties of Decomposition: Dependency Preservation, Lossless Join, Problems with Null Valued & Dangling Tuple, Multivalued Dependencies.

UNIT-IV: Transaction Management: Transaction Concept, Transaction State, Concurrent Executions, Serializability: Conflict and View Serializability, Concurrency Control: Lock-Based Protocol, Recovery: Log-Based Recovery.

UNIT-V (DYNAMIC CONTENTS): Big Data and Distributed Databases: CAP theorem, eventual consistency, sharding. NoSQL and NewSQL Databases: Document (MongoDB), Key-Value (Redis), Column-family (Cassandra), Graph (Neo4j), Google Spanner, CockroachDB. Real-Time Data Processing and Streaming Databases: Apache Kafka, Apache Flink.

RECOMMENDED BOOKS

1. Database System Concepts, Abraham Silberschatz Henry F. Korth S. Sudarshan, McGraw-Hill 6th Edition.
2. Database Management System, Raghu Ramakrishnan Johannes Gehrke, McGraw Hill 3rd Edition.
3. Fundamentals of Database System, Elmasri & Navathe, Addison-Wesley Publishing, 5th Edition.
4. An Introduction to Database Systems, Date C. J, Addison-Wesley Publishing, 8th Edition.

Centre for Artificial Intelligence

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Differentiate between traditional file systems and the database approach.
CO2	Construct relational schemas and demonstrate the use of relational algebra operations to query and manipulate relational data.
CO3	Develop SQL queries for data definition, manipulation, and control, and analyze relational schemas for normalization.
CO4	Examine transaction processing concepts and analyze concurrency control and recovery mechanisms in database systems.
CO5	Compare traditional RDBMS with modern distributed and NoSQL databases, and evaluate their suitability for real-time data processing scenarios.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1							2	2	2
CO2	3	3	2	2	2							2	2	2
CO3	3	3	2	2	2				2	2	2	2	2	3
CO4	3	3	3	2	2				2	2	2	2	2	3
CO5	2	2	3	2	3	2	2	1	2	2	2	3	3	3

Centre for Artificial Intelligence
THEORY OF COMPUTATION
(31242202/ 27242202/ 28242202)

COURSE OBJECTIVES

- To understand computability, decidability, and complexity through problem solving.
- To analyze and design abstract model of computation & formal languages
- To understand and conduct mathematical proofs for computation and algorithms.

UNIT-I: Introduction of Automata Theory: Examples of automata machines, Finite Automata as a language acceptor and translator, Moore machines and mealy machines, composite machine, Conversion from Mealy to Moore and vice versa.

UNIT-II: Types of Finite Automata: Non Deterministic Finite Automata (NDFA), Deterministic finite automata machines, conversion of NDFA to DFA, minimization of automata machines, regular expression, Arden's theorem. Meaning of union, intersection, concatenation and closure, 2 way DFA.

UNIT-III: Grammars: Types of grammar, context sensitive grammar, and context free grammar, regular grammar. Derivation trees, ambiguity in grammar, simplification of context free grammar, conversion of grammar to automata machine and vice versa, Chomsky hierarchy of grammar, killing null and unit productions. Chomsky normal form and Greibach normal form.

UNIT-IV: Push down Automata: example of PDA, deterministic and non-deterministic PDA, conversion of PDA into context free grammar and vice versa, CFG equivalent to PDA, Petri Net model. Turing Machine: Techniques for construction. N-P complete problems.

UNIT-V (DYNAMIC CONTENTS): Decidability and Recursively Enumerable Languages, decidability, decidable languages, undecidable languages. Verifying neural network behaviour (undecidability challenges). Halting problem analogues in AI agent planning. Context-free grammars for large code-model training datasets.

RECOMMENDED BOOKS

1. Introduction to Automata Theory Language & Computation, Hopcroft & Ullman, Narosa Publication.
2. Element of the Theory Computation, Lewis & Christors, Pearson.
3. Theory of Computation, Chandrasekhar & Mishra, PHI.
4. Theory of Computation, Wood, Harper & Row.
5. Introduction to Computing Theory, Daniel I-A Cohen, Wiley.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	explain the basic concepts of switching and finite automata theory & languages.
CO2	relate practical problems to languages, automata, computability and complexity.
CO3	construct abstract models of computing and check their power to recognize the languages.
CO4	analyze the grammar, its types, simplification and normal form.
CO5	apply formal mathematical methods to prove properties of languages, grammars and automata.

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CO-PO Mapping Matrix													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	3	2							3	1	1
CO2	2	3	3	2	3			2				3	2	2
CO3	3	3	3	3	3				2	2	2	2	2	2
CO4	3	2	3	3	2	3	3		3	3	2	3	3	2
CO5	3	2	2	3	3	3	2	2		2	3	3	3	3

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SOFTWARE ENGINEERING
(31242203/ 24242204/ 27242203/ 28242203)

COURSE OBJECTIVES

- To understand the process of software development and software life cycle models.
- To understand project management and risk management associated with various types of projects.
- To know the familiarity with the concept of software testing, quality assurance and configuration management process.

UNIT-I: Introduction to Software Engineering, Software Development Life Cycle (SDLC): Waterfall, Incremental, Spiral Model, Prototyping, RAD, V-Model. Agile Software Development: Scrum, Kanban, XP, Roles, Ceremonies, Artifacts. Software Engineering Ethics and Professional Practice

UNIT-II: Requirements Engineering: Functional vs Non-functional requirements. Elicitation techniques (interviews, observation, surveys, JAD, prototyping). Requirements specification & documentation (SRS). Requirements modeling (DFDs, Use Case diagrams). Requirements validation & management. System Design: Architectural design styles - Layered, Client–Server, Microservices. Design principles. Coupling, Cohesion, Modularity. UML Diagrams: Class, Sequence, Activity, State, Component

UNIT-III: Software Construction: Coding standards, guidelines, and best practices. Code refactoring & code reviews. Software reuse & component-based development. Software Testing: Testing levels - Unit, Integration, System, Acceptance. Testing techniques - White-box testing (basis path, control-flow testing); Black-box testing (equivalence partitioning, boundary value analysis). Test case design, test automation fundamentals. Debugging strategies. Maintenance: Types of maintenance - corrective, preventive, perfective, adaptive. Reverse engineering, reengineering. Software evolution & legacy system migration.

UNIT-IV: Project Management: Project planning and scheduling (Gantt charts, PERT/CPM). Estimation techniques: LOC, Function Point, Use Case Points, COCOMO. Risk management and mitigation. Quality Assurance & Standards: Software quality metrics. Reviews, audits, inspections. ISO 9001, CMMI, Six Sigma in software. Software reliability models.

UNIT-V (DYNAMIC CONTENTS): Modern Development Paradigms: Microservices Architecture & Serverless Computing, Cloud-Native Software Engineering, Configuration management systems (Git, CI/CD basics). DevOps fundamentals (Continuous Integration, Delivery, Deployment), Containerization & Orchestration (Docker, Kubernetes).

RECOMMENDED BOOKS

1. Software Engineering, Sommerville, Pearson.
2. Software Engineering: A Practitioner's Approach, Roger S. Pressman, McGraw Hill.
3. Software Engineering, K.K. Agrawal & Yogesh Singh, New Age Publication.
4. Software Engineering, Rajib Mall, PHI.

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COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Select appropriate development models for specific software project scenarios.
CO2	Evaluate requirement specifications, propose improvements and design models.
CO3	Analyze program behavior to identify defects and implement debugging strategies.
CO4	Design project plans using estimation and scheduling techniques.
CO5	Analyse modern software development paradigms.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	1							2	2	2
CO2	3	3	2	2	2						1	2	2	2
CO3	3	3	2	2	2					1	2	2	2	3
CO4	3	3	3	2	2	1	1	1	2	2	2	2	2	3
CO5	2	2	3	2	3	2	2	1	2	2	2	3	3	3

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NETWORK AND WEB SECURITY

(31242204/ 24242202/ 27242204/ 28242204)

COURSE OBJECTIVES

- To introduce foundational principles of network and web security.
- To equip students with the ability to analyze, design, and implement security solutions.
- To develop competency in emerging and modern security technologies

UNIT-I: Concepts of security: CIA triad, threats, vulnerabilities, attacks. Types of attacks: passive vs active, DoS/DDoS, spoofing, MITM, replay. Security services & mechanisms. Steganography. Cryptographic foundations: Symmetric & asymmetric encryption, DES and AES.

UNIT-II: Public Key Infrastructure (PKI) & Key Management, RSA and Diffie-Hellman key exchange. Hashing, digital signatures, certificates, Kerberos. Secure communication basics (TLS/SSL).

UNIT-III: Firewalls: packet filters, stateful inspection, proxy firewalls. Intrusion Detection & Prevention Systems (IDS/IPS). VPN: IPSec, SSL VPN. Secure routing & switching. Wireless network security: WEP, WPA, WPA2/WPA3. Email security: S/MIME, PGP. Network access control, RADIUS.

UNIT-IV: Web application architecture & threat landscape. SQL injection, XSS, CSRF, Broken authentication, Insecure deserialization. Secure coding principles for web apps. Web communication security (HTTPS, HSTS, CSP). Web server security and misconfigurations. Cookie security, session management attacks.

UNIT-V (DYNAMIC CONTENTS): Zero Trust Architecture, Smart contract security, Blockchain-based identity management, Penetration testing, Quantum-safe cryptography.

RECOMMENDED BOOKS

1. Network Security Essentials: Applications & Standards, William Stallings, Pearson.
2. Network Security - Private Communication in a Public World, G. Kaufman, Prentice-Hall.
3. Cryptography & Network Security – Principles & Practice, William Stallings, Prentice Hall.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Analyze security concepts and basic cryptographic techniques like DES and AES.
CO2	Evaluate PKI and key management methods and secure authentication and communication (RSA, DH, TLS).
CO3	Compare and configure network security tools such as firewalls, IDS/IPS, VPNs, and wireless security protocols.
CO4	Apply secure coding and web security controls to mitigate major web vulnerabilities.
CO5	Explain emerging security concepts (Zero Trust, blockchain, smart contracts) and assess quantum-safe techniques.

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CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	3	2					2	2	3	1	1
CO2	2	3	3	2	3			2		3	3	3	2	2
CO3	3	3	3	3	3				2	2	2	2	2	2
CO4	3	2	3	3	2	3	3		3	3	2	3	3	2
CO5	3	2	2	3	3	3	2	2		2	3	3	3	3

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CALCULUS AND OPTIMIZATION TECHNIQUES

(31242205/ 24242205/ 27242205/ 28242205)

COURSE OBJECTIVES

- To introduce the techniques of differential and integral calculus in engineering problems
- To illustrate the concept of ordinary differentiation equation
- To explore linear programming problem and numerical optimization

UNIT-I: Maclaurin's and Taylor's theorem, Partial differentiation, Euler's theorem, Jacobian, Maxima and Minima of one and two variables.

UNIT-II: Definite integral as limit of a sum, application in summation of series, Beta and Gamma function and its properties, transformation of Beta function, Gamma functions, transformation of Gamma function, relation between Beta and Gamma function, Legendre's duplication formula, double & triple integral, Change of order of integration, Length of the curves, Volumes and surfaces.

UNIT-III: Ordinary differential equations of first and higher order, Linear higher order differential equation with constant coefficients, Homogeneous linear differential equation and Simultaneous differential equations.

UNIT-IV: Concept of optimization, constrained and unconstrained optimization, LPP formulation, Graphical method, Simplex method, Duality of LPP, Transportation and Assignment problems.

UNIT-V: Concept of numerical methods, methods for solving matrix problems and linear systems by LU decomposition: Crout & do little method, Gauss elimination, Gauss-Seidel, and Gauss Jacobi, Interpolation: finite differences, difference operators, Newton's interpolation formula, Newton's divided difference formula, Lagrange's interpolation formula, singular value decomposition.

RECOMMENDED BOOKS

1. E. Kreyszig: Advance Engineering Mathematics, John Wiley & Sons, 10 th Edition (2011).
2. H. A. Taha: Operations Research an Introduction, Pearson, 9 th Edition (2014).
3. R. K. Jain, S. R. K. Iyengar: Advance Engineering Mathematics, Narosa Publishing House Pvt.Ltd, 5 th Edition (2016).
4. F. B .Hildebrand: Advanced Calculus for application, Englewood Cliffs, N. J. Prentice- Hall, 2nd Edition (1980).
5. J. Nocedal and S. Wright: Numerical Optimization, Springer Series in Operations Research and Financial Engineering, 2006.
6. B.V. Ramanna: Higher Engineering Mathematics, McGraw Hill Education, 1 st Edition (2017).
7. Introduction to Linear Optimization by Bertsimas, Tsitsiklis. MIT Press (1997)

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	apply differential calculus in basic engineering problems
CO2	use integration techniques to determine the solution of various complex problems
CO3	solve the differential equations by various methods
CO4	find the optimal solution using various methods of linear programming problems.
CO5	evaluate the numerical techniques

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CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	1	2		1		1	1	3	2	2
CO2	3	3	3	3	2	3	1	2	1	1	1	3	2	2
CO3	3	3	3	3	3	1	1		1	1	1	3	2	1
CO4	3	3	3	3	3				2	2	3	3	2	2
CO5	3	3	3	3	3				2	2		3	2	1

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ROBOT KINEMATICS

(24242201)

COURSE OBJECTIVES

- To introduce the functional elements of Robotics
- To impart knowledge on the kinematics of mechanism
- To introduce the dynamics and control of manipulators

UNIT-I: Introduction to Robotics: History, Law of Robotics: Terminologies, Classifications Overview: Links & Joints, Coordinate Systems, Work Volume, Precision, Repeatability & Accuracy Position and Orientation of Objects: Roll, Pitch and Yaw Angles, Joint Configuration of Five Types of Serial Manipulators, Wrist Configuration, Overview of end effector.

UNIT-II: Degrees of Freedoms: of various mechanisms and its application, Kinematics: Mobility Analysis, Displacement Analysis: constrained mechanisms and robots, Velocity Analysis: constrained mechanisms and robots, singularity.

UNIT-III: Translation Matrix - Rotation matrix, Euler Angles, Quaternion Fundamental, Dot and Cross Products, Frames and Joint Coordinates, Homogeneous Transformation, D-H Convention and Procedures: Forward kinematics Solution using D-H Convention: 3R Planar mechanism, 3 DOF RRP, Cartesian, Articulated 3 DOF robots.

UNIT-IV: Joint space technique, Trajectory planning and control, use of p-degree polynomial, Cubic Polynomial-Cartesian space Technique, Parametric descriptions, Straight line and circular paths, Position and orientation planning.

UNIT-V (DYNAMIC CONTENTS): SCARA Manipulator Kinematic and Dynamic analysis, Jacobian-Prismatic and rotary joints, Lagrange Euler formulation, Dynamic model: Manipulator control problem, Linear control schemes, Adaptive controller. Selection and Application of Serial Manipulators: Industrial applications of robots, Medical, Household, Entertainment, Space, Underwater, Defence, Disaster management. Applications of Micro and Nano robots.

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RECOMMENDED BOOKS

1. R.K. Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
2. John J. Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M. P. Groover, M. Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.
4. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
5. K. K.Appu Kuttan, Robotics, I K International, 2007.
6. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
7. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
8. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,Chennai, 1998.
9. S.Ghoshal, " Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.
10. S. B. Nikku, Introduction to Robotics – Analysis, Control, Applications, 3rd edition, John Wiley & Sons Ltd., 2020.
11. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education 2014.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	illustrate the significance, social impact and future prospects of robotics and automation in various engineering applications.
CO2	describe the components and anatomy of robotic systems and basics of robotics.
CO3	explain different motions of a robotic system through kinematic modeling.
CO4	employ a suitable path planning of end-effectors for a given robotics application.
CO5	develop the kinematic and dynamic model for a robot manipulator.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		1		1	3	2	2	1		1	1	3	2
CO2	3	1	1		1									
CO3	2	3	2	3	3	1			1			1	3	1
CO4	2	3	3	2	3	2								
CO5	3	3	3	3	3	1	1	1	2	2	1	3	3	2

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DATA SCIENCE

(27242201)

COURSE OBJECTIVES

- To provide foundational understanding of data science concepts, workflow, and applications.
- To equip students with essential skills in data collection, cleaning, preprocessing, statistical analysis, core machine learning algorithms and exploratory data analysis.

UNIT-I: Data Science overview, roles & responsibilities of a data scientist, CRISP-DM methodology, Types of data, data collection methods, data quality issues. Data acquisition: APIs, web scraping, databases. Data cleaning: handling missing values, outliers, duplicates.

UNIT-II: Data transformation: normalization, standardization, encoding categorical variables, feature scaling. Feature engineering: extraction, selection, dimensionality reduction (PCA basics). Visualization using Matplotlib, Seaborn, Plotly. Advanced visualizations: heatmaps, pair plots, box plots, violin plots.

UNIT-III: Descriptive statistics: mean, median, variance, skewness. Probability distribution functions: Normal, Binomial, Poisson, Exponential. Hypothesis testing: z-test, t-test, chi-square test. Correlation and covariance. Regression basics: simple and multiple linear regression; evaluation metrics.

UNIT-IV: Types of machine learning: supervised, unsupervised, reinforcement learning. Supervised learning: Linear regression, Logistic regression, KNN, Naive Bayes, Decision Trees, Random Forest, SVM. Unsupervised learning: K-Means clustering, Hierarchical clustering, DBSCAN, PCA. Model evaluation metrics (Accuracy, Precision, Recall, F1, ROC-AUC, Confusion matrix, RMSE, MAE). Overfitting, underfitting, bias-variance tradeoff, cross-validation, regularization.

UNIT-V (DYNAMIC CONTENTS): Big Data technologies overview (Hadoop, Spark basics). Deep Learning fundamentals and CNN/RNN concepts, frameworks (TensorFlow/PyTorch).

RECOMMENDED BOOKS

1. Python Data Science Handbook, Jake VanderPlas, O'Reilly Media, 2016.
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, 3rd Edition, O'Reilly Media, 2022.
3. An Introduction to Statistical Learning with Applications in R (or Python), Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 2nd Edition, 2021.
4. Python for Data Analysis, Wes McKinney, 3rd Edition, O'Reilly, 2022.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Explain the fundamental concepts, workflow, and tools of data science
CO2	Apply appropriate data preprocessing and visualization techniques.
CO3	Apply statistical reasoning and hypothesis testing for data-driven decisions.
CO4	Implement various supervised and unsupervised machine learning algorithms.
CO5	Explain emerging trends and advanced technologies in Data Science.

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CO-PO Mapping Matrix													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	3				1	1		2	2	2
CO2	3	3	3	3	3				2	2		3	3	3
CO3	3	3	1	3	3				2	1	1	3	3	3
CO4	3	3	3	3	3	1	1		3	2	2	3	3	3
CO5	2	2	2	2	3	2	2	1	1	2	1	3	3	3

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MACHINE LEARNING

(28242201)

COURSE OBJECTIVES

- To introduce fundamental concepts, mathematical foundations, and scope of machine learning.
- To develop skills for model evaluation, optimization, and practical application of ML algorithms.

UNIT-I: Introduction to ML: definition, applications, types of learning. ML pipeline: data loading, preprocessing, modeling, evaluation, deployment. Mathematical foundations: linear algebra basics, gradient descent, cost functions. Parametric vs. non-parametric models. Bias–variance trade-off. Python ML ecosystem: NumPy, Pandas, Scikit-learn.

UNIT-II: Linear models: Linear & Polynomial Regression, Ridge, Lasso, Logistic Regression. Tree-based methods: Decision Trees, Random Forest, Gradient Boosting. Instance-based: K-Nearest Neighbors. Probabilistic models: Naive Bayes, Gaussian Discriminant Analysis. Support Vector Machines (hard & soft margin, kernel trick).

UNIT-III: Clustering: K-means, hierarchical clustering, DBSCAN. Association rule mining: Apriori, FP-growth. Anomaly detection. Dimensionality reduction: PCA, SVD. Visualization of high-dimensional data (t-SNE basics).

UNIT-IV: Performance metrics: precision, recall, F1-score, confusion matrix, ROC-AUC. Cross-validation techniques. Hyperparameter tuning: Grid Search, Random Search, Bayesian Optimization. Ensemble methods: bagging, boosting (AdaBoost, Gradient Boosting, XGBoost basics). Overfitting/Underfitting prevention, regularization. Handling imbalanced datasets (SMOTE, resampling).

UNIT-V (DYNAMIC CONTENTS): Deep Learning overview: Neural networks, backpropagation, activation functions. Modern architectures: Transformers, Vision Transformers, CNN advancements.

RECOMMENDED BOOKS

1. Machine Learning: A Probabilistic Perspective, Kevin Murphy
2. Pattern Recognition and Machine Learning, Christopher Bishop
3. Introduction to Machine Learning with Python, Andreas C. Müller & Sarah Guido.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Explain the fundamental concepts, workflow, and mathematical foundations of machine learning.
CO2	Implement major supervised learning algorithms for regression and classification tasks.
CO3	Apply unsupervised learning techniques to discover patterns in data.
CO4	Evaluate, optimize, and improve machine learning models using advanced techniques.
CO5	Explain modern machine learning advancements.

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CO-PO Mapping Matrix													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	3				1	1		2	2	2
CO2	3	3	3	3	3				2	2		3	3	3
CO3	3	3	1	3	3				2	1	1	3	3	3
CO4	3	3	3	3	3	1	1		3	2	2	3	3	3
CO5	2	2	2	2	3	2	2	1	1	2	1	3	3	3

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PROJECT MANAGEMENT, ECONOMICS & FINANCING

(31242211/ 24242211/ 27242211/ 28242211)

COURSE OBJECTIVES

- To provide knowledge about project attributes and planning essentials, develop project networks, make rational decisions for project completion, utilize resources effectively, and understand the basics of project finances and management.

UNIT-I: Project Planning: Introduction to Project Management, Difference between Project and Production, Attributes of a Project: Time, Cost, Quality and Safety. Stakeholders of a Project, Project life cycle. Project Planning: Types of Project Plans and feasibility.

UNIT-II: Project Network logic: Project Networking and work flows, Activity duration and methods of estimating activity duration – One time estimate three time estimates, Duration estimation procedure. Use of Bar Charts, Mile stone charts and networks, Network representation schemes: Activity on Arrow and Activity on Node Networks (A-o-A & A-o-N), Logic behind developing project network and simple network calculations, Critical paths and floats.

UNIT-III: Decision making through networks: CPM, PERT & PDM: Use of network in Decision Making: Importance of critical path, Monitoring the progress and updating the project plan. Use of floats in Resource smoothening, Introduction to Precedence Diagramming Method (PDM), Different lag and lead relations in terms of SS(Start to Start), SF(Start to Finish), Finish to Start(FS), and Finish to Finish(FF) and composite relations.

UNIT-IV: Project Cost Control: Breakeven analysis in planning stage, Direct and indirect cost, slope of direct cost curve, Total project cost and optimum duration, contracting the network for cost optimization. Escalation & Variation in prices.

UNIT-V: Projects Financing: Introduction to project financing; Role of governments in financing projects, Funder and Concessionaire: Economic multiplier effects of Projects; Means of financing-public finance and private finance, Granting authority: World Bank Group, IMF,ADB, Micro and Small Enterprises Funding Scheme (MSME), Elementary understanding of Procurement of infrastructure projects through Public Private Partnership (PPP) route, Build Operate Transfer (BOT), Build Operate Own & Transfer (BOOT); Stakeholders' perspectives, Lifecycle of PPP projects, Micro & Macro economics concepts and its application in Project Financing.

RECOMMENDED BOOKS

1. Project Management Scheduling PERT and CPM by Dr. B.C. Punmia, K.K. Khandelawal
2. PERT & CPM Principles and Applications by L.S. Srinath, Affiliated EWP Pvt. Ltd.
3. Project Planning and Control by Albert Lester, Fourth Edition Elsevier Butterworth-Heinemann.
4. A Management Guide to PERT/CPM With GERT/PDM/DCPM and Other networks by Jerome D. Wiest, Ferdinand K. Levy, Prentice Hall.
5. Project Management with CPM and PERT by Joseph J . Moder, Cecil R . Phillips, Van Nostrand Reinhold Company

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COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Explain the attributes of the project and its different phases.
CO2	Develop the project network based on work breakdown structure and estimation of activity durations.
CO3	Analyze the project network and make decisions on the various alternates.
CO4	Evaluate the optimum cost of the project for assigned deadlines.
CO5	Apply different methods for managing the finances to complete a project within stipulated time.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1			1				1	3	1		
CO2	3	3	3	2	2				1		3	1	1	1
CO3	2	3	2	3	2						3	1		
CO4	2	3	2	3	2						3	1	1	1
CO5	2	2	2	2	1	1		1	1		3	1	1	1

ANNEXURE - VI

Experiment list/ Lab manual and project list (Macro Project-II) of all the Laboratory Courses
B.Tech.
[Artificial Intelligence (AI)/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]
IV Semester
for batch admitted in 2024-25

Centre for Artificial Intelligence

DATABASE MANAGEMENT SYSTEM LAB

(31242206/ 24242207)

1. SQL Queries: SELECT queries using WHERE, BETWEEN, LIKE, ORDER BY, GROUP BY, HAVING.
2. DDL Commands: CREATE, ALTER, DROP tables. Defining constraints (PK, FK, UNIQUE, CHECK, NOT NULL).
3. DML Commands: INSERT, UPDATE, DELETE operations using sample datasets.
4. SQL Joins: INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN queries.
5. Set Operations: UNION, INTERSECT, MINUS/EXCEPT operations.
6. Aggregate Functions: COUNT, SUM, AVG, MIN, MAX with grouping.
7. Subqueries & Nested Queries: Single-row, multi-row, and correlated subqueries.
8. Views: Creating, updating, and deleting views.
9. Indexes & Sequences: Creating and using indexes for optimization. Creating sequences (if supported).
10. PL/SQL Basics: Anonymous blocks demonstrating variables, loops, and conditional statements.
11. Stored Functions: Writing user-defined functions (UDFs).
12. Stored Procedures: Creating and invoking stored procedures.
13. Cursors: Explicit cursor to iterate over table rows.
14. Exceptions in PL/SQL: Predefined and user-defined exceptions.
15. Database Triggers: Row-level & statement-level triggers (BEFORE/AFTER INSERT/UPDATE/DELETE).
16. Transactions & Concurrency: Demonstration of COMMIT, ROLLBACK, SAVEPOINT. Concurrent update simulation (using two sessions).

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Apply basic SQL commands (DDL, DML, DCL, TCL) to create and manage relational database objects.
CO2	Execute complex SQL queries involving joins, subqueries, set operations, indexing, and views.
CO3	Develop PL/SQL blocks including functions, procedures, cursors, exceptions, and triggers to implement business logic.
CO4	Demonstrate transaction management, concurrency control, and integrity constraints in relational databases.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1					1	1	1	1
CO2	3	2	2	2	1	1					1	1	2	2
CO3	3	2	3	2	2	2		1	1	2	1	2	2	2
CO4	2	2	2	3	2	2	1	1	1	2	1	2	2	2

Centre for Artificial Intelligence
JAVA PROGRAMMING LAB
(31242207/ 27242207/ 28242207)

1. Introduction to Java Programming Environment: Overview of Java platform: JVM, JDK, JRE. Installing and configuring Java. Writing and executing basic Java programs. Command-line arguments, data types, operators, expressions.
2. Control Structures and Arrays: Conditional statements: if, if–else, switch. Looping constructs: for, while, do-while. Arrays: single and multi-dimensional. String operations: String, StringBuffer, StringBuilder.
3. Object-Oriented Programming Concepts: Classes, objects, constructors. Method overloading & overriding. Inheritance (types, uses, super keyword). Abstraction: abstract classes and interfaces. Encapsulation and access modifiers. Packages and Java API usage.
4. Exception Handling, I/O, and File Management: Exception types, try-catch-finally, throw & throws. User-defined exceptions. Java I/O streams: byte streams, character streams. File reading and writing.
5. Multithreading and Collections Framework: Thread creation: extending Thread, implementing Runnable. Thread lifecycle and synchronization. Introduction to Collections. Using ArrayList, LinkedList, HashMap, HashSet, Iterator.
6. GUI Programming (AWT/Swing): AWT/Swing components: Frame, Button, Label, TextField. Layout managers. Event handling (ActionListener, MouseListener, etc.). Simple GUI-based applications.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Apply fundamental Java programming constructs
CO2	Implement object-oriented programming concepts
CO3	Develop robust applications using exception handling, Collections Framework and file handling, and multithreading.
CO4	Design interactive GUI applications and demonstrate an integrated Java solution.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1							1	1	1
CO2	3	2	3	2	1							1	2	2
CO3	3	2	3	2	2		1		1	1	1	2	2	2
CO4	2	2	2	2	2	1	1	1	2	1	1	2	2	2

Centre for Artificial Intelligence
COMPETITIVE PROGRAMMING LAB
(31242208/ 24242208/ 27242208/ 28242208)

OBJECTIVE:

- To build strong foundational skills in programming logic, time–space complexity, and problem-solving techniques used in competitive programming.
- To enable students to apply data structures, algorithms, graphs, dynamic programming, and number theory concepts for solving medium to advanced-level coding problems.
- To prepare students for national and global coding contests by developing speed, accuracy, debugging skills, and consistent practice on online judge platforms.

UNIT 1: Basics of C++/Python, input–output, loops, conditionals, functions. Introduction to time–space complexity and constraints. Arrays, strings, frequency maps, simple logic problems. Basics of STL (vector, set, map, pair). Practice: 40–50 beginner problems on LeetCode/CodeChef.

UNIT 2: Core Data Structures & Techniques: Stacks, queues, linked lists, heaps, hash maps. Two-pointer, sliding window, prefix sums, hashing. Binary search and sorting-based logic patterns. Practice on GFG DS Track & LeetCode/CodeChef Data Structures. Target: 30–40 DS-based problems.

UNIT 3: Graphs & Dynamic Programming, Graph basics: BFS, DFS, components, cycles. Shortest paths: Dijkstra, Bellman-Ford, MST algorithms. Recursion, memoization, DP introduction. DP topics: knapsack, LIS, LCS, grid DP.Practice: 30-40 graph & DP problems on LeetCode/CodeChef.

UNIT 4: Advanced Algorithms & Number Theory, Sieve, modular arithmetic, combinatorics, modular inverse. Fast exponentiation, prime factorization. Greedy strategies and optimization techniques. Bit manipulation & bitmask DP. Practice: 30–40 advanced-level problems across platforms.

UNIT 5: Contest Practice & Deployment Registration on LeetCode, CodeChef, GFG, HackerRank. Weekly contests, mock tests, debugging strategies. Editorial writing and clean coding practices. Mini-project: CP notebook/GitHub repository. Target: 30–40 problems + 6 mock contests.

Reference Books

1. "Competitive Programming 4" by Steven Halim & Felix Halim (2018).
2. "Guide to Competitive Programming" by Antti Laaksonen (Springer, 2017).
3. "Programming Challenges: The Competitive Programmer's Handbook" by Laaksonen (Revised Edition 2016).
4. Elements of Programming Interviews in C++" by Adnan Aziz et al. (2016).

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Solve beginner-level CP problems using programming fundamentals.
CO2	Apply appropriate data structures and algorithmic techniques for intermediate problems.
CO3	Use graph algorithms and dynamic programming to solve complex problems.
CO4	Implement advanced number theory, greedy methods, and optimization in contest environments.
CO5	Participate effectively in coding contests and maintain consistent problem-solving practice.

Centre for Artificial Intelligence

CO-PO Mapping Matrix													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	1							1	1	1
CO2	3	2	3	2	1							1	2	2
CO3	3	2	3	2	2		1		1	1	1	2	2	2
CO4	2	2	2	2	2	1	1	1	2	1	1	2	2	2
CO5	2	2	2	2	2	1	1	1	1	1	1	2	1	1

Centre for Artificial Intelligence

ROBOT KINEMATICS LAB

(24242206)

List of Programs/Experiments

1. Study of kinematic links, pairs and chains
2. To find the degree of freedom of a given mechanism.
3. To Study Straight Line Mechanism.
4. Study of Open and Closed kinematic chain mechanism:
    a. Oldham Coupling Mechanism,
    b. A quick return mechanism and
    c. CAM follower mechanism.
5. Experimentation on RoboAnalyzer software.
6. Validation of the forward kinematics of manipulators through RoboAnalyzer.
    a. Demonstration of 2D, 3D Transformation, Scaling
    b. Demonstration Rotation,
    c. Demonstration Translation,
    d. Demonstration Multiple transformation, and Homogeneous Transformations
7. Kinematics analysis of 2R Manipulators by RoboAnalyser.
8. Demonstration of D-H convention for kinematic analysis.
9. Kinematics of PUMA 560: Robot teaching
10. Study of adaptive controllers.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Apply the fundamental principles of kinematic links, pairs, mechanisms, transformations, and D–H parameters to analyze robotic manipulators.
CO2	Implement forward kinematics and kinematic analysis of serial manipulators using RoboAnalyzer and validate results experimentally.
CO3	Evaluate basic robotic control concepts such as robot teaching and PID control through laboratory experiments.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	2							1	1	1
CO2	2	2	1	3	3							2	1	1
CO3	1	2	2	2	2	1	1	1	1	1	1	2	2	2

Centre for Artificial Intelligence

DATA SCIENCE LAB

(27242206)

List of Programs/Experiments

1. Basic Python syntax, variables, data types, control structures, functions.
2. Working with NumPy: Array creation, indexing, slicing, reshaping. Vectorized operations and broadcasting.
3. Data Manipulation using Pandas: Creating DataFrames and Series. Handling missing values, filtering, sorting, merging, grouping.
4. Data Import and Export: Loading CSV, Excel, JSON, and SQL data. Writing datasets to files.
5. Exploratory Data Analysis (EDA) – Descriptive Statistics: Summary statistics, distributions, cross-tabulation. Detecting outliers.
6. Data Visualization using Matplotlib: Line, bar, histogram, scatter, box plots. Subplots and styling.
7. Data Visualization using Seaborn: Pairplot, heatmap, countplot, distplot. Correlation matrix visualization.
8. Data Cleaning and Preprocessing: Handling missing data, encoding, scaling, normalization. Date-time processing.
9. Feature Engineering: Creating new features. Binning, one-hot encoding, label encoding. Dimensionality reduction basics (PCA).
10. Linear Regression: Implement simple and multiple linear regression. Visualize regression lines. Evaluate using RMSE, MAE, R^2.
11. Logistic Regression: Binary classification using logistic regression. Confusion matrix, accuracy, precision, recall, F1-score.
12. Decision Trees & Random Forests: Building decision tree classifiers/regressors. Applying ensemble learning (Random Forest). Feature importance analysis.
13. K-Means Clustering: Implement K-Means. Elbow method for optimal K. Cluster visualization.
14. Naïve Bayes Classifier: Text classification (spam detection or sentiment analysis).
15. Model Evaluation & Validation: Train-test split, k-fold cross-validation. Hyperparameter tuning with GridSearchCV.
16. Time Series Analysis (Basic): Plotting time series. Moving averages, decomposition.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Apply Python programming and essential data manipulation techniques
CO2	Implement exploratory data analysis (EDA) and visualize datasets
CO3	Build and evaluate machine learning models

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	2	2							1	1	2
CO2	3	3	3	3	3	1						2	3	3
CO3	3	3	3	3	3	2	1	1	1	1	1	3	3	3

Centre for Artificial Intelligence

MACHINE LEARNING LAB

(28242206)

1. Introduction to Python for ML: Basics of Python, NumPy, Pandas, Matplotlib, Seaborn.
2. Data Preprocessing: Handling missing values, outlier detection. Encoding (label, one-hot), feature scaling (standardization/normalization).
3. Exploratory Data Analysis (EDA): Descriptive statistics, distribution plots, correlation heatmaps.
4. Train-Test Split and Cross-Validation: Dataset partitioning and performing k-fold cross-validation.
5. Linear Regression: Simple & Multiple linear regression. Model evaluation: RMSE, MAE, R^2 score.
6. Logistic Regression: Binary classification using logistic regression. Confusion matrix, ROC curve, AUC.
7. K-Nearest Neighbors (KNN): Classification using distance metrics. Optimal K selection using cross-validation.
8. Naïve Bayes Classifier: Gaussian/Multinomial NB on text or tabular data. Spam detection / sentiment classification.
9. Support Vector Machines (SVM): Linear and RBF kernel. Hyperparameter tuning using GridSearchCV.
10. Decision Trees: Classification & regression trees. Visualizing the tree. Impact of max_depth, min_samples_split.
11. Random Forests & Ensemble Methods: Bagging, Random Forest, and feature importance. Comparing single tree vs ensemble performance.
12. K-Means Clustering: Clustering workflow. Elbow method and silhouette score.
13. Hierarchical Clustering: Agglomerative clustering. Dendrogram visualization.
14. Dimensionality Reduction (PCA): Eigenvalues/eigenvectors, explained variance ratio. Visualization in 2D space.
15. Artificial Neural Networks (ANN) – Basic: Building a simple feedforward network using TensorFlow/Keras or Scikit-learn. Training, validation, accuracy evaluation.
16. Model Evaluation & Hyperparameter Tuning: GridSearchCV, RandomizedSearchCV. Bias-variance tradeoff.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1	Apply data preprocessing, cleaning, and preparation techniques essential for machine learning tasks.
CO2	Implement supervised & unsupervised learning algorithms and evaluate them using appropriate performance metrics.
CO3	Develop an end-to-end machine learning workflow

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	2	2							1	1	2
CO2	3	3	3	3	3	1						2	3	3
CO3	3	3	3	3	3	2	1	1	1	1	1	3	3	3

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MACRO PROJECT-II

(31242210/ 24242210/ 27242210/ 28242210)

1. Intelligent Student Performance Prediction System
2. Smart Healthcare Diagnosis Assistant
3. Online Book Recommendation System
4. Intelligent Traffic Management System
5. E-Commerce Customer Behavior Analytics System
6. Crop Disease Detection & Yield Prediction System
7. Banking Fraud Detection System
8. Job Recommendation and Skill Assessment Portal
9. Smart Energy Consumption Monitor
10. Intelligent Chatbot for Academic Queries
11. Library Management System with Book Recommendation
12. Sports Analytics and Player Performance Predictor
13. Transport Fare Estimation and Route Optimization System
14. Smart Attendance System with Face Recognition
15. Loan Eligibility & Default Prediction System
16. Intelligent Inventory Management & Demand Forecasting
17. Accident Detection & Emergency Response System
18. Student Mentorship and Course Recommendation Engine
19. Social Media Sentiment Analysis Tool
20. Real Estate Price Prediction & Property Finder
21. Hospital Resource Optimization System
22. Personalized Fitness & Nutrition Recommendation System
23. Vehicle Number Plate Recognition System
24. Smart Banking Chatbot with Predictive Insights
25. Intelligent Complaint Management System
26. Indoor Navigation System for Large Buildings
27. Blood Donation & Matching System
28. Cyberbullying Detection System
29. Smart Tourism Recommendation System
30. Intelligent Resume Screening and Ranking System

ANNEXURE - VII

List of additional courses for Honours/Minors to be offered from SWAYAM/NPTEL/Institute MOOC based platform for B.Tech. [Artificial Intelligence (AI)/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning] IV Semester for batch admitted in 2024-25

List of courses to be opted for B. Tech. Honours in IV Semester

(for batch admitted in academic session 2024 – 25

(to be opted by students of Parent Department)

Course Code	Course Name	Course Code	Course Name
Track 1: Information Security		**Track 2: Internet of Things**	
H24042801	Information Security - 5 - Secure Systems Engineering (8 weeks)	H24042804	Introduction to Internet Of Things (12 weeks)
H24042802	Secure Computation: Part I (12 weeks)	H24042805	Foundations of Cyber Physical Systems (12 weeks)
H24042803	Foundations of Cryptography (12 weeks)	H24042806	Embedded Systems Design (12 weeks)
Track 3: High Performance Computing			
H24042807	Basics of Computational Complexity (12 weeks)		
H24042808	Advanced Computer Architecture (12 weeks)		
H24042809	Parallel Computer Architecture (12 weeks)		

Above Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform

List of courses to be opted for B. Tech. Minor in IV Semester

(for batch admitted in academic session 2024 – 25

(to be opted by students of other Department)

Minor Specialization in Artificial Intelligence	
S. No.	**Course Name**
1	Artificial Intelligence: Knowledge Representation and Reasoning (12 weeks)
2	GPU Architectures and Programming (12 weeks)
3	Parallel Computer Architecture (12 weeks)

Above Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform

Note: In each semester (starting from IV to VIII semester), it is required to opt for new subjects towards Honours Degree/ Minor Specialization.

ANNEXURE-VIII

List of Professional Certification Platforms and relating Certifications with Specific Domain/Areas of Certification for B. Tech. [Artificial Intelligence (AI)/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning] under the flexible curriculum

(Batch admitted in academic session 2024 – 25)

Centre for Artificial Intelligence

List of Professional Certification Courses			
S. No.	**Course Name**	**Duration**	**Link**
1	IBM Full Stack Software Developer Professional Certificate	5 month	https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer?utm_source=chatgpt.com#courses
2	Meta Android Developer Professional Certificate	7 weeks	https://www.coursera.org/professional-certificates/meta-back-end-developer
3	Certified Ethical Hacker (CEH)	6 month	https://www.eccouncil.org/train-certify/certified-ethical-hacker-ceh/#section_course_info
4	Oracle Cloud Infrastructure and Technology Exams	6 month	https://education.oracle.com/buy-exam
5	Oracle Cloud Applications DELTA Exams & OCI Multi Cloud Architect Associate Exam	6 month	https://education.oracle.com/buy-exam
6	Oracle Cloud Applications Exams	6 month	https://education.oracle.com/buy-exam
7	Oracle Foundations Exams for Students	6 month	https://education.oracle.com/buy-exam
8	Red Hat System Administration - I/II	3 month	https://courses.networknuts.net/redhat-delhi-lp/?utm_source=google&utm_medium=cpc&utm_campaign=&utm_term=e_red%20hat%20certification&device=c&matchtype=e&adposition=&gad_source=1&gad_campaignid=12435426400&gbraid=0AAAAAD6LwPtvLsGetAR-znoaKueJj8CI4&gclid=Cj0KCQjwgIXCBhDBARIsAELC9ZiPiWYPwF3G8UACFKqLS-i5D4OTXdN5fIJlYzihpuT5U_gJNlXokk8aAh4cEALw_wcB#
9	AWS Certified DevOps Engineer	6 months	https://aws.amazon.com/certification/certified-devops-engineer-professional/
10	AWS Certified Solutions Architect - Professional	6 months	https://aws.amazon.com/certification/certified-solutions-architect-professional/
11	IBM AI Engineering Professional Certificate	4 month	https://www.coursera.org/professional-certificates/ai-engineer
12	CS50's Introduction to Artificial Intelligence with Python	2 months	https://pll.harvard.edu/course/cs50s-introduction-artificial-intelligence-python
13	Microsoft AI & ML Engineering Professional Certificate	6 months	https://www.coursera.org/professional-certificates/microsoft-ai-and-ml-engineering
14	Generative AI Engineering with LLMs Specialization	3 months	https://www.coursera.org/specializations/generative-ai-engineering-with-llms

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List of Professional Certification Courses			
15	Deep Learning Specialization	6 weeks	https://www.coursera.org/specializations/deep-learning
16	Microsoft AI & ML Engineering Professional Certificate	6 months	https://www.coursera.org/professional-certificates/microsoft-ai-and-ml-engineering
17	Meta Back-End Developer Professional Certificate	7 weeks	https://www.coursera.org/professional-certificates/meta-back-end-developer

ANNEXURE-IX

CO Attainments, Gap Analysis and Corrective Measures Taken for the improvement in CO attainment levels of the courses taught in B. Tech. [Artificial Intelligence (AI)/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning] II Semester

(Session: Jan. - June 2025)

Centre for Artificial Intelligence

Branch & Semester	Course name & Code		Course Outcome Statements	CO attainment levels from Quiz/ Assignment	CO attainment Levels from Minor 1	CO attainment Levels from Minor 2	CO attainment Levels from Major	CO Direct Attainment levels	CO Indirect Attainment Levels from CO Feedback	Overall CO attainment	Target	Attained/ not attained	Action taken for Not Attained
AI 2nd	**Discrete Structures (31241201)**	**CO1**	explain the concepts of set theory, propositional logic, graph theory, discrete numeric function and algebraic structure.	3.00	2.44		2.80	**2.75**	2.32	**2.7**	2.5	Attained	-
		CO2	apply mathematical reasoning and logical thinking to solve problems	3.00	2.44		2.95	**2.80**	2.25	**2.7**	2.5	Attained	-
		CO3	determine the solutions of problems pertaining to computer sciences using graph theory concepts.	3.00		2.00	2.94	**2.65**	2.29	**2.6**	2.5	Attained	-
		CO4	solve counting and recursive problems using combinatorial analysis.	3.00		2.33	2.74	**2.69**	2.27	**2.6**	2.5	Attained	-
		CO5	analyze error control coding techniques to enhance communication system reliability.	2.60			2.50	**2.55**	2.17	**2.5**	2.5	Attained	-
AI 2nd	**Data Structures (31241204)**	**CO1**	analyze algorithms using asymptotic notations and perform operations on arrays and linked lists.	2.10	2.20		2.31	**2.20**	2.26	**2.2**	2	Attained	-
		CO2	construct stacks and queues, and use them to solve real world problems.	2.20	2.10		2.12	**2.14**	2.24	**2.2**	2	Attained	-
		CO3	distinguish between different types of trees and identify the application of each.	1.80		2.20	2.16	**2.05**	2.33	**2.1**	2	Attained	-
		CO4	apply graph theory concepts and algorithms.	1.90		2.12	2.02	**2.01**	2.33	**2.1**	2	Attained	-
		CO5	compare various searching, sorting and hashing techniques.	2.30			2.40	**2.35**	2.29	**2.3**	2	Attained	-

AI 2nd	**Basic Electrical & Electronics Engineering (31241205)**	**CO1**	analyze electrical and magnetic circuits to evaluate transient responses in capacitive and inductive circuits.	2.80	2.13		2.13	**2.35**	2.06	**2.3**	2	Attained	-
		CO2	analyze single-phase and three-phase AC circuits, including power measurements and power factor correction	2.70	2.13		3.00	**2.61**	2.16	**2.5**	2	Attained	-
		CO3	explain the generation of three-phase EMFs	2.40		2.27	2.93	**2.53**	2.09	**2.4**	2	Attained	-
		CO4	describe the construction and working principles of transformers, analyze their performance using EMF equations and phasor diagrams, and evaluate their efficiency and applications	2.40		2.53	1.00	**1.98**	2.13	**2**	2	Attained	-
		CO5	apply semiconductor physics principles to analyze PN junction and Zener diodes, design rectifiers, and identify the applications of special-purpose diodes in circuits	2.53			2.53	**2.53**	2.09	**2.4**	2	Attained	-
AI 2nd	**Data Structures Lab (31241207)**	**CO1**	implement sorting techniques.	2.30	2.60		2.50	**2.47**	2.29	**2.4**	2.2	Attained	-
		CO2	analyze the complexity of tree data structure.	2.20	2.30		2.30	**2.27**	2.26	**2.3**	2	Attained	-
		CO3	choose appropriate data structures for specific scenarios.	2.00		2.20	2.10	**2.10**	2.33	**2.1**	2	Attained	-
		CO4	explain the importance of binary search trees.	2.60		2.70	2.40	**2.57**	2.30	**2.5**	2	Attained	-
		CO5	solve real world problems using graphs.	2.10			2.50	**2.30**	2.33	**2.3**	2	Attained	-
AIR 2nd	**Discrete Structures (24241201)**	**CO1**	explain the concepts of set theory, propositional logic, graph theory, discrete numeric function and algebraic structure.	2.70	2.45		2.85	**2.67**	2.60	**2.7**	2.2	Attained	-
		CO2	apply mathematical reasoning and logical thinking to solve problems	2.67	2.72		2.94	**2.78**	2.70	**2.8**	2.2	Attained	-

		CO3	determine the solutions of problems pertaining to computer sciences using graph theory concepts.	2.91	2.80		2.85	**2.85**	2.80	**2.8**	2.2	Attained	-
		CO4	solve counting and recursive problems using combinatorial analysis	2.55		2.72	2.78	**2.68**	2.40	**2.6**	2.2	Attained	-
		CO5	analyze error control coding techniques to enhance communication system reliability	2.90		2.00	2.67	**2.52**	2.60	**2.5**	2.2	Attained	-
AIR 2nd	**Modern Computer Architecture (24241202)**	**CO1**	escribe the organization of the Control unit, ALU, Memory and the I/O unit.	2.82	2.61		2.10	**2.51**	2.40	**2.5**	2	Attained	-
		CO2	analyze different computer architectures and their applications.	2.00	2.72		2.42	**2.38**	2.80	**2.5**	2	Attained	-
		CO3	contrast between different modes of Input-Output data transfer.	2.31	2.11	2.41	2.16	**2.25**	2.60	**2.3**	2	Attained	-
		CO4	utilize the modern design structures of Pipelined and Multiprocessors systems.	2.91		2.00	2.67	**2.53**	2.10	**2.4**	2	Attained	-
		CO5	evaluate the performance of distributed and high-performance computing architectures.	2.80		1.90	2.74	**2.48**	2.30	**2.4**	2	Attained	-
		CO6	create parallel computing and programming models to harness the power of GPUs using CUDA.	1.90		2.23	2.39	**2.17**	2.10	**2.2**	2	Attained	-
AIR 2nd	**Object Oriented Programming (24241203)**	**CO1**	describe fundamental principles of object-oriented programming.	3.00	2.15		2.92	**2.69**	2.80	**2.7**	2	Attained	-
		CO2	construct and manage object life cycles using various types of constructors and destructors, while employing inline and friend functions effectively in programming.	2.00	2.41		3.00	**2.47**	2.60	**2.5**	2	Attained	-
		CO3	apply compile-time and runtime polymorphism using function and operator overloading, while addressing potential challenges of	3.12	2.90	3.00	3.00	**3.01**	2.30	**2.9**	2	Attained	-

			operator overloading and type casting.										
		CO4	develop well-structured, modular programs that leverage classes, objects, and inheritance to enhance code maintainability and reusability.	3.00	2.80	2.00	2.92	**2.68**	2.60	**2.7**	2	Attained	-
		CO5	design reusable and generic code using function and class templates, handle runtime errors with exception handling, and utilize the Standard Template Library for efficient data manipulation.	3.00	2.60	1.90	2.67	**2.54**	2.70	**2.6**	2	Attained	-
AIR 2nd	**Data Structures (24241204)**	**CO1**	analyze algorithms using asymptotic notations and perform operations on arrays and linked lists.	2.10	2.20		2.31	**2.20**	2.26	**2.2**	2	Attained	-
		CO2	construct stacks and queues, and use them to solve real world problems.	2.20	2.10		2.12	**2.14**	2.24	**2.2**	2	Attained	-
		CO3	distinguish between different types of trees and identify the application of each.	1.80		2.20	2.16	**2.05**	2.33	**2.1**	2	Attained	-
		CO4	apply graph theory concepts and algorithms.	1.90		2.12	2.02	**2.01**	2.33	**2.1**	2	Attained	-
		CO5	compare various searching, sorting and hashing techniques.	2.30			2.40	**2.35**	2.29	**2.3**	2	Attained	-
AIR 2nd	**Sensors and Actuators (24241205)**	**CO1**	describe the functional elements of measurement systems, identify different types of errors, and evaluate the static and dynamic characteristics of measurement systems.	2.00	2.70		3.00	**2.57**	2.32	**2.5**	2	Attained	-
		CO2	analyze various types of transducers for diverse measurement applications.	2.60	2.80		2.63	**2.68**	2.25	**2.6**	2	Attained	-
		CO3	explain the principles and applications of sensors, characterize smart sensors, and analyze the design and operation of	2.80		2.50	2.50	**2.60**	2.29	**2.5**	2	Attained	-

			MEMS-based systems for multidisciplinary applications.										
		CO4	assess the performance and suitability of selected sensors and actuators for a specific control	2.00		2.60	2.10	**2.23**	2.27	**2.2**	2	Attained	-
		CO5	apply the principles of micro-actuation, analyze the design and fabrication of microsensors and microactuators, and explore the integration of smart sensor technologies with IoT systems for innovative applications.	2.00			2.30	**2.15**	2.17	**2.2**	2	Attained	-
AIR 2nd	**Object Oriented Programming Lab (24241206)**	**CO1**	apply the principles of object-oriented programming paradigm to programming problems.	3.00	2.15		2.92	**2.69**	2.80	**2.7**	2	Attained	-
		CO2	use classes and objects to model real-world entities in a program.	2.00	2.41		3.00	**2.47**	2.60	**2.5**	2	Attained	-
		CO3	apply the concepts of base classes, derived classes, and method overriding.	3.00	2.90	3.00	3.00	**2.98**	2.30	**2.8**	2	Attained	-
		CO4	implement exception handling to manage errors and unexpected situations in a program.	2.28	2.80	2.41	2.92	**2.60**	2.60	**2.6**	2	Attained	-
		CO5	create generic and reusable code using STL.	3.00	2.30	1.90	2.67	**2.47**	2.70	**2.5**	2	Attained	-
		CO6	solve real world problems using the concepts of object-oriented programming	3.00	2.00	2.70	2.72	**2.61**	2.80	**2.6**	2	Attained	-
AIR 2nd	**Data Structures Lab (24241207)**	**CO1**	implement sorting techniques.	2.30	2.60		2.50	**2.47**	2.29	**2.4**	2.2	Attained	-
		CO2	analyze the complexity of tree data structure.	2.20	2.30		2.30	**2.27**	2.26	**2.3**	2	Attained	-
		CO3	choose appropriate data structures for specific scenarios.	2.00		2.20	2.10	**2.10**	2.33	**2.1**	2	Attained	-
		CO4	explain the importance of binary search trees.	2.60		2.70	2.40	**2.57**	2.30	**2.5**	2	Attained	-
		CO5	solve real world problems using graphs.	2.10			2.50	**2.30**	2.33	**2.3**	2	Attained	-

AIR 2nd	**Sensors and Actuators Lab (24241208)**	**CO1**	interpret the terminology of Instrumentation and analyze various sensors.	2.30	2.73		2.60	**2.54**	2.90	**2.6**	2.4	Attained	-
		CO2	apply signal conditioning for measurements.	2.40	2.42		2.60	**2.47**	2.80	**2.5**	2.4	Attained	-
		CO3	explain measurement techniques for industrial and laboratory applications of different transducers.	2.40		2.50	2.50	**2.47**	2.60	**2.5**	2.4	Attained	-
AIR 2nd	**Micro Project-II (24241210)**	**CO1**	Explain the principles of OOP and their applications in solving real-world problems.	3.00	2.15		2.92	**2.69**	2.80	**2.7**	2	Attained	-
		CO2	Develop and manipulate data structures like stacks and queues to solve problems	2.00	2.41		3.00	**2.47**	2.60	**2.5**	2	Attained	-
		CO3	Examine the relationships between OOP principles and data structure implementations in program design	3.00	2.90		3.00	**2.97**	2.30	**2.8**	2	Attained	-
		CO4	Design and develop a micro-project that integrates OOP concepts and appropriate data structures to solve a real-world problem.	2.28		2.41	2.92	**2.54**	2.60	**2.5**	2	Attained	-
		CO5	Construct reusable and modular code using OOP principles for solving a complex programming challenge	3.00		1.90	2.67	**2.52**	2.70	**2.6**	2	Attained	-
AIR 2nd	**Sustainability & Environmental Science (24241211)**	**CO1**	Explain the fundamental concepts of environmental science, including ecosystems and the causes of environmental degradation.	3.00	3.00	3.00	2.56	**2.89**	3.00	**2.9**	2	Attained	-
		CO2	Analyze the sources, causes, and impacts of air, water, and solid waste pollution and propose appropriate mitigation strategies.	2.98	3.00	2.96	2.36	**2.83**	3.00	**2.9**	2	Attained	-
		CO3	Evaluate the effectiveness of environmental policies and	2.54	2.15	2.85	2.78	**2.58**	2.90	**2.6**	2	Attained	-

			global frameworks in addressing environmental challenges.										
		CO4	Explain the concepts of sustainability and sustainable development goals.	2.14	2.56	2.36	2.45	**2.38**	2.40	**2.4**	2	Attained	-
		CO5	Apply various solutions for achieving sustainable development.	2.03	2.13	2.08	2.03	**2.07**	2.10	**2.1**	2	Attained	-
AIDS 2nd	**Discrete Structures (27241201)**	**CO1**	explain the concepts of set theory, propositional logic, graph theory, discrete numeric function and algebraic structure.	2.67	2.45		2.85	**2.66**	2.70	**2.7**	2.2	Attained	-
		CO2	apply mathematical reasoning and logical thinking to solve problems	2.67	2.78		2.94	**2.80**	2.78	**2.8**	2.2	Attained	-
		CO3	determine the solutions of problems pertaining to computer sciences using graph theory concepts.	2.92	2.90		2.89	**2.90**	2.82	**2.9**	2.2	Attained	-
		CO4	solve counting and recursive problems using combinatorial analysis	2.55		2.72	2.74	**2.67**	2.40	**2.6**	2.2	Attained	-
		CO5	analyze error control coding techniques to enhance communication system reliability	2.50		2.00	2.69	**2.40**	2.61	**2.4**	2.2	Attained	-
AIDS 2nd	**Modern Computer Architecture (27241202)**	**CO1**	describe the organization of the Control unit, ALU, Memory and the I/O unit.	2.60	2.11		3.00	**2.57**	2.44	**2.5**	2.2	Attained	-
		CO2	evaluate hierarchical memory systems, design effective caching strategies, and optimize memory performance using advanced techniques and scheduling algorithms.	3.00	2.22		2.89	**2.70**	2.15	**2.6**	2.2	Attained	-
		CO3	compare distributed and parallel computing paradigms, address concurrency challenges, and implement synchronization techniques for distributed systems.	2.89		3.00	3.00	**2.96**	2.23	**2.8**	2.2	Attained	-

		CO4	design parallel processing architectures and implement multithreading for high-performance computing applications.	2.44		2.67	2.22	**2.44**	2.39	**2.4**	2.2	Attained	-
		CO5	develop parallel programs using the CUDA programming model, manage GPU-CPU data exchange, and optimize computations with threads and blocks.	2.01			3.00	**2.51**	2.07	**2.4**	2.2	Attained	-
AIDS 2nd	**Object Oriented Programming (27241203)**	**CO1**	describe fundamental principles of object-oriented programming.	2.73	2.64		2.89	**2.75**	2.71	**2.7**	2.2	Attained	-
		CO2	construct and manage object life cycles using various types of constructors and destructors, while employing inline and friend functions effectively in programming.	2.86	2.52		2.65	**2.68**	2.69	**2.7**	2	Attained	-
		CO3	apply compile-time and runtime polymorphism using function and operator overloading, while addressing potential challenges of operator overloading and type casting.	2.34		2.64	2.70	**2.56**	2.80	**2.6**	2	Attained	-
		CO4	develop well-structured, modular programs that leverage classes, objects, and inheritance to enhance code maintainability and reusability.	2.47		2.54	2.53	**2.51**	2.80	**2.6**	2	Attained	-
		CO5	design reusable and generic code using function and class templates, handle runtime errors with exception handling, and utilize the Standard Template Library for efficient data manipulation.	2.99			3.00	**3.00**	2.75	**2.9**	2	Attained	-
AIDS 2nd	**Object Oriented Programming Lab (27241206)**	**CO1**	apply the principles of object-oriented programming paradigm to programming problems.	2.76	2.73		2.75	**2.75**	2.75	**2.7**	2	Attained	-

		CO2	use classes and objects to model real-world entities in a program.	2.64	2.42		2.88	**2.65**	2.71	**2.7**	2	Attained	-
		CO3	apply the concepts of base classes, derived classes, and method overriding.	2.40		2.64	2.63	**2.56**	2.80	**2.6**	2	Attained	-
		CO4	implement exception handling to manage errors and unexpected situations in a program.	2.63		2.75	3.00	**2.79**	2.76	**2.8**	2	Attained	-
		CO5	create generic and reusable code using STL.	2.52			3.00	**2.76**	2.80	**2.8**	1.6	Attained	-
AIDS 2nd	**Sustainability & Environmental Science (27241211)**	**CO1**	Explain the fundamental concepts of environmental science, including ecosystems and the causes of environmental degradation.	3.00	3.00	3.00	2.56	**2.89**		**2.3**	2	Attained	-
		CO2	Analyze the sources, causes, and impacts of air, water, and solid waste pollution and propose appropriate mitigation strategies.	2.98	3.00	2.96	2.36	**2.83**		**2.3**	2	Attained	-
		CO3	Evaluate the effectiveness of environmental policies and global frameworks in addressing environmental challenges.	2.54	2.15	2.85	2.78	**2.58**		**2.1**	2	Attained	-
		CO4	Explain the concepts of sustainability and sustainable development goals.	2.14	2.56	2.36	2.45	**2.38**		**1.9**	1.5	Attained	-
		CO5	Apply various solutions for achieving sustainable development.	2.03	2.13	2.08	2.03	**2.07**		**1.7**	1.5	Attained	-
AIML 2nd	**Discrete Structures (28241201)**	**CO1**	explain the concepts of set theory, propositional logic, graph theory, discrete numeric function and algebraic structure.	2.67	2.48		2.70	**2.62**	2.46	**2.6**	2.2	Attained	-
		CO2	apply mathematical reasoning and logical thinking to solve problems	2.67	2.78		2.94	**2.80**	2.10	**2.7**	2.2	Attained	-

		CO3	determine the solutions of problems pertaining to computer sciences using graph theory concepts.	2.92	2.90		2.89	**2.90**	2.29	**2.8**	2.2	Attained	-
		CO4	solve counting and recursive problems using combinatorial analysis	2.55		2.75	2.74	**2.68**	2.39	**2.6**	2.2	Attained	-
		CO5	analyze error control coding techniques to enhance communication system reliability	2.54		2.35	2.69	**2.53**	2.17	**2.5**	2.2	Attained	-
AIML 2nd	**Modern Computer Architecture (28241202)**	**CO1**	describe the organization of the Control unit, ALU, Memory and the I/O unit.	2.50	3.00		3.00	**2.83**	2.62	**2.8**	2.2	Attained	-
		CO2	evaluate hierarchical memory systems, design effective caching strategies, and optimize memory performance using advanced techniques and scheduling algorithms.	3.00	2.22		2.89	**2.70**	2.40	**2.6**	2.2	Attained	-
		CO3	compare distributed and parallel computing paradigms, address concurrency challenges, and implement synchronization techniques for distributed systems.	2.94		3.00	3.00	**2.98**	2.19	**2.8**	2.2	Attained	-
		CO4	design parallel processing architectures and implement multithreading for high-performance computing applications.	2.72		2.56	2.40	**2.56**	2.22	**2.5**	2.2	Attained	-
		CO5	develop parallel programs using the CUDA programming model, manage GPU-CPU data exchange, and optimize computations with threads and blocks.	2.44			2.28	**2.36**	2.17	**2.3**	2.2	Attained	-
AIML 2nd	**Object Oriented Programming (28241203)**	**CO1**	describe fundamental principles of object-oriented programming.	2.73	2.64		2.89	**2.75**	2.71	**2.7**	2.2	Attained	-
		CO2	construct and manage object life cycles using various types of constructors and destructors, while employing inline and friend	2.86	2.52		2.65	**2.68**	2.69	**2.7**	2	Attained	-

			functions effectively in programming.										
		CO3	apply compile-time and runtime polymorphism using function and operator overloading, while addressing potential challenges of operator overloading and type casting.	2.34		2.64	2.70	**2.56**	2.80	**2.6**	2	Attained	-
		CO4	develop well-structured, modular programs that leverage classes, objects, and inheritance to enhance code maintainability and reusability.	2.47		2.54	2.53	**2.51**	2.80	**2.6**	2	Attained	-
		CO5	design reusable and generic code using function and class templates, handle runtime errors with exception handling, and utilize the Standard Template Library for efficient data manipulation.	2.99			3.00	**3.00**	2.75	**2.9**	2	Attained	-
AIML 2nd	**Object Oriented Programming Lab (28241206)**	**CO1**	apply the principles of object-oriented programming paradigm to programming problems.	2.76	2.73		2.75	**2.75**	2.75	**2.7**	2	Attained	-
		CO2	use classes and objects to model real-world entities in a program.	2.64	2.42		2.88	**2.65**	2.71	**2.7**	2	Attained	-
		CO3	apply the concepts of base classes, derived classes, and method overriding.	2.40		2.64	2.63	**2.56**	2.80	**2.6**	2	Attained	-
		CO4	implement exception handling to manage errors and unexpected situations in a program.	2.63		2.75	3.00	**2.79**	2.76	**2.8**	2	Attained	-
		CO5	create generic and reusable code using STL.	2.52			3.00	**2.76**	2.80	**2.8**	1.6	Attained	-
AIML 2nd	**Micro Project-II (28241210)**	**CO1**	explain the principles of OOP and their applications in solving real-world problems.	3.00	2.60		3.00	**2.87**	2.80	**2.9**	2.2	Attained	-
		CO2	develop and manipulate data structures like stacks and queues to solve problems.	3.00	2.45		3.00	**2.82**	2.60	**2.8**	2.2	Attained	-

		CO3	examine the relationships between OOP principles and data structure implementations in program design.	3.00	2.80		3.00	**2.93**	2.48	**2.8**	2.2	Attained	-
		CO4	design and develop a micro-project that integrates OOP concepts and appropriate data structures to solve a real-world problem.	3.00		3.00	3.00	**3.00**	2.35	**2.9**	2.2	Attained	-
		CO5	construct reusable and modular code using OOP principles for solving a complex programming challenge.	2.40		2.05	2.30	**2.25**	2.27	**2.3**	2.2	Attained	-

ANNEXURE-X

Curriculum Feedback from various stakeholders, its analysis and impact report in B. Tech. [Artificial Intelligence (AI)/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning] (for the courses taught during Jan.-June 2025 Session)

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Action Taken on Student Feedback of Course Curriculum: Jan-June 2025

Based on the feedback data received from total **203** students (2nd, semester of AI, AIML, AIDS and AIR) for the
academic session Jan-June 2025, following points have been analysed:

- It has been observed that, majority of the students of AI, AIML, AIDS and AIR (2nd, semester) are strongly agreed, some of the students are agreed and few of them have strongly disagreed with the syllabus/ content that they have studied.

Some students have suggested the following changes in the course curriculum:

i. There is a need to remove sets from Discrete Structures
ii. Course content of Basic Electrical & Electronics Engineering needs to be updated

The above mentioned suggestions have been forwarded to the relevant course committee for further action.

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COURSE CURRICULUM FEEDBACK (by Students on MOODLE)

Course-wise Analysis of Curriculum Feedback by Students for

Artificial intelligence

(Average value of responses (on a scale of 1 to 5) 5: Strongly Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Strongly disagree)

AI 2nd Semester							
Subject code/name	**1 .The course is well designed**	**2. The units are balanced**	**3. The learning material was available to you**	**4. The content was clear and easy to understand**	**5.The course was relevant and updated for present needs**	**6.The course meets your career expectations**	**7. The course will be useful to meet your higher studies/future aspirations.**
Discrete Structures (31241201)	4.20	4.10	4.27	4.27	4.20	4.20	4.17
Modern Computer Architecture (31241202)	3.02	2.87	3.00	2.82	3.11	3.02	3.04
Object Oriented Programming (31241203)	3.79	3.91	3.86	3.74	3.67	3.77	3.84
Data Structures (31241204)	4.25	4.20	4.22	4.12	4.18	4.22	4.25
Basic Electrical & Electronics Engineering (31241205)	3.62	3.69	3.66	3.69	3.72	3.66	3.69

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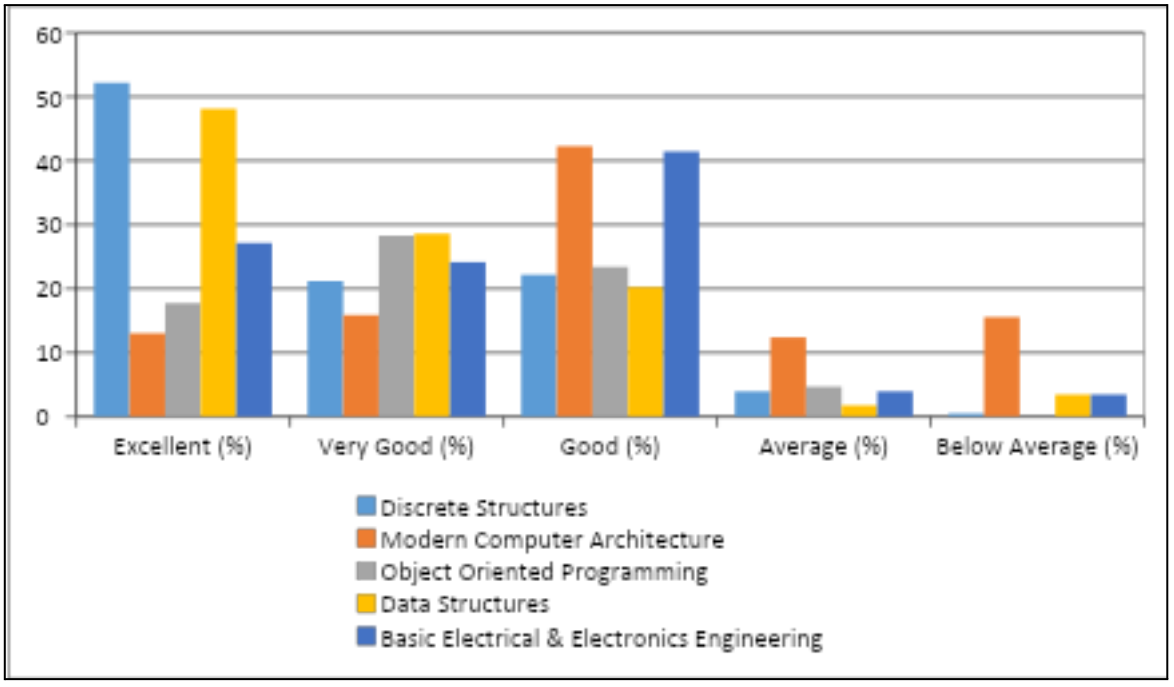
AI 2nd Semester								
Parameter(Average Grading)				Excellent (%)	Very Good (%)	Good (%)	Average (%)	Below Average (%)
Subject Code	Subject Name	Semester	Faculty Name					
(31241201)	Discrete Structures	II	Dr. Rahul Kumar	52.22	21.18	22.17	3.94	0.49
(31241202)	Modern Computer Architecture	II	Dr. Pawan Dubey	13.02	15.87	42.22	12.38	15.56
(31241203)	Object Oriented Programming	II	Dr. Shipra Shukla	17.73	28.33	23.40	4.68	0.00
31241204	Data Structures	II	Dr. Mir Shahnawaz Ahmad	48.13	28.57	20.22	1.76	1.32
(31241205)	Basic Electrical & Electronics Engineering	II	Dr. Sunil Kumar Shukla	27.09	24.14	41.38	3.94	3.45



AI 2nd Semester

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Course-wise Analysis of Curriculum Feedback by Students for

Artificial intelligence and Robotics

(Average value of responses (on a scale of 1 to 5) 5: Strongly Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Strongly disagree)

AIR 2nd Semester							
Subject code/name	**1 .The course is well designed**	**2. The units are balanced**	**3. The learning material was available to you**	**4. The content was clear and easy to understand**	**5.The course was relevant and updated for present needs**	**6.The course meets your career expectations**	**7. The course will be useful to meet your higher studies/future aspirations.**
Discrete Structures (24241201)	4.26	4.13	4.26	4.10	4.15	4.18	4.03
Modern Computer Architecture (24241202)	3.98	3.96	3.93	3.84	4.00	3.96	3.93
Object Oriented Programming (24241203)	4.12	4.23	4.23	4.08	4.19	4.19	4.31
Sensors and Actuators (24241205)	3.47	3.68	3.53	3.42	3.63	3.58	3.68

AIR 2nd Semester								
Parameter(Average Grading)				**Excellent (%)**	**Very Good (%)**	**Good (%)**	**Average (%)**	**Below Average (%)**
Subject Code	**Subject Name**	**Semester**	**Faculty Name**					
(24241201)	Discrete Structures	**II**	Dr. Neelam Arya	46.15	26.37	25.27	1.47	0.73
(24241202)	Modern Computer Architecture	**II**	Dr. Abhishek Bhatt	36.83	25.40	33.33	4.13	0.32
(24241203)	Object Oriented Programming	**II**	Dr. Bhagat S. Raghuwanshi	40.11	34.62	28.57	22.53	0.00
(24241205)	Sensors and Actuators	**II**	Dr. Neeraj Mishra	12.07	1.48	14.04	3.45	1.72

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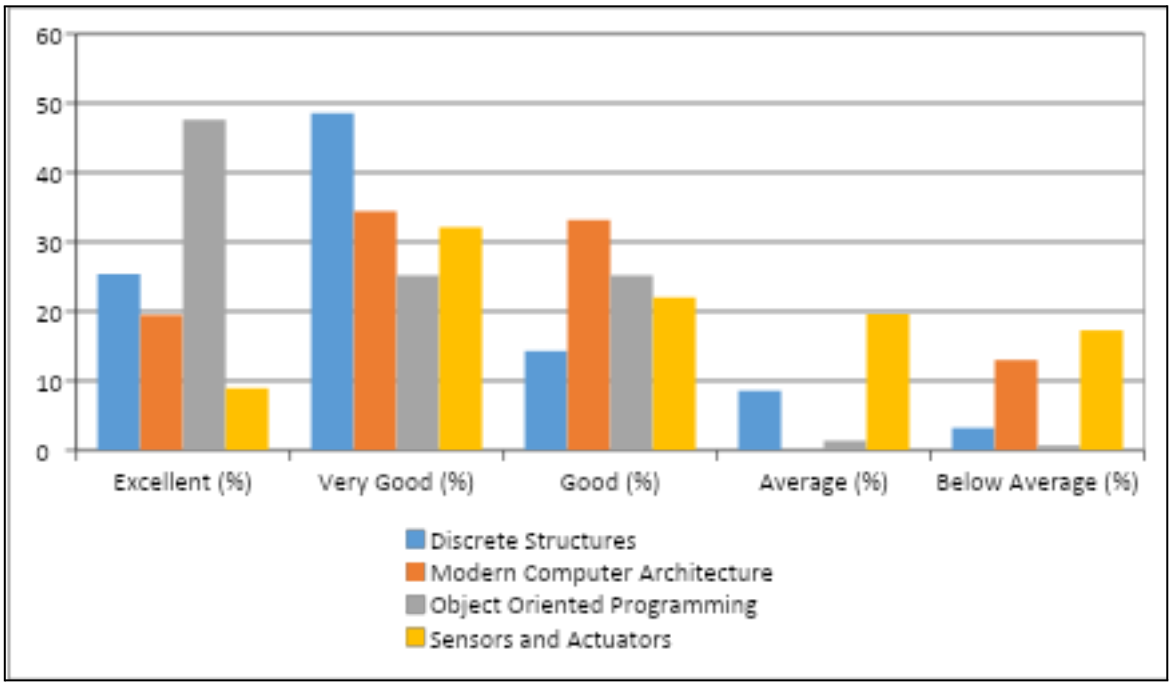

AIR 2nd Semester

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Course-wise Analysis of Curriculum Feedback by Students for

Artificial intelligence and Data Science

(Average value of responses (on a scale of 1 to 5) 5: Strongly Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Strongly disagree)

AIDS 2nd Semester							
Subject code/name	**1 .The course is well designed**	**2. The units are balanced**	**3. The learning material was available to you**	**4. The content was clear and easy to understand**	**5.The course was relevant and updated for present needs**	**6.The course meets your career expectations**	**7. The course will be useful to meet your higher studies/future aspirations.**
Discrete Structures (27241201)(40)	3.83	3.88	3.83	3.85	3.85	3.80	3.88
Modern Computer Architecture (27241202)	3.55	3.59	3.41	3.36	3.59	3.27	3.55
Object Oriented Programming (27241203)	4.14	4.29	4.19	4.19	4.00	4.19	4.24
Basic Electrical & Electronics Engineering (27241205)	3.08	2.96	3.08	2.96	2.88	2.83	2.92

AIDS 2nd Semester								
Parameter(Average Grading)				**Excellent (%)**	**Very Good (%)**	**Good (%)**	**Average (%)**	**Below Average (%)**
Subject Code	**Subject Name**	**Semester**	**Faculty Name**					
(27241201)	Discrete Structures	**II**	Dr. Rahul Kumar	25.36	48.57	14.29	8.57	3.21
(27241202)	Modern Computer Architecture	**II**	Dr. Hardev Singh Pal	19.48	34.42	33.12	0.00	12.99
(27241203)	Object Oriented Programming	**II**	Dr. Arun Kumar	47.62	25.17	25.17	1.36	0.68
(27241205)	Basic Electrical & Electronics Engineering	**II**	Dr. Vibha Tiwari	8.93	32.14	22.02	19.64	17.26

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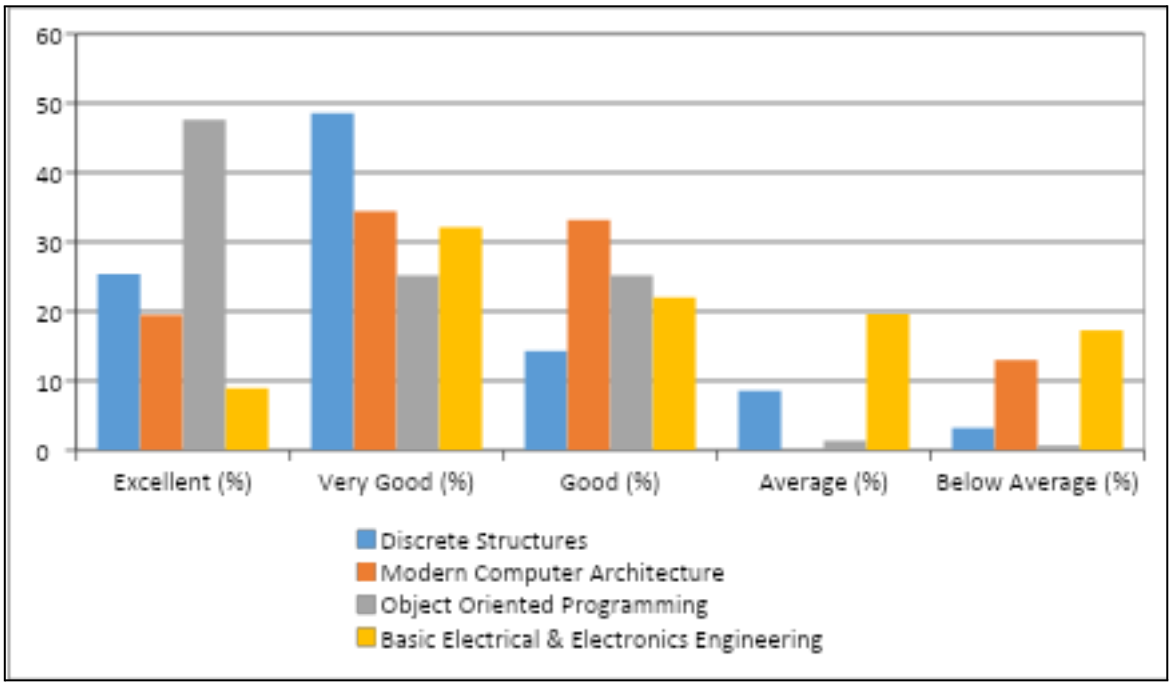

AIDS 2nd Semester

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Course-wise Analysis of Curriculum Feedback by Students for

Artificial intelligence and Machine Learning

(Average value of responses (on a scale of 1 to 5) 5: Strongly Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Strongly disagree)

AIML 2nd Semester							
Subject code/name	**1 .The course is well designed**	**2. The units are balanced**	**3. The learning material was available to you**	**4. The content was clear and easy to understand**	**5.The course was relevant and updated for present needs**	**6.The course meets your career expectations**	**7. The course will be useful to meet your higher studies/future aspirations.**
Discrete Structures (28241201)(42)	3.48	3.57	3.5	3.48	3.40	3.36	3.38
Modern Computer Architecture (28241202))	3.71	3.38	3.67	3.57	3.71	3.67	3.48
Object Oriented Programming (28241203))	4.11	4.26	4.16	4.16	4.05	4.21	4.21
Data Structures (28241204)(43)	3.88	3.84	3.74	3.77	3.67	3.58	3.70
Basic Electrical & Electronics Engineering (28241205)	3.00	2.92	3.08	3.08	2.77	2.69	2.92

AIML 2nd Semester								
Parameter(Average Grading)				**Excellent (%)**	**Very Good (%)**	**Good (%)**	**Average (%)**	**Below Average (%)**
Subject Code	**Subject Name**	**Semester**	**Faculty Name**					
(28241201)	Discrete Structures	II	Dr. Neelam Arya	23.81	25.17	29.25	15.99	5.78
(28241202)	Modern Computer Architecture	II	Dr. Hardev Singh Pal	23.81	36.73	27.21	0.00	12.24
(28241203))	Object Oriented Programming	II	Dr. Arun Kumar	48.12	23.31	26.32	1.50	0.75
(28241204)	Data Structures	II	Dr. Shipra Shukla	20.44	20.69	26.60	6.16	0.25
(28241205)	Basic Electrical & Electronics Engineering	II	Dr. Vibha Tiwari	15.38	19.78	28.57	14.29	21.98

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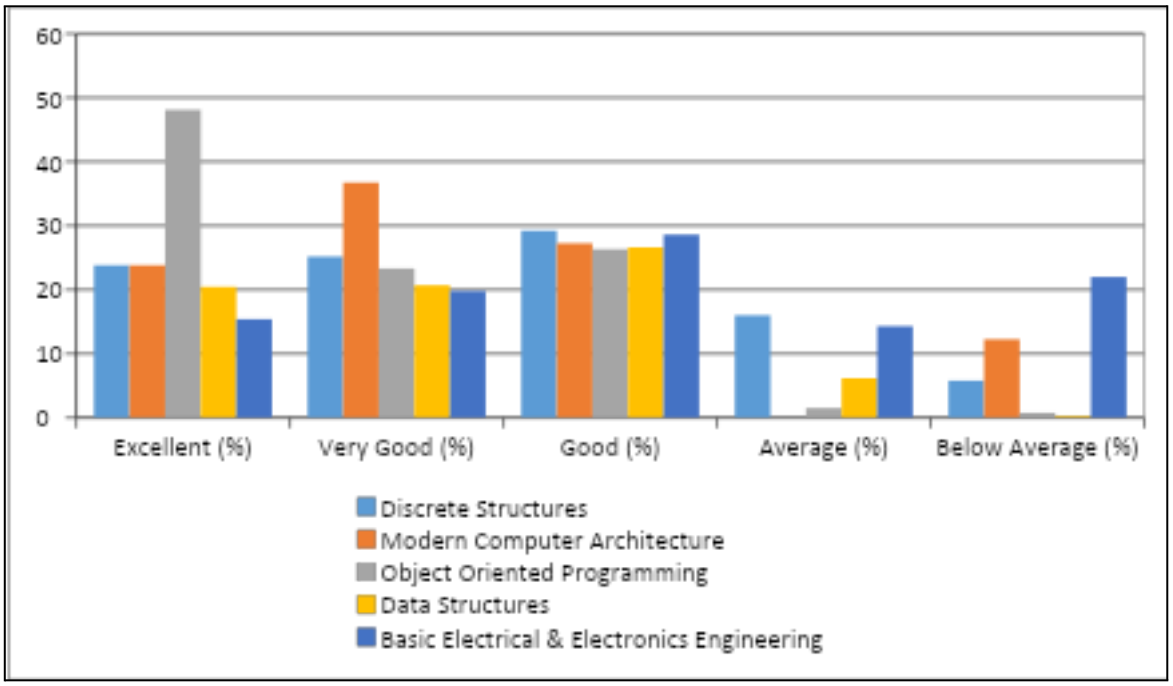

AIML 2nd Semester