माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
Deemed University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ GRADE

Centre for Artificial Intelligence

BOARD OF STUDIES (BoS) PROCEEDING
of
CENTRE FOR ARTIFICIAL INTELLIGENCE
(Meeting Dated - 06 June, 2025)

Centre for Artificial Intelligence

Board of Studies (BoS) in Centre For Artificial Intelligence
(Meeting Dated - 06 June, 2025)

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 Mining & Warehousing	3270521/ 3280521	2021	2025	5%	9	3	https://web.mitsgwalior.in/board-of-studies-bos-cai
Robot Operating System	3240524	2023	2025	7%	9	3	https://web.mitsgwalior.in/board-of-studies-bos-cai
Statistical Programming With R	3270524/ 3280524	2024	2025	12%	9	3	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**
Professional Skills & Competencies	2240723/ 2270723/ 2280723	Competitive coding skills, Docker, Scikit-learn, TensorFlow	3	2	https://web.mitsgwalior.in/board-of-studies-bos-cai
Machine Learning & Optimization	3270525/ 3280525	Regularization, Evolutionary Algorithms, Hyperparameter Tuning, Multi-objective Optimization.	9	3	https://web.mitsgwalior.in/board-of-studies-bos-cai

Centre for Artificial Intelligence

Date: 06.06.2025

Minutes of Meeting of Board of Studies (BoS) in Centre for Artificial Intelligence

The meeting of the Board of Studies (BoS) in the Centre for Artificial Intelligence was held on 06 June, 2025 at 12:00 PM in offline mode. During the meeting following were present:

1.	Dr. Rajni Ranjan Singh	Chairman
2.	Dr. Tej Singh	Member
3.	Dr. Pawan Dubey	Member
4.	Dr. Bhagat S. Raghuwanshi	Member
5.	Dr. Sunil Kumar Shukla	Member
6.	Dr. Vibha Tiwari	Member
7.	Dr. Mir Shahnawaz Ahmad	Member
8.	Dr. Arun Kumar	Member
9.	Dr. Abhishek Bhatt	Member
10.	Dr. Sanjeev Kumar Dwivedi	Member
11.	Dr. Shweta Chauhan	Member
12.	Dr. Hardev Singh Pal	Member
13.	Dr. Shipra Shukla	Member
14.	Dr. Rahul Kumar	Member
15.	Dr. Sumit Dhariwal	Member
16.	Dr. Neelam Sharma	Member
17.	Dr. Neelam Arya	Member
18.	Dr. Mausam Chouksey	Member
19.	Dr. Anurag Singh Tomar	Member
20.	Dr. Nandkishor Joshi	Member
21.	Dr. Satyam Omar	Member

The following deliberation took place in the meeting:

Item 1	To confirm the minutes of previous BoS meeting held in the month of December 2024 **The minutes of the previous BoS meeting held on 05 Dec., 2024 were presented, discussed and confirmed.**
Item 2	To review and finalize the scheme structure of B. Tech. VII Semester with the provision of Three (02) Departmental Electives (DEs) and one (01) Open Category (OC) Course. (Out of which Open category course is to be run through MITS MOOCs and Two (02) Departmental Electives are to be run through SWAYAM/NPTEL platform with credit transfer. {for the batch admitted in 2022-23}. **The scheme structure of B. Tech. VII Semester [Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning], batch admitted in academic session 2022-23 (under the flexible curriculum), was discussed and recommended. The scheme is annexed as Annexure - I.**

Centre for Artificial Intelligence

Item 3

To introduce a two-credit course titled "Professional Skills & Competencies" in the VII semester scheme for the batch admitted in 2022–23.

The course titled "Professional Skills & Competencies" along with its syllabus and COs was presented, discussed and recommended. The same is annexed as Annexure - I and II.

Item 4

To propose the list of courses which the students can opt from SWAYAM/NPTEL/MOOC based Platforms, to be offered in online mode for Two (02) Departmental Electives (DE) Course, with credit transfer in the B.Tech. VII Semester under the flexible curriculum {for the batch admitted in 2022-23}.

The courses were presented, discussed and recommended. The list of courses is annexed as Annexure - I.

Item 5

To propose the list of the courses (as per the format given below) which the students can opt from MITS MOOCs to be offered in blended mode for Open Category (OC) courses for students of B.Tech. VII Semester under the flexible curriculum {for the batch admitted in 2022-23}.

The below mentioned Open Category courses were presented, discussed and recommended during the meeting:

S. No.	Name of the Course	Course Faculty	Mentor
1	**Social Networks**	**Dr. Shubha Mishra**	**Dr. Shubha Mishra**

Item 6

To propose the list of "Additional Courses" which can be opted for getting an (i) Honours (for students of the host department) and (ii) Minor Specialization (for students of other departments). These will be offered through SWAYAM/NPTEL/MOOC based Platforms for the B.Tech. VII semester students{for the batch admitted in 2022-23}.

The below mentioned honours and minor specialization courses were presented, discussed and recommended:

List of courses to be opted for Honours in VII Semester

Course Code	Course Name	Course Code	Course Name
Track 1: Information Security		**Track 2: Internet of Things**	
H24062601	Secure Computation Part-II (12 Weeks)	H24072602	Introduction to Industry 4.0 and Industrial IoT (12 Weeks)
H24072601	Practical Cyber Security for Cyber Security Practitioners (12 Weeks)	H24072603	Distributed Systems (8 Weeks)
H24052601	Cyber Security and Privacy (12 weeks)	H24052603	Introduction to Internet of Things (12 weeks)
H24052602	Ethical Hacking (12 weeks)	H24052604	Sensor Technology: Physics, Fabrication and Circuits (8 weeks)
Track 3: High Performance Computing			
H24072604	Advanced Distributed Systems (12 Weeks)		
H24072605	Computational Complexity (12 Weeks)		
H27052605	Multi-Core Computer Architecture (12 weeks)		
H27052606	Distributed System (12 weeks)		

Minor Specialization in Artificial Intelligence and Machine Learning in VII Semester
(to be opted by students of other Department)

S. No.	Course Name
1	Deep Learning - IIT Ropar
2	Computer Vision

Centre for Artificial Intelligence

Item 7	To review and finalize the Experiment list/ Lab manual for Departmental Laboratory Courses (DLC) to be offered in B. Tech. VII semester {for the batch admitted in 2022-23}. **The Experiment list/ Lab manual for Departmental Laboratory Courses to be offered in B. Tech. VII semester (for batches admitted in 2022-23) was proposed, reviewed and recommended. The same is annexed in Annexure - II.**
Item 8	To review and finalize the *scheme structure of B.Tech. V Semester under* the flexible curriculum {for the batch admitted in 2023-24}. **The scheme structure of B. Tech. VI Semester [Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning], batch admitted in academic session 2023-24 (under the flexible curriculum), was discussed and recommended. The scheme is annexed as Annexure - III.**
Item 9	To review and finalize the syllabi for all *Departmental Core (DC) Courses* of B. Tech. *V Semester (for b*atch admitted in 2023-24) under the flexible curriculum along with their COs. **The syllabus of all DC courses, along with COs, of B. Tech. V Semester [Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning], batch admitted in academic session 2023-24, was discussed, reviewed and recommended. The syllabus of various courses is annexed as Annexure - IV.**
Item 10	To review and recommend the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B. Tech. *V Semester* {for the batch admitted in 2023-24}. **The Experiment list/ Lab manual for Departmental Laboratory Courses to be offered in B. Tech. V semester (for batches admitted in 2023-24) was proposed, reviewed and recommended. The same is annexed in Annexure - IV.**
Item 11	To review and recommend the list of projects which can be assigned under the 'Skill based mini-project' category in various laboratory components based courses to be offered in B.Tech. V Semester {for the batch admitted in 2023-24}. **The list of projects assigned under the 'Skill based mini-project' category in various laboratory courses to be offered in B.Tech. V Semester (for batches admitted in 2023-24) was proposed, reviewed and recommended. The same is annexed in Annexure - IV.**
Item 12	To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered in online mode under *Self-Learning/ Presentation*, in the B.Tech. *V Semester* {for the batch admitted in 2023-24}. **The below mentioned list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered in online mode under Self-Learning/ Presentation for B.Tech. V Semester (for batches admitted in 2023-24) was proposed, reviewed and recommended:**
Item 13	To propose the list of "*Additional Courses*" which can be opted for getting an (i) Honours (for students of the host department) and (ii) Minor Specialization (for students of other departments)

	List of courses offered under Self-learning/Presentation (SWAYAM/ NPTEL/MOOC)
1.	Business Analytics & Data Mining Modeling using R Part II (4 weeks)
2.	Demystifying Networking (4 weeks)
3.	Introduction to Computer and Network Performance Analysis using Queuing Systems (4 weeks)
4.	Introduction to Quantum Computing: Quantum Algorithms and Qiskit (4 weeks)
5.	Mobile Virtual Reality and Artificial Intelligence(4 weeks)
6.	Software Conceptual Design(4 weeks)

Centre for Artificial Intelligence

These will be offered through SWAYAM/NPTEL/MOOC based Platforms for the B.Tech. *V semester* students {for the batch admitted in 2023-24}.

The below mentioned list of Honours and Minor Specialization courses from SWAYAM/NPTEL/MOOC Platforms to be offered in online mode for B.Tech. V Semester (for batches admitted in 2023-24) was proposed, reviewed and recommended:

List of courses to be opted for Honours in V Semester			
Track 1: Information Security		**Track 2: Internet of Things**	
H24052701	Cyber Security and Privacy (12 Weeks)	H24052703	Introduction to Internet of Things (12 Weeks)
H24052702	Ethical Hacking (12 Weeks)	H24052704	Sensor Technology: Physics, Fabrication and Circuits (8 Weeks)
Track 3: High Performance Computing			
H24052705	Multi-Core Computer Architecture (12 Weeks)		
H24052706	Distributed System (12 Weeks)		

Minor Specialization in Artificial Intelligence and Machine Learning for V Semester *(to be opted by students of other Department)*	
S. No.	**Course Name**
1	Fundamentals of Artificial Intelligence
2	Reinforcement Learning

Item 14

To review the *CO attainments, to identify gaps and to suggest corrective measures* for the improvement in the CO attainment levels for all the courses taught during July-Dec 2024 session.

The CO attainment levels of various courses, taught during July-Dec 2024 session, were reviewed, along with the Gap identification and necessary action taken for not attained CO levels. The same is annexed as Annexure - V.

Item 15

To review *curricula feedback* from various stakeholders, its analysis and impact.

The curricula feedback from various stakeholders for B. Tech. III/V/VII Semesters [Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning] during July-Dec. 2024, were reviewed and discussed. The same is annexed in Annexure - VI.

Item 16

Any other matter

NIL

Suggestions by the experts/members:

After a thorough review of course contents, some of the contents in the Vth unit of Professional Skills and Competencies course was updated to include the missing tools. The members also updated the contents of Statistical Programming with R and Experimental List of Data Science courses.

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

Dr. Tej Singh **Dr. Pawan Dubey** **Dr. Bhagat S. Raghuwanshi** **Dr. Sunil Kumar Shukla** **Dr. Vibha Tiwari**

Centre for Artificial Intelligence

Dr. Mir Shahnawaz Ahmad

Absent.
Dr. Shubha Mishra

Dr. Arun Kumar

Dr. Abhishek Bhatt

Dr. Sanjeev Kumar Dwivedi

Dr. Shweta Chauhan

Dr. Hardev Singh Pal

Dr. Shipra Shukla

Dr. Rahul Kumar

Dr. Sumit Dhariwal

6/6/25
Dr. Neelam Sharma

Dr. Neelam Arya

Dr. Mausam Chouksey

Dr. Anurag S. Tomar

Dr. Nandkishor Joshi

Dr. Satyam Omar

Dr. Muktesh Gupta

06/06/25
Dr. Rajni Ranjan Singh
Head, Center for Artificial Intelligence [Chairman, BoS]

ANNEXURE-I

Scheme

of

B. Tech. VII Semester

[Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]

(Batch admitted in academic session 2022 – 23)

Centre for Artificial Intelligence

Scheme of Evaluation

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

(for batch admitted in academic session 2022 – 23)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam
				Theory Slot				Practical Slot			MOOCs			L	T	P			
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation		Assignment	Exam							
				End Sem. Exam.	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project									
1.	DE	DE	*Departmental Elective (DE-2)	-	-	-	-	-	-	-	25	75	100	3	-	-	**3**	Blended	MCQ
2.	DE	DE	*Departmental Elective (DE-3)	-	-	-	-	-	-	-	25	75	100	3	-	-	**3**	Blended	MCQ
3.	OC	OC	#Open Category (OC-2)	50	10	20	20	-	-	-	-	-	100	3	-	-	**3**	Blended	MCQ
4.	2240721	DLC	AR-VR Lab	-	-	-	-	60	20	20	-	-	100	-	-	4	**2**	Offline	SO
5.	2240722	DLC	Creative Problem Solving	-	-	-	-	25	25	-	-	-	50	-	-	4	**2**	Offline	SO
6.	2240723	DLC	**Professional Skills & Competencies	-	-	-	-	40	60	-	-	-	100	-	-	4	**2**	Offline	SO
7.	2240724	DLC	Summer Internship Project-III (04 weeks) (Evaluation)	-	-	-	-	60	-	-	-	-	60	-	-	4	**2**	Interactive	SO
Total				**50**	**10**	**20**	**20**	**185**	**105**	**20**	**50**	**150**	**610**	**9**	**-**	**16**	**17**		
8.	1000008	**MAC**	Universal Human Values & Professional Ethics(UHVPE)	50	10	20	20	-	-	-	-	-	100	2	-	-	GRADE	Blended	**MCQ**
Additional Course for Honours or minor Specialization				**Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization**															

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

**** Professional Skills & Competencies will include and prepare the students on coding skills, technical proficiency (industry readiness and higher studies), aptitude, communication & soft skill set, etc.**

***Course will run through SWAYAM/NPTEL platform with credit transfer**

#Course will run through MITS MOOCs

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

Mode of Teaching			Mode of Examination		Total Credits
Offline	**Blended**	**Interactive**	**MCQ**	**SO**	
6	9	2	9	8	**17**
35.29	52.94	11.77	52.94	47.06	**Credits %**

Centre for Artificial Intelligence

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

(for batch admitted in academic session 2022 – 23)

DE -2*		
S. No.	**Subject Code**	**Subject Name**
1.	2240731	Reinforcement Learning (12 Weeks)
2.	2240732	Industrial Robotics: Theories for Implementation (12 Weeks)
3.	2240733	Software Testing (12 Weeks)

DE-3*		
S. No.	**Subject Code**	**Subject Name**
1.	2240734	Deep Learning for Computer Vision (12 Weeks)
2.	2240735	Big Data Computing (8 Weeks)
3.	2240736	Mechanics and Control of Robotic Manipulators (8 Weeks)

List of courses to be opted for Honours in VII Semester

Honours* *(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**	
H24062601	Secure Computation Part-II (12 Weeks)	H24072602	Introduction to Industry 4.0 and Industrial IoT (12 Weeks)
H24072601	Practical Cyber Security for Cyber Security Practitioners (12 Weeks)	H24072603	Distributed Systems (8 Weeks)
H24052601	Cyber Security and Privacy (12 weeks)	H24052603	Introduction to Internet of Things (12 weeks)
H24052602	Ethical Hacking (12 weeks)	H24052604	Sensor Technology: Physics, Fabrication and Circuits (8 weeks)
Track 3: High Performance Computing			
H24072604	Advanced Distributed Systems (12 Weeks)		
H24072605	Computational Complexity (12 Weeks)		
H27052605	Multi-Core Computer Architecture (12 weeks)		
H27052606	Distributed System (12 weeks)		

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

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

Centre for Artificial Intelligence

Scheme of Evaluation

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

(for batch admitted in academic session 2022 – 23)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam
				Theory Slot				Practical Slot			MOOCs								
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation		Assignment	Exam		L	T	P			
				End Sem. Exam.	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project									
1.	DE	DE	*Departmental Elective(DE-2)	-	-	-	-	-	-	-	25	75	100	4	-	-	**4**	Blended	MCQ
2.	DE	DE	*Departmental Elective (DE-3)	-	-	-	-	-	-	-	25	75	100	3	-	-	**3**	Blended	MCQ
3.	OC	OC	#Open Category (OC-2)	50	10	20	20	-	-	-	-	-	100	3	-	-	**3**	Blended	MCQ
4.	2270721	DLC	AR-VR Lab	-	-	-	-	60	20	20	-	-	100	-	-	4	**2**	Offline	SO
5.	2270722	DLC	Creative Problem Solving	-	-	-	-	25	25	-	-	-	50	-	-	4	**2**	Offline	SO
6.	2270723	DLC	**Professional Skills & Competencies	-	-	-	-	40	60	-	-	-	100	-	-	4	**2**	Offline	SO
7.	2270724	DLC	Summer Internship Project-III (04 weeks) (Evaluation)	-	-	-	-	60	-	-	-	-	60	-	-	4	**2**	Interactive	SO
Total				**50**	**10**	**20**	**20**	**185**	**105**	**20**	**50**	**150**	**610**	**10**	**-**	**16**	**18**		
8.	1000008	**MAC**	Universal Human Values & Professional Ethics (UHVPE)	50	10	20	20	-	-	-	-	-	100	2	-	-	GRADE	Blended	**MCQ**
Additional Course for Honours or minor Specialization				**Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization**															

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

**** Professional Skills & Competencies will include and prepare the students on coding skills, technical proficiency (industry readiness and higher studies), aptitude, communication & soft skill set, etc.**

***Course will run through SWAYAM/NPTEL platform with credit transfer**

#Course will run through MITS MOOCs

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

Mode of Teaching			Mode of Examination		Total Credits
Offline	**Blended**	**Interactive**	**MCQ**	**SO**	
6	10	2	10	8	**18**
33.33	55.56	11.11	55.56	44.44	**Credits %**

Centre for Artificial Intelligence

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

(for batch admitted in academic session 2022 – 23)

DE -2*		
S. No.	**Subject Code**	**Subject Name**
1	2270731	Responsible and Safe AI Systems (12 Weeks)
2	2270732	Deep Learning for Computer Vision (12 Weeks)
3	2270733	Applied Accelerated AI (12 Weeks)

DE-3*		
S. No.	**Subject Code**	**Subject Name**
1.	2270734	Big Data Computing (8 Weeks)
2.	2270735	Software Testing (12 Weeks)
3.	2270736	Artificial Intelligence for Economics (8 Weeks)

List of courses to be opted for Honours in VII Semester

Honours* *(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**	
H24062601	Secure Computation Part-II (12 Weeks)	H24072602	Introduction to Industry 4.0 and Industrial IoT (12 Weeks)
H24072601	Practical Cyber Security for Cyber Security Practitioners (12 Weeks)	H24072603	Distributed Systems (8 Weeks)
H24052601	Cyber Security and Privacy (12 weeks)	H24052603	Introduction to Internet of Things (12 weeks)
H24052602	Ethical Hacking (12 weeks)	H24052604	Sensor Technology: Physics, Fabrication and Circuits (8 weeks)
Track 3: High Performance Computing			
H24072604	Advanced Distributed Systems (12 Weeks)		
H24072605	Computational Complexity (12 Weeks)		
H27052605	Multi-Core Computer Architecture (12 weeks)		
H27052606	Distributed System (12 weeks)		

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

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

Centre for Artificial Intelligence

Scheme of Evaluation

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

(for batch admitted in academic session 2022 – 23)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam
				Theory Slot				Practical Slot			MOOCs								
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation		Assignment	Exam		L	T	P			
				End Sem. Exam.	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project									
1.	DE	DE	*Departmental Elective(DE-2)	-	-	-	-	-	-	-	25	75	100	4	-	-	**4**	Blended	MCQ
2.	DE	DE	*Departmental Elective (DE-3)	-	-	-	-	-	-	-	25	75	100	3	-	-	**3**	Blended	MCQ
3.	OC	OC	#Open Category (OC-2)	50	10	20	20	-	-	-	-	-	100	3	-	-	**3**	Blended	MCQ
4.	2280721	DLC	AR-VR Lab	-	-	-	-	60	20	20	-	-	100	-	-	4	**2**	Offline	SO
5.	2280722	DLC	Creative Problem Solving	-	-	-	-	25	25	-	-	-	50	-	-	4	**2**	Offline	SO
6.	2280723	DLC	**Professional Skills & Competencies	-	-	-	-	40	60	-	-	-	100	-	-	4	**2**	Offline	SO
7.	2280724	DLC	Summer Internship Project-III (04 weeks) (Evaluation)	-	-	-	-	60	-	-	-	-	60	-	-	4	**2**	Interactive	SO
Total				**50**	**10**	**20**	**20**	**185**	**105**	**20**	**50**	**150**	**610**	**10**	**-**	**16**	**18**		
8.	1000008	**MAC**	Universal Human Values & Professional Ethics(UHVPE)	50	10	20	20	-	-	-	-	-	100	2	-	-	GRADE	Blended	**MCQ**
Additional Course for Honours or minor Specialization				**Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization**															

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

**** Professional Skills & Competencies will include and prepare the students on coding skills, technical proficiency (industry readiness and higher studies), aptitude, communication & soft skill set, etc.**

***Course will run through SWAYAM/NPTEL platform with credit transfer**

#Course will run through MITS MOOCs

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

Mode of Teaching			Mode of Examination		
Offline	**Blended**	**Interactive**	**MCQ**	**SO**	**Total Credits**
6	10	2	10	8	**18**
33.33	55.56	11.11	55.56	44.44	**Credits %**

Centre for Artificial Intelligence

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

(for batch admitted in academic session 2022 – 23)

DE -2*		
S. No.	**Subject Code**	**Subject Name**
1	2280731	Responsible and Safe AI Systems (12 Weeks)
2	2280732	Deep Learning for Computer Vision (12 Weeks)
3	2280733	Applied Accelerated AI (12 Weeks)

DE-3*		
S. No.	**Subject Code**	**Subject Name**
1.	2280734	Big Data Computing (8 Weeks)
2.	2280735	Software Testing (12 Weeks)
3.	2280736	Artificial Intelligence for Economics (8 Weeks)

List of courses to be opted for Honours in VII Semester

Honours* *(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**	
H24062601	Secure Computation Part-II (12 Weeks)	H24072602	Introduction to Industry 4.0 and Industrial IoT (12 Weeks)
H24072601	Practical Cyber Security for Cyber Security Practitioners (12 Weeks)	H24072603	Distributed Systems (8 Weeks)
H24052601	Cyber Security and Privacy (12 weeks)	H24052603	Introduction to Internet of Things (12 weeks)
H24052602	Ethical Hacking (12 weeks)	H24052604	Sensor Technology: Physics, Fabrication and Circuits (8 weeks)
Track 3: High Performance Computing			
H24072604	Advanced Distributed Systems (12 Weeks)		
H24072605	Computational Complexity (12 Weeks)		
H27052605	Multi-Core Computer Architecture (12 weeks)		
H27052606	Distributed System (12 weeks)		

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

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

Centre for Artificial Intelligence

B. Tech. VII Semester

(for batch admitted in academic session 2022 – 23)

OC-2# (to be selected by students of other department)		
S. No.	**Subject Code**	**Subject Name**
1.	OC2	Social Networks

#*Course will run through MITS MOOCs*

B. Tech. VII Semester

(for batch admitted in academic session 2022 – 23)

Minor Specialization in Artificial Intelligence and Machine Learning* *(to be opted by students of other Department)*	
S. No.	**Course Name**
1	Deep Learning - IIT Ropar
2	Computer Vision

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

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

ANNEXURE-II

Experiment list/ Lab manual

for

Departmental Laboratory Course (DLC) of

B. Tech. VII Semester

[Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]

(Batch admitted in academic session 2022 – 23)

Centre for Artificial Intelligence

DEPARTMENTAL LAB (AR-VR Lab) (2240721/2270721/2280721)

COURSE OBJECTIVES

- Enable students to develop practical skills in creating and manipulating 3D models and animations for use in AR and VR environments.
- Enable students to create intuitive and responsive user interfaces for interacting with virtual objects.
- Support students in developing projects that showcase their ability to innovate and think critically.

List of Experiments

1. Overview and setting up Unity for AR/ VR development
2. Develop a scene in Unity that includes: cube, plane and sphere, apply transformations on the 3 game objects.
3. Develop a scene in Unity that includes a cube, plane and sphere. Create a new material and texture separately for three Game objects. Change the color, material and texture of each Game object separately in the scene.
4. Develop a scene in Unity that includes a sphere and plane. Apply Rigid body component, material and Box collider to the game Objects
5. Study on enhancement and improving markers with Vuforia engine.
6. Implement and visualize scaling and rotation transformations on a 3D object in an AR environment.
7. Implementing Marker-less and Marker-Based AR with Vuforia engine
8. Implementing Animations in AR/VR Using Vuforia
9. Creating 3D objects using Blender.

COURSE OUTCOMES

After completing this, the students will be able to:

CO1. Create new projects and properly configure them for AR/VR application development
CO2. Develop Marker-Based and Markerless AR Applications
CO3. Develop and import 3D models into AR/VR environments
CO4. Integrate VR input and output hardware to enhance the user experience.
CO5. Develop applications that simulate real-world scenarios, such as a virtual gym or training simulations.
CO6. Identify areas for improvement and implement changes to optimize performance and user satisfaction.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	3				2	1	2	2	2	1
CO2	3	2	3	2	3				2	1	2	2	2	1
CO3	3	2	3	1	3				2	1	2	2	2	1
CO4	3	2	3	1	3				2	1	2	2	2	1
CO5	3	3	3	2	3	2	1		2	3	2	3	2	1
CO6	3	3	3	3	3	2	1		2	3	3	3	2	1

Centre for Artificial Intelligence

DEPARTMENTAL LAB (AR-VR Lab) (2240721/2270721/2280721)

Skill based Mini Projects

Micro/ Macro Projects : Game Development

(The developed game should be a single player game .Score Card is to be displayed for each game. Apply your creativity for making game interesting)

1. Develop a VR Golf Game. The scene should contain a play area (golf course), which consists of a series of cups/holes each having different scores. Display the score card.
2. Develop a VR game in Unity such that on each gun trigger click, destroy the cubes placed on the plane and gain a score point .
3. Develop a VR Basketball Game.
4. Develop an AR bowling game with one image target .

Mini Projects

1. Develop a VR environment for flying helicopter
2. Develop a VR environment for moving car simulation.
3. Develop a VR environment to visit a zoo
4. Develop a VR environment for virtual Gym
5. Create a multiplayer VR game (battlefield game).

Centre for Artificial Intelligence

CREATIVE PROBLEM SOLVING (2240722/2270722/2280722)

COURSE OBJECTIVES

- To solve open-ended, real-world problems using systematic problem-solving methods.
- To apply interdisciplinary approaches to problem-solving.
- To develop team-based solutions through collaborative projects.

List of Experiments

1. Choose a standard algorithm (e.g., Dijkstra, Quicksort) and propose a modification to improve performance in a specific use case.
2. Reimagine a common app (e.g., calendar, to-do list, news reader) using SCAMPER to generate at least 3 innovative features.
3. Identify the root causes behind a known software/system failure (e.g., a crash in Zoom, data breach, etc.) using Fishbone Diagram.
4. Take a vague problem like "Improve online education" and generate 3-5 concrete, solvable, and measurable AI/CS problem statements.
5. Interview 3–5 users of the college ERP system and ideate improvements. Propose a new user interface or feature using design thinking.
6. Create a wireframe/prototype (on paper or Figma) for an app that supports mental wellness in students using AI recommendations.
7. Given sample data (e.g., books, movies, courses), design a simple rule-based or collaborative filtering recommender.
8. Analyze a small dataset (e.g., hiring, lending) and identify potential biases. Suggest methods to reduce bias in training.
9. Analyze an AI failure (e.g., facial recognition bias, chatbot toxicity) and propose a creative solution to prevent such issues.
10. Design a smart system (e.g., smart parking, fire alert, air quality monitoring) using sensor data simulation and basic ML classification.
11. Develop a Python automation script to extract and process data from a website or automate repetitive desktop tasks.

COURSE OUTCOMES

After completing this, the students will be able to:

CO1 Apply creative thinking tools to reimagine and improve existing software applications.

CO2 Analyze the root causes of failures in software systems and datasets using structured problem-solving techniques.

CO3 Design innovative AI-based systems and interfaces that address real user needs, ensuring usability and ethical AI integration.

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

Centre for Artificial Intelligence

PROFESSIONAL SKILLS & COMPETENCIES (2240723/ 2270723/ 2280723)

(Activity Based Learning)

COURSE OBJECTIVES

- To equip students with essential professional competencies.
- To develop analytical and technical skills.

Module 1: Communication Skills

Verbal Communication: Public speaking, Group discussions, and Interview handling. Non-verbal Communication: Body language, Gestures, Listening skills. Written Communication: Résumé writing, Email etiquette, Cover letters, Report Writing. Presentation Skills: Visual aids, Audience engagement, Delivery techniques. English (Verbal Ability): Passage/Sentence Rearrangement, Error Detection and Correction, fill in the Blanks, Reading Comprehension Passages, Sentence Completion, Synonyms and Antonyms, Words Completion, Para jumbles etc.

Activities: Mock interviews and GDs, Email & résumé writing workshops, Peer review and instructor feedback.

Module 2: General Aptitude

Quantitative Aptitude: Number systems, Ratios, Percentages, Averages, Time & Work, Probability. Logical Reasoning: Series, Puzzles, Syllogisms, Direction sense, Blood relations. Data Interpretation: Tables, Pie charts, Graphs.

Activities: Weekly quizzes, Group problem-solving sessions, Timed mock aptitude tests.

Module 3: Basic Coding Skills

Basic Programming Concepts, Syntax and semantics, Input/output handling, Variables, data types, Loops. Functions and recursion. Arrays, strings. Sorting and searching, Pointers (C/C++) / References (Java/Python). Exception handling (Java, Python).

Activities: Technical round based Weekly coding exercises, Mini hands-on projects, Error debugging practice, Mock technical tests.

Module 4: Competitive Coding Skills

Introduction to Data Structures: Linked Lists (Singly, Doubly), Problem solving using linked lists. Stacks, Queues, Trees (Binary, BST, basic traversals), Heaps (Min/Max heap concepts), Graphs (Adjacency list/matrix, BFS, DFS), Sets (HashSet, TreeSet). OOPS concepts: Encapsulation, Abstraction, Inheritance and Polymorphism. Introduction to Databases, ER-model, basics of SQL. Version Control: Git, GitHub.

Activities: Weekly coding contests, Problem solving on competitive coding platforms like Leetcode, Codeforces, Hackerrank etc., Peer-to-peer code review, Mock technical interviews.

Module 5: Discipline Specific Tools*

Docker, Postman, MySQL, VS Code, Linux Shell, Jupyter Notebook, Pandas, Scikit-learn, TensorFlow, Tableau, Kaggle.

Activities: Tool-based lab exercises, Branch-specific mini projects, Short presentations on use-cases of tools in industry.

Centre for Artificial Intelligence

COURSE OUTCOMES

After completion of the course students will be able to:

CO1 Demonstrate effective communication strategies in professional scenarios including interviews and group discussions.

CO2 Solve real-world quantitative and logical reasoning problems with time-bound accuracy.

CO3 Implement basic algorithms using standard programming languages.

CO4 Design efficient algorithmic solutions to solve coding problems.

CO5 Apply discipline-specific tools to simulate, model, or develop solutions relevant to core engineering problems.

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

ANNEXURE-III

Scheme

of

B. Tech. V Semester

[Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]

(Batch admitted in academic session 2023 – 24)

Centre for Artificial Intelligence

Scheme of Evaluation

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

(for batch admitted in academic session 2023 – 24)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam.
				Theory Slot				Practical Slot									
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation			L	T	P			
				End Sem. Exam.	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project							
1.	3240521	DC	Software Engineering	50	10	20	20	-	-	-	100	3	-	-	3	Blended	MCQ
2.	3240522	DC	Data Science	50	10	20	20	40	30	30	200	3	-	2	4	Blended	MCQ
3.	3240523	DC	Theory of Computation	50	10	20	20	-	-	-	100	3	-	-	3	Blended	PP
4.	3240524	DC	Robot Operating System	50	10	20	20	40	30	30	200	3	-	2	4	Blended	PP
5.	3240525	DC	Soft Computing Techniques	50	10	20	20	-	-	-	100	3	-	-	3	Blended	PP
6.	3240526	DLC	Minor Project-I **	-	-	-	-	40	60	-	100	-	-	4	2	Offline	SO
7.	3240527	Seminar/ Self-Study	Self-learning/Presentation (SWAYAM/NPTEL/ MOOC)#	-	-	-	-	40	-	-	40	-	-	2	1	Online and Mentoring	SO
8.	300XXX	**CLC**	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
9.	3240528	DLC	Summer Internship Project-II (Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				**250**	**50**	**100**	**100**	**270**	**120**	**60**	**950**	**15**	**-**	**16**	**23**	-	-
10.	1000006	**MAC**	Disaster Management	50	10	20	20	-	-	-	100	2	-	-	GRADE	Blended	MCQ
Additional Course for Honours or minor Specialization				**Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization**													

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

**** The minor project-I may be evaluated by an internal committee for awarding sessional marks.**

 # Compulsory registration for one online course using SWAYAM/NPTEL/ MOOC, evaluation through attendance, assignments and presentation

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

Mode of Teaching				Mode of Examination				
Offline	**Online and Mentoring**	**Blended**	**Interactive**	**PP**	**AO**	**MCQ**	**SO**	**Total Credits**
4	1	17	1	10	0	7	6	**23**
17.39	**4.35**	**73.91**	**4.35**	**43.48**	**0**	**30.43**	**26.09**	**Credits %**

Centre for Artificial Intelligence

Scheme of Evaluation

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

(for batch admitted in academic session 2023 – 24)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam.
				Theory Slot				Practical Slot									
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation			L	T	P			
				End Sem. Exam.	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project							
1.	3270521	DC	Data Mining & Warehousing	50	10	20	20	-	-	-	100	3	-	-	3	Blended	MCQ
2.	3270522	DC	Data Science	50	10	20	20	40	30	30	200	3	-	2	4	Blended	MCQ
3.	3270523	DC	Compiler Design	50	10	20	20	-	-	-	100	3	-	-	3	Blended	PP
4.	3270524	DC	Statistical Programming with R	50	10	20	20	40	30	30	200	3	-	2	4	Blended	MCQ
5.	3270525	DC	Machine Learning & Optimization	50	10	20	20	-	-	-	100	3	-	-	3	Blended	PP
6.	3270526	DLC	Minor Project-I **	-	-	-	-	40	60	-	100	-	-	4	2	Offline	SO
7.	3270527	Seminar/ Self-Study	Self-learning/Presentation (SWAYAM/NPTEL/ MOOC)#	-	-	-	-	40	-	-	40	-	-	2	1	Online and Mentoring	SO
8.	300XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
9.	3270528	DLC	Summer Internship Project-II (Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				**250**	**50**	**100**	**100**	**270**	**120**	**60**	**950**	**15**	**-**	**16**	**23**	**-**	**-**
10.	1000006	**MAC**	Disaster Management	50	10	20	20	-	-	-	100	2	-	-	GRADE	Blended	**MCQ**
Additional Course for Honours or minor Specialization				**Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization**													

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

**** The minor project-I may be evaluated by an internal committee for awarding sessional marks.**

 # Compulsory registration for one online course using SWAYAM/NPTEL/ MOOC, evaluation through attendance, assignments and presentation

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

Mode of Teaching				Mode of Examination				Total Credits
Offline	**Online and Mentoring**	**Blended**	**Interactive**	**PP**	**AO**	**MCQ**	**SO**	
4	1	17	1	9	0	8	6	**23**
17.39	**4.35**	**73.91**	**4.35**	**39.13**	**0**	**34.78**	**26.09**	**Credits %**

Centre for Artificial Intelligence

Scheme of Evaluation

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

(for batch admitted in academic session 2023 – 24)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam.
				Theory Slot				Practical Slot									
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation			L	T	P			
				End Sem. Exam.	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project							
1.	3280521	DC	Data Mining & Warehousing	50	10	20	20	-	-	-	100	3	-	-	3	Blended	MCQ
2.	3280522	DC	Data Science	50	10	20	20	40	30	30	200	3	-	2	4	Blended	MCQ
3.	3280523	DC	Compiler Design	50	10	20	20	-	-	-	100	3	-	-	3	Blended	PP
4.	3280524	DC	Statistical Programming with R	50	10	20	20	40	30	30	200	3	-	2	4	Blended	MCQ
5.	3280525	DC	Machine Learning & Optimization	50	10	20	20	-	-	-	100	3	-	-	3	Blended	PP
6.	3280526	DLC	Minor Project-I **	-	-	-	-	40	60	-	100	-	-	4	2	Offline	SO
7.	3280527	Seminar/ Self-Study	Self-learning/Presentation (SWAYAM/NPTEL/ MOOC)#	-	-	-	-	40	-	-	40	-	-	2	1	Online and Mentoring	SO
8.	300XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
9.	3280528	DLC	Summer Internship Project-II (Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				**250**	**50**	**100**	**100**	**270**	**120**	**60**	**950**	**15**	**-**	**16**	**23**	**-**	**-**
10.	1000006	**MAC**	Disaster Management	50	10	20	20	-	-	-	100	2	-	-	GRADE	Blended	MCQ
Additional Course for Honours or minor Specialization				**Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization**													

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

**** The minor project-I may be evaluated by an internal committee for awarding sessional marks.**

 # Compulsory registration for one online course using SWAYAM/NPTEL/ MOOC, evaluation through attendance, assignments and presentation

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

Mode of Teaching				Mode of Examination				Total Credits
Offline	**Online and Mentoring**	**Blended**	**Interactive**	**PP**	**AO**	**MCQ**	**SO**	
4	1	17	1	9	0	8	6	**23**
17.39	**4.35**	**73.91**	**4.35**	**39.13**	**0**	**34.78**	**26.09**	**Credits %**

B. Tech. V Semester ***(Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning)***

(for batch admitted in academic session 2023 – 24)

List of courses offered under Self-learning/Presentation (SWAYAM/ NPTEL/MOOC)*	
1.	Business Analytics & Data Mining Modeling using R Part II (4 weeks)
2.	Demystifying Networking (4 weeks)
3.	Introduction to Computer and Network Performance Analysis using Queuing Systems (4 weeks)
4.	Introduction to Quantum Computing: Quantum Algorithms and Qiskit (4 weeks)
5.	Mobile Virtual Reality and Artificial Intelligence(4 weeks)
6.	Software Conceptual Design(4 weeks)

Centre for Artificial Intelligence

List of courses to be opted for Honours in V Semester*

B. Tech. V Semester

(Information Technology (Artificial Intelligence and Robotics)),
(Artificial Intelligence (AI) and Data Science),
(Artificial Intelligence (AI) and Machine Learning)

(for batch admitted in academic session 2023 – 24)

(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**	
H24052701	Cyber Security and Privacy (12 Weeks)	H24052703	Introduction to Internet of Things (12 Weeks)
H24052702	Ethical Hacking (12 Weeks)	H24052704	Sensor Technology: Physics, Fabrication and Circuits (8 Weeks)
Track 3: High Performance Computing			
H24052705	Multi-Core Computer Architecture (12 Weeks)		
H24052706	Distributed System (12 Weeks)		

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

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

B. Tech. V Semester

(for batch admitted in academic session 2023 – 24)

Minor Specialization in Artificial Intelligence and Machine Learning*

(to be opted by students of other Department)

S. No.	Course Name
1	Fundamentals of Artificial Intelligence
2	Reinforcement Learning

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

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

ANNEXURE-IV

Syllabi (along with Experiment List)
of
Departmental Core Courses (DC)
of
B. Tech. V Semester
[Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]

(Batch admitted in academic session 2023 – 24)

Centre for Artificial Intelligence

SOFTWARE ENGINEERING (3240521)

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: Definition, Software Engineering-Layered Technology, Software Characteristics and Components, Software Model: Software Development of Life Cycle Model (SDLC), The Waterfall Model, Iterative Waterfall Model, Prototyping Model, Spiral Model, RAD Model. Selection Criteria of Model: Characteristics of Requirements, Status of Development Team, Users Participation, Type of Project and Associated Risk.

Unit - II

Requirement Engineering: Definition, Requirement Engineering Activity , Types of Requirement- Functional and Nonfunctional Requirements, User and System Requirements, Requirement Elicitation Methods, Requirement Analysis Methods, Requirement Documentation (SRS), Requirement Validation, Requirement Management.

Unit - III

Design Concept, Principle and Methods: Design Fundamentals, Design Principles, Effective Modular Design, Design Representations, Architectural Design, Procedural Design, Data Directed design, Real Time Design, Object Oriented Design, Coupling and Cohesion.

Unit - IV

Software Metrics, Project Management and Estimation: Metrics in Process and Project Domains, Software Measurement, Software Quality Metrics, Project Management-Basics-People, Product, Process, Project, Estimation- Software Project Estimation, Decomposition Techniques- Function Point Estimation, Line of Code (LOC) Based estimation, Empirical Estimation, COCOMO Model, Project Scheduling Techniques.

Unit - V

Software Testing: Definitions, Software Testing Life Cycle (STLC), Test Case Design, Strategic Approach to Software Testing- Verification & Validation , Strategic Issues, Criteria for Completion of Testing, Unit Testing, Integration Testing, Validation Testing, System Testing, Black Box Testing Techniques, White Box Testing Techniques, Acceptance Testing.

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.

COURSE OUTCOMES

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

CO1. explain the concepts of software engineering.

CO2. analyze and design software for real world problems.

CO3. compare the techniques for software project management & estimation.

CO4. choose an appropriate software development model for a real-life software project.

CO5. design software using modern tools and technologies.

CO6. test the software through different approaches.

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	2	1	2	1		3	2	1
CO2	3	3	3	3	3	2	3	2	2	1	2	3	3	1
CO3	3	3	3	3	3	2	2	1	1	1	1	3	1	2
CO4	3	3	3	3	3	3	3	1	3	2	2	2	2	2
CO5	3	3	3	3	3	3	3	3	2	2	3	3	2	2
CO6	3	3	3	3	3	3	3	3	3	2	3	3	2	2

Centre for Artificial Intelligence

DATA MINING & WAREHOUSING (3270521/ 3280521)

COURSE OBJECTIVES

- To understand the significance of data mining in a real-world perspective. and gain the understanding of data mining techniques, algorithms and commonly used tools.
- To develop the ability for applying data mining techniques and tools for solving real-world problems.

Unit I

Introduction: Motivation, importance, Data types for Data Mining: Relational Databases, Data Ware-Houses. Transactional Databases, Advanced Database System and Its Applications, Data Mining Functionalities, Concept/Class Description, Association Analysis Classification & Prediction, Cluster Analysis, Outlier Analysis, Classification of Data Mining Systems, Major Issues in Data Mining.

Unit II

Data Pre-processing: Data Cleaning, Data Integration and Transformation and Data Reduction. Discretization and Concept Hierarchy Generation. Data Mining Primitives Languages and System Architectures, Concept Description, Characterization and Comparison Analytical, Characterization. Data Warehouse and OLTP Technology for Data Mining: Differences between Operational Database Systems & Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology

Unit III

Mining Association Rules in Large Databases: Association Rule Mining: Market Basket Analysis, Basic Concepts, Mining Single Dimensional Boolean Association Rules from Transactional Databases: The Apriori Algorithm, Generating Association Rules from Frequent Items, Improving the Efficiency of Apriori, other Algorithms & their Comparison, Mining Multilevel Association Rules, Multidimensional Association Rules, Constraint Based Association Rule Mining.

Unit IV

Classification & Prediction and Cluster Analysis: Issues Regarding Classification & Prediction, Different Classification Methods, Prediction, Cluster Analysis, Major Clustering Methods, Currently Available Tools.

Unit V

Data Warehousing: Introduction, need and significance, challenges & issues in warehousing, difference between data mining & warehousing, case studies- stock market, supermarket etc. , implementation of current applications involving data mining.

RECOMMENDED BOOKS

1. Data Mining: Concepts and Techniques, Han and Kamber, Morgan Kaufmann Publications.
2. Data Mining Techniques, A. K. Pujari, Universities Press Pvt. Ltd.
3. Data Warehousing in the Real World, Sam Anahory, Pearson Publication.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: explain fundamental concepts of data mining and data warehousing.

CO2: classify database systems and data models of data warehouses.

CO3: compare methods for storing & retrieving data from different data sources.

CO4: apply data mining techniques for knowledge extraction from large amounts of data.

CO5: predict trends to make informed decisions.

CO6: develop real world applications using data mining techniques.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	2	2	1	1	1	1	3	1	1
CO2	3	3	3	3	3	3	2	1	1	2	1	3	2	2
CO3	3	3	3	3	3	3	2	2	2	1	2	3	2	2
CO4	3	3	3	3	3	3	3	3	3	2	3	3	3	3
CO5	3	3	3	3	3	3	3	2	2	2	2	3	3	3
CO6	3	3	3	3	3	3	3	3	3	2	3	3	3	3

Centre for Artificial Intelligence

DATA SCIENCE (3240522/ 3270522/ 3280522)

COURSE OBJECTIVES

- To provide fundamental knowledge about Data Science
- To understand data preprocessing techniques
- To analyze the Data Science techniques solutions for real world problems

Unit I

Understanding Data: Types of Data, Source, Data Science Life Cycle, Data Collection Techniques. Ethical Considerations: Privacy and Consent; Data Ownership and Rights; Bias and Fairness in Data Collection. Data Cleaning; Handling missing values, Outlier detection and treatment, Data deduplication.

Unit II

Data Transformation: Normalization and standardization, Encoding categorical variables (one-hot encoding, label encoding), Feature scaling, Feature Engineering:Feature extraction, Time-based features, Data Integration:Merging data from multiple sources, Resolving schema conflicts, Data Reduction:Feature Selection; Filter methods, Wrapper methods PCA and LDA.

Unit III

Descriptive Statistics and Inferential statistics: Analyzing and Summarizing Data, Measures of Central Tendency: Mean, Median, and Mode, Measures of Dispersion: Variance, Standard Deviation, and Range. Variability in Data, Graphical Representations: Histograms; Visualizing Data Distribution Box plots; Identifying Outliers and Quartiles. Scatter plots; Examining Relationships between Variables, Hypothesis Testing (z-test, t-test, chi-squared test).

Unit IV

Supervised Learning: Regression - Linear regression, polynomial regression. Performance metrics for regression: R, R-Square, Mean Square Error(MSE), Root Mean Square Error (RMSE) Classification: Binary and Multi class classification, Logistic regression, Decision tree, Performance metrics for classification - Accuracy; Sensitivity; Specificity; Area Under the Curve (AUC); Recursive Operating Characteristic (ROC); Error Matrix; Type-I and Type II Error; F-Measures. Cross Validation, Bias-Variance Tradeoff, Validation on Benchmark Dataset, Hyperparameter Tuning.

Unit V

Unsupervised Learning: Clustering, K-means, Hierarchical clustering, Anomaly Detection, Density Estimation, Evaluation Metrics: Silhouette score; Davies-Bouldin index; Adjusted Rand Index (ARI).

RECOMMENDED BOOKS

1. "The Data Science Handbook" by Field Cady, Publisher: Wiley
2. "Data Science from Scratch" by Joel Grus, Publisher: O'Reilly
3. "An Introduction to Statistical Learning: With Applications in R" by Gareth M. James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Publisher: Springer
4. "An Introduction to Statistical Learning: With Applications in R" by Gareth M. James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Publisher: Springer

COURSE OUTCOMES

After completion of the course students will be able to:

CO1 define the concepts and importance of data science.
CO2 describe and investigate the data.
CO3 implement descriptive and inferential statistics approach on real world data
CO4 develop real world solutions using supervised and unsupervised learning methods.
CO5 evaluate the best performing algorithms based on performance metrics.
CO6 examine the stability of machine learning based models.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3			2		2	1		3	2	1
CO2	3	3	3	3	1	2		2					3	1
CO3	3	3	3	3			1				1		1	2
CO4	3	3	3	3		1		1	3	2	2	2	2	2
CO5	3	3	3	3	2	2			2				2	2
CO6	3	3	3	3	2		2	2		2	2	3	2	2

Centre for Artificial Intelligence

DATA SCIENCE (3240522/ 3270522/ 3280522)

List of Experiment

1. Study of data science libraries such as Numpy, Pandas etc. for Numerical computations and data manipulation.
2. Write a python program to perform descriptive statistics such as Central Tendency Measures (Mean, Median and Mode), Measure of Dispersion (Variance, Standard Deviation), Skewness and Kurtosis.
3. Write a program to Create visualizations (box plots, scatter plots) to identify outliers and relationships between variables.
4. Write a program to show various encoding methods used for ordinal data
5. Write a program to Normalize and standardize the data.
6. Build a linear regression model to predict a continuous target variable and evaluate model performance using R-squared, MSE, and RMSE.
7. Implement logistic regression for binary classification and Evaluate accuracy, sensitivity, and specificity.
8. Construct a decision tree for multi-class classification using various feature selection techniques.
9. Implement the k-means clustering Algorithm for a given dataset.
10. Implement the DBSCAN Algorithm for a given dataset and explain how it can be used for outlier detection

Course Outcomes:

After completion of the course, students will be able to

CO1. define the concepts and importance of data science.

CO2. describe and investigate the data.

CO3. implement descriptive and inferential statistics approach on real world data

CO4. develop real world solutions using supervised and unsupervised learning methods.

CO5. evaluate the best performing algorithms based on performance metrics.

CO6. examine the stability of machine learning based models.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3			2		2	1		3	2	
CO2	3	3	3	3	1	2		2					3	1
CO3	3	3	3	3			1				1			2
CO4	3	3	3	3		1		1	3	2	2	2	2	
CO5	3	3	3	3	2	2			2					
CO6	3	3	3	3	2		2	2		2	2	3	2	2

Centre for Artificial Intelligence

DATA SCIENCE (3240522/ 3270522/ 3280522)

Skill based Mini Projects

Micro Projects:

1. Write a python script to demonstrate how to read different types of data sets (.txt, .csv etc) from a website or disk.
2. Write a python program to calculate the Mean, Median and Mode.
3. Write a script to create a Gaussian curve using python.
4. Draw bar plot and pie plot for any dataset.
5. Write a Program in Python to Join Two Data Frames.
6. Write a python program to find NaN and Null value and replace with any number.
7. Write a python program to calculate Interquartile range (IQR).
8. Write a python program to compute correlation coefficient.
9. Write a python program to calculate the Variance, Standard Deviation, Skewness and Kurtosis.
10. Write a program to calculate Z-Score for any data.

Macro Projects:

1. Write a program to identify the missing value in any dataset and how to handle and replace it.
2. Write a program to show one hot encoding in any dataset.
3. Write a program to show label encoding in any dataset.
4. Write a python program to count the frequency of occurrence of a word (Frequency distributions) in a body of text.
5. Write a python program to draw correlation matrix.
6. Write a program to draw residual Plot for any data.
7. Write a program to show various distributions of Data over any Dataset.
8. Write a program to compute weighted averages in Python either defining your own functions or using Numpy.
9. Develop a machine learning model to detect fraudulent credit card transactions. Explore anomaly detection techniques and evaluate model performance.
10. Build a model to detect fake news articles.

Mini Projects:

1. Use historical stock price data to predict future stock prices. Explore time series analysis and machine learning algorithms.
2. Create a system that detects driver fatigue based on facial expressions or eye movements. Use computer vision techniques and machine learning.
3. Analyze sentiments in text data.
4. Consider any Dataset from online repository to design and implement a Price prediction problem.
5. Consider any Dataset from online repository to design and implement a problem using Linear Regression and Logistic Regression.
6. Consider any Dataset from online repository and demonstrate working of various feature selection and normalization techniques.
7. Design and implement weather forecasting system.

8. Customer Segmentation- Identify segments of customers to target the potential user base using clustering (i.e. K-means clustering). Divide customers into groups according to common characteristics like gender, age, interests and spending habits. Dataset: Mall_Customers dataset
9. Fake News Detection- fake news is sometimes transmitted through the internet by some unauthorised sources, which creates issues for the targeted person and it makes them panic and leads to even violence. Dataset: fake-news kaggle.
10. Cab Pickups Analysis- cab pickup and distribution, time, days when pickup happens regularly, Dataset: Uber-Pickups dataset

Centre for Artificial Intelligence

THEORY OF COMPUTATION (3240523)

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.

Unit V

Turing Machine: Techniques for construction. Universal Turing machine Multitape, multihead and multidimensional Turing machine, N-P complete problems. Decidability and Recursively Enumerable Languages, decidability, decidable languages, undecidable languages, Halting problem of Turing machine & the post correspondence problem.

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 the course students will 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 interpret rigorously formal mathematical methods to prove properties of languages, grammars and automata.
CO6 develop an overview of how automata theory, languages and computation are applicable in engineering 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	2	2			2	2	3	1	1
CO2	2	3	3	2	3	3	3	2		3	3	3	2	2
CO3	3	3	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
CO6	3	2	2	3	2	2	2	2				2	2	2

Centre for Artificial Intelligence

COMPILER DESIGN (3270523/ 3280523)

COURSE OBJECTIVES

- Introduce the structure and phases of a compiler.
- Familiarize students with lexical, syntactic, and semantic analysis.
- Enable the design and implementation of parsers and code generators.

Unit I

Introduction to Compilers: Overview of Compilation: Compiler vs Interpreter, Phases of a Compiler: Lexical, Syntax, Semantic, Intermediate Code Generation, Optimization, Code Generation, Code Linking, Compiler construction tools: Lex, Yacc, and equivalents, Bootstrapping and Cross Compilation.

Unit II

Lexical Analysis: Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Regular Expressions and Finite Automata (DFA, NFA), Construction of Lexical Analyzer using Lex or Flex.

Unit III

Syntax Analysis: Context-Free Grammars, Parse Trees and Derivations, Top-down Parsing: Recursive Descent, LL(1), Bottom-up Parsing: Operator Precedence, LR, SLR, LALR, Syntax Error Handling.

Unit IV

Semantic Analysis and Intermediate Code Generation: Syntax-directed Definitions and Translation Schemes, Symbol Tables and Scoping, Type Checking and Type Conversion, Intermediate Code Generation: Three Address Code, Quadruples, Triples, Backpatching and Boolean Expression Handling.

Unit V

Code Optimization and Code Generation: Issues in Code Generation, Basic Blocks and Control Flow Graphs, Peephole Optimization, Loop Optimization, DAG Representation, Code Generation Algorithms, Register Allocation and Instruction Scheduling.

RECOMMENDED BOOKS

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, 2nd Edition, Pearson Education (Dragon Book).
2. Dick Grune et al., Modern Compiler Design, Springer.
3. Keith D. Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann.
4. Andrew W. Appel, Modern Compiler Implementation in C/Java/ML, Cambridge University Press.
5. Allen I. Holub, Compiler Design in C, Prentice Hall.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	Explain the phases and architecture of a compiler and its components.
CO2	Construct lexical analyzers and parsers using formal grammars and automated tools.
CO3	Analyze syntactic and semantic structures using context-free grammars and syntax trees.
CO4	Evaluate and optimize intermediate code representations for efficient target code generation.
CO5	Design and implement a simple compiler for a miniature programming language.

CO-PO Mapping Matrix

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

Centre for Artificial Intelligence

ROBOT OPERATING SYSTEM (3240524)

COURSE OBJECTIVES

- To study Robot programming fundamentals and ROS platform
- To understand the installation and applications of ROS
- To understand the Robot navigation through Simulations.

Unit I

Introduction to Robotics: Laws of Robotics, Different types of robots, Applications of Robotics, Review of sensors control actions and actuators, Robot kinematics and dynamics, Trajectory planning approaches.

Unit II

Learning Basics of Ubuntu/Linux: Linux basic commands for robotics, Linux IDE & Text Editor: VS Code, nano, gedit, Linux and I/O board communication: USB to Serial communication, Linux and Camera interfacing, Linux kernel customization, Raspberry Pi and Linux overview, Linux commands, GPIO handling.

Unit III

Learning Basics of Robot Simulator: Getting started with Robot simulator concepts, Overview of different robotic simulators: Webots, Ignition, Gazebo & CoppeliaSim, Robot Programming: Getting started with ROS, ROS Equation, Utility and applications of ROS

Unit IV

ROS Architecture and concepts, Various file systems of ROS, ROS Coding styles, IDE, ROS Hello World, ROS TurtleSim, ROS Workspace and package, ROS Client libraries: roscpp & rospy, Understanding roslaunch, rosbag, Rviz, rqt. Applications of ROS in Robotics.

Unit V

Learning ROS programming using TurtleSim: roscpp and rospy, Understanding ROS concepts using TurtleSim, Moving TurtleSim using ROS programming, Understanding Transformation and frames, Working with TF broadcaster and listener, Creating TF for your robot, Working with ROS TF tools, TurtleSim projects, draw your caricature using TurtleSim, Object tracking using TurtleSim.

RECOMMENDED BOOKS

6. Robot Operating System for Absolute Beginners: Robotics Programming Made Easy“
7. Programming Robots with ROS” by Quigley, Gerkey and Smart.
8. The Linux Command Line” by William Shotts.
9. “It-Yourself Guide to the Robot Operating System: Volumes” by Patrick Goebel.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	demonstrate knowledge of operating system dedicated to Robot
CO2	analyze various case studies of ROS application
CO3	apply spatial transformation to obtain forward and inverse kinematics through programming
CO4	solve robot dynamics problems, generate joint trajectory for path planning and Programming
CO5	apply working principle of various ROS debugging process
CO6	identify applications of robots in industry

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	2			2		2	1		3	2	
CO2	3	3	3	1	1	2		2					3	1
CO3	3	3	3	3			1				1			2
CO4	3	3	3	3		1		1	3		2	2		
CO5	3	3	3	3	2	2			2					
CO6	3	2	3	3			2	2		2	2	3	2	2

Centre for Artificial Intelligence

ROBOT OPERATING SYSTEM (3240524)

List of Programs

1. Implement basic Linux commands for terminal operations in ROS environment
2. Implement virtual machine concepts and Installation of ROS environment.
3. Creation of basic inter nodes communication between Talker listener nodes.
4. Create ROS2 nodes using the Turtlesim simulator of the ROS environment.
5. Executing Turtlesim for running nodes, teleoperations, swamping and remapping of nodes.
6. Implementation of Mitsubishi Robotic Arm, calibration and Melfa programming basics.
7. Perform object Pick and Drop operations through Mitsubishi robotic arm.
8. Perform various operations on Smorphy robotic kit and implement its remote navigation process.
9. Design a voice based action synchronization for a humanoid Robot.

COURSE OUTCOMES

After completing this, the students will be able to:

CO1. illustrate the basics of Robot operating system simulation interface.

CO2. explain basic Linux commands for ROS installation.

CO3. demonstrate node concepts in multi-Robot system communication.

CO4. apply basic robotic actions with Robotic arm

CO5. analyze the robotic prototypes used in various industries

CO6. demonstrate various actions using humanoid robots.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3			2		2	1		3	2	
CO2	3	3	3	3	1	2		2					3	1
CO3	3	3	3	3			1				1			2
CO4	3	3	3	3		1		1	3		2	2		
CO5	3	3	3	3	2	2			2					
CO6	3	3	3	3			2	2		2	2	3		

Centre for Artificial Intelligence

ROBOT OPERATING SYSTEM (3240524)

Skill based Mini Projects

Micro Project:

- Study of Raspberry pi board
- Understanding the line follower system.
- Create an electronic obstacle avoidance system.
- Implement a SLAM model.
- Implement GaZebo in ROS
- Perform kinematics for Robotics arm
- Design a Gesture control flow in Robotic Applications
- Implement various functions of Drones.

Macro Projects:

- Perform operations with Raspberry pi board sensor interfacing units
- Implement different sensors used in line follower.
- Design a SLAM and Turtle sim node navigation system
- Implement path planning with Turtle sim node system
- Perform various functions pertaining to drone kinematics
- Design a joint coordinate system for Robotic Arm
- Implement a Lidar sensor in robot Navigation.
- Perform Humanoid Calibration.

Mini Project:

- Design of Line Following Robot using ROS with Raspberry Pi.
- Design of obstacle avoidance Robot using ROS with Raspberry Pi.
- Implementation of SLAM using ROS TurtleSim.
- Path Planning robot using Raspberry and ROS.
- Drone simulation using Gazebo and ROS
- Robotic Arm simulation using ROS
- Gesture controlled robot using ROS
- Design an Autonomous mobile robot using ROS

Centre for Artificial Intelligence

STATISTICAL PROGRAMMING WITH R (3270524/ 3280524)

COURSE OBJECTIVES

- To understand the principles of traditional and computational statistics
- To develop proficiency in R programming, and apply computational statistics techniques

Unit I

Introduction to R: Installation Procedure of R and Rstudio, Packages & Libraries in R, R Commands, Objects, Functions, Simple Manipulations, Matrices and Arrays, Factors, Lists, Data Frames, Data Import and Manipulation in R, Exploratory Data Analysis (EDA).

Unit II

Scripts, Logical Operators, Conditional Statements, Loops in R, Switch Statement, Creating List and Data Frames, List and Dataframe Operations, Function Creation in R. Miscellaneous functions: Sequence, repetition, sorting, generate random numbers, user-defined functions, lapply, sapply, and tapply function.

Unit III

Data Visualization in R, Basic Plotting types: Barchart, Pie Chart, Histogram, Density plot, Boxplot; Plot customization: Adding legend, Adding color in plots, Adding axis labels and chart title, Modifying axis and scales; Overlay plots in R

Unit IV

Basic Statistics with R: Measures of central tendency: Arithmetic Mean, Median, Quantiles, Modes Geometric Mean and Harmonic Mean, Range, IQR, Absolute Deviation and Absolute Mean Deviation, Mean Squared Error, Variance, Standard Deviation, Coefficients of Variation and Boxplot.

Unit V

Advanced Statistics with R: Raw and Central Moments, Absolute Moments, Computation of Moments, Skewness & Kurtosis, Univariate & Bivariate Scatter Plots, Smooth Scatter plots, Correlation Coefficient, Rank Correlation Coefficient, Measures of Association for Discrete & Continuous Probability Distribution, Binomial Distribution, Normal Distribution, Sampling Distribution, Types of Sampling: Probability vs non-Probability.

RECOMMENDED BOOKS

1. Givens, G. H. and Hoeting, J. A. (2013). Computational Statistics (2nd ed.). Hoboken, NJ: John Wiley & Sons, Inc.
2. Gentle, J. E. (2009). Computational Statistics. New York, NY: Springer.
3. James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). *An Introduction to Statistical Learning: with Applications in R.* New York, NY: Springer.
4. Wendy L. Martinez and Angel R, "Martinez Computational Statistics," Chapman & Hall/CRC, 2002.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1 Compare and contrast traditional and computational statistics, explaining the role of computation as a tool of discovery

CO2 Implement computational statistics techniques using the software R.

CO3 Estimate statistical functions or parameters by selecting and implementing appropriate computational statistics techniques

CO4 Evaluate the choice of applying a specific computational statistics technique to a given problem.

CO5 Analyze large data sets and computational statistics techniques using graphical displays

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

Centre for Artificial Intelligence

STATISTICAL PROGRAMMING WITH R (3270524/ 3280524)

List of Programs

1. Installation of R and R studio
2. Use R to explore datasets visually and numerically using histograms, box plots, scatter plots, and summary statistics.
3. Implement vectors, matrices, sorting and indexing in R
4. Implement conditional expressions, vectorization and functions in R
5. Summarize and sort data with R
6. Implement probability and monte carlo simulations in R
7. Implement Central limit theorems in R
8. Create populations, samples, parameters and estimates using R
9. Implement Bayesian Statistics and regression in R
10. Implement various methods of data wrangling.

Skill based Mini Projects

1. Choose a dataset from a repository like Kaggle and perform comprehensive EDA using R. Generate visualizations such as histograms, box plots, scatter plots, and compute summary statistics.
2. Choose a real-world dataset and create an R script to summarize and sort the data based on various attributes. Implement functions to calculate different summary statistics for the dataset.3.
3. Select a messy or incomplete dataset and clean it using R. Tasks may include handling missing values, correcting data types, removing duplicates, and standardizing formats.
4. Obtain a time series dataset from sources like financial markets, weather stations, or social media. Use R to analyze trends, seasonality, and correlations within the time series data.
5. Choose a dataset suitable for predictive modeling tasks, such as predicting house prices, customer churn, or disease diagnosis. Split the dataset into training and testing sets, and build predictive models using techniques like linear regression, decision trees, or random forests. Evaluate model performance using metrics like accuracy, precision, recall, and ROC curves.
6. Obtain a spatial dataset containing geographic information, such as maps, satellite imagery, or GPS data. Use R packages like sp and rgdal to perform spatial analysis tasks such as point pattern analysis, spatial autocorrelation, or interpolation.
7. Choose a population dataset and simulate the process of drawing multiple samples from it in R. Calculate sample statistics and compare them with population parameters to understand the concept of estimation.
8. Implement Bayesian linear regression in R using packages like rstan or brms. Apply the model to a dataset and interpret the results, including posterior distributions and credible intervals.

Centre for Artificial Intelligence

SOFT COMPUTING TECHNIQUES (3240525)

COURSE OBJECTIVES

- To provide the student with the basic understanding of neural networks and fuzzy logic fundamentals, Program the related algorithms and Design the required and related systems.
- To understand the fundamental theory and concepts of neural networks, several neural network paradigms and its applications.
- To understand the basics of an evolutionary computing paradigm known as genetic algorithms and its application to engineering optimization problems.

Unit I

Introduction to Soft Computing: Soft Computing v/s Hard Computing, Basic models of Artificial Neural Networks, Terminologies of ANNs McCulloch-Pitts Neurons, Linear Separability, Hebb Network, Supervised Learning Networks: Introduction, Perceptron Networks, Back Propagation Networks, Radial Basis Function Networks, Hopfield networks.

Unit II

Fuzzy Set Theory: Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Fuzzy rules, Fuzzy Reasoning, Defuzzification: Lambda-Cuts for Fuzzy sets (Alpha-Cuts), Lambda-Cuts for Fuzzy Relations. Fuzzy Inference System: Introduction, Mamdani Fuzzy Model, Takagi-Sugeno Fuzzy Model.

Unit III

Evolutionary Algorithm: Traditional optimization and Search Techniques, Basic Terminologies in GA, Operators in Genetic Algorithm, Stopping Condition for Genetic Algorithm Flow, Classification of Genetic Algorithm, Comparison with Evolutionary algorithm, Application of Genetic algorithm.

Unit IV

Introduction to Nature-Inspired Optimization Algorithms: Particle Swarm Optimization (PSO) Algorithm, Differential Evolution (DE) Algorithm, Artificial Bee Colony (ABC) Algorithm, Ant Colony Optimization (ACO) Algorithm, Cuckoo Search (CS), Firefly Algorithm (FA), Immune Algorithm (IA), Grey Wolf Optimization (GWO), Spider Monkey Optimization.

Unit V

Hybrid Soft Computing Techniques: Introduction, Neuro-fuzzy Hybrid system, Adaptive Neuro fuzzy inference system(ANFIS), Genetic Neuro Hybrid system, Application of Soft Computing Techniques.

RECOMMENDED BOOKS

1. Principles of Soft Computing, S. N. Sivanandam and S. N. Deepa , Wiley Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications- S. Rajasekaran & G.A. Vijayalakshmi Pai, PHI.
2. Introduction to Soft Computing Neuro-Fuzzy and Genetic Algorithms, Samir Roy and Udit Chakraborty, Pearson.
3. Neural Networks and Learning Machines-Simon Haykin PHI.
4. Fuzzy Logic and Engineering Application, Tomthy Ross, TMH.
5. Evolutionary Optimization Algorithms, D. Simon (2013), Wiley.
6. Fundamentals of Natural Computing: Basic Concepts, Algorithms, and Applications, L. N. de Castro (2006), CRC Press.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1 define basic concepts of neural networks and fuzzy systems.
CO2 compare solutions by applying various soft computing approaches on a given problem.
CO3 develop and train different supervised and unsupervised learning.
CO4 classify various nature inspired algorithms according to their application aspect.
CO5 compare the efficiency of various hybrid systems.
CO6 design a soft computing model for solving real world problems.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3								2	2	2
CO2	3	3	3	3	2	2			1			2	3	3
CO3	3	3	3	3	3	3		1				1	3	3
CO4	3	3	3	3			2		1	1		1	3	3
CO5	3	3	3	3									1	1
CO6	3	3	3	3	3	2		1	1	1	2	1	3	3

Centre for Artificial Intelligence

MACHINE LEARNING & OPTIMIZATION (3270525/ 3280525)

COURSE OBJECTIVES

- To understand the foundational concepts of machine learning and mathematical optimization.
- To apply supervised, unsupervised, and reinforcement learning algorithms to real-world problems.
- To analyze model performance and fine-tune hyperparameters for optimization.

Unit I

Introduction to Machine Learning: Types of Machine Learning: Supervised, Unsupervised, Reinforcement Learning, Applications and challenges, Key Concepts: Model, Training, Testing, Features, Labels, Evaluation Metrics: Accuracy, Precision, Recall, F1 Score, ROC-AUC.

Unit II

Supervised Learning and Optimization: Linear Regression, Logistic Regression, Support Vector Machines (SVM), Decision Trees, Random Forests, Gradient Descent and Variants (SGD, Mini-batch GD, Momentum, Adam), Overfitting, Underfitting, Regularization (L1, L2).

Unit III

Unsupervised Learning: Clustering: K-means, Hierarchical, DBSCAN; Dimensionality Reduction: PCA, t-SNE, Anomaly Detection, Applications in image and text data.

Unit IV

Optimization Techniques: Convex vs. Non-convex Optimization, Constrained and Unconstrained Optimization, Evolutionary Algorithms (Genetic Algorithm, Particle Swarm Optimization), Simulated Annealing, Bayesian Optimization, Multi-objective Optimization.

Unit V

Advanced Machine Learning and Applications: Neural Networks and Deep Learning, Reinforcement Learning and Policy Optimization, Hyperparameter Tuning (Grid Search, Random Search, Bayesian Optimization), Case Studies: ML in Healthcare, Finance, IoT, Ethical Considerations and Bias in ML.

RECOMMENDED BOOKS

1. Tom M. Mitchell, Machine Learning, McGraw-Hill.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press.
4. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press.
5. S. S. Rao, Engineering Optimization: Theory and Practice, Wiley.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	Explain the basic principles of machine learning and different categories of learning algorithms.
CO2	Apply supervised and unsupervised machine learning models to solve engineering and data-centric problems.
CO3	Evaluate model performance and analyze the effect of various hyperparameters and regularization techniques.
CO4	Design and implement optimized machine learning workflows using relevant tools and libraries.
CO5	Assess the optimization techniques applied in model training and selection for real-world scenarios.

CO-PO Mapping Matrix

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

ANNEXURE-V

CO attainments, Gaps Analysis and Corrective Measures

for the improvement in the CO attainment levels for all the courses taught during July-Dec. 2024 session

Centre for Artificial Intelligence

CO attainment with Gap Analysis and action taken (AIR, AIDS and AIML) for July-Dec. 2024

					Direct Attainment				Indirect Attainment							
Faculty Name	**Branch & Semester**	**Cource name & Code**		**Course Outcome Statements**	**CO attainment levels from Quiz/ Assignment**	**CO attainment Levels from Mid Sem (Avg. of mid sem I & II)**	**CO attainment Levels from End Sem**	**CO direct attainment levels**	**CO indirect attainment Levels from End Smester Seminar**	**CO indirect attainment Levels from one minute paper writing**	**CO indirect attainment Levels from CO Feedback**	**CO indirect attainment levels**	**Overall CO attainment**	**Target (To be set for Overall CO Attainment)**	**Attained/not attained**	**Action taken for Not Attained**
Dr. Shweta Chauhan	**AIDS/AIML 7th**	**Generative AI (270731/280731)**	**CO1**	Illustrate the basic concepts, scope and significance of generative AI.	2.8	2.3	2.43	**2.5**	2.8	3	2.8	**2.9**	**2.6**	2.5	Attained	-
			CO2	Comprehend different types of generative models and their architectures and functioning of GANs.	2.9	2.8	2.8	**2.8**	2	3	2.7	**2.6**	**2.8**	2.5	Attained	-
			CO3	Implement the VAEs and flow-based models.	2	2.4	2.6	**2.4**	2.8	2.8	2.5	**2.7**	**2.5**	2.5	Attained	-
			CO4	Explore advanced generative techniques like autoregressive and transformer-based models.	3	2.6	2.4	**2.6**	2.4	3	2.5	**2.6**	**2.6**	2.5	Attained	-
			CO5	Apply generative AI techniques to practical problems	2.4	2.5	2.6	**2.5**	3	2.6	3	**2.9**	**2.6**	2.5	Attained	-
			CO6	Analyze the ethical implications, societal impact and challenges associated with generative AI.	2.5	2.4	2.6	**2.5**	2.8	2.5	2.9	**2.8**	**2.6**	2.5	Attained	-
Dr. Tej Singh	**AIDS/AIML 7th**	**Pattern Recognition (270732/280732)**	**CO1**	explain the basic principle of image processing	2.8	2.3	2.2	**2.4**	3	3	3	**3**	**2.5**	2.5	Attained	-
			CO2	apply the advance pattern recognition algorithms on images	2	1.5	3	**2.4**	2	3	3	**2.8**	**2.5**	2.5	Attained	-
			CO3	analyse the potential of basic image processing	2.8	1	3	**2.5**	2.8	2.8	3	**2.9**	**2.6**	2.5	Attained	-
			CO4	compare different pattern recognition algorithms on different domain	2	2.6	2.92	**2.6**	2.4	3	3	**2.9**	**2.7**	2.5	Attained	-
			CO5	develop the real world application of pattern recognition	3	2.7	2.67	**2.8**	3	2.6	3	**2.9**	**2.8**	2.5	Attained	-
			CO6	design basic programming structure for image processing using python	2.5	2.7	2.72	**2.7**	2.8	2.2	3	**2.8**	**2.7**	2.5	Attained	-
Dr. Neeraj Mishra	**AIR 7th**	**Humanoid Robotics (240732)**	**CO1**	define the technical aspects of various types of humanoid robot.	2.9	2.5	2.9	**2.8**	3	2.6	2.5	**2.7**	**2.8**	2.5	Attained	-
			CO2	explain the details of mechanism and design of humanoid robot.	3	2.7	3	**2.9**	3	2.4	3	**2.9**	**2.9**	2.5	Attained	-
			CO3	interpret the ZMP and the dynamics of humanoid robot.	2.6	2.5	3	**2.8**	2.8	2.6	3	**2.9**	**2.8**	2.5	Attained	-
			CO4	examine the Biped walking pattern.	2.8	2.7	2.9	**2.8**	2.9	2.8	2.6	**2.7**	**2.8**	2.5	Attained	-
			CO5	determine the whole-body motion of humanoid robot.	2.5	2.6	2.9	**2.7**	2.6	3	2.5	**2.7**	**2.7**	2.5	Attained	-
			CO6	develop the trends of humanoid robot in society.	2.3	2.4	2.6	**2.5**	2.5	2.8	2.4	**2.5**	**2.5**	2.5	Attained	-
Dr. Pawan Dubey	**AIR 7th**	**Robot Operating System (240731)**	**CO1**	demonstrate knowledge of operating system dedicated to Robot	3	2.29	3.00	**2.8**	3.00	3.00	3.00	**3**	**2.8**	2	Attained	-
			CO2	understand various case studies of ROS application	1.43	2.57	3.00	**2.5**	3.00	3.00	3.00	**3**	**2.6**	2	Attained	-
			CO3	apply spatial transformation to obtain forward and inverse kinematics through programming	1	1.71	2.57	**2**	2.86	2.57	3.00	**2.9**	**2.2**	2	Attained	-
			CO4	solve robot dynamics problems, generate joint trajectory for path planning and Programming	2.57	3.00	3.00	**2.9**	3.00	2.29	3.00	**2.8**	**2.9**	2	Attained	-
			CO5	apply working principle of various ROS debugging process	1	1.71	3.00	**2.2**	1.00	3.00	3.00	**2.5**	**2.3**	2	Attained	-
			CO6	appreciate applications of robots in industry.	1	2.86	3.00	**2.5**	3.00	3.00	3.00	**3**	**2.6**	2	Attained	-
Mrs. Geetika Hazra	**AIR 7th**	**Universal Human Values & Professional Ethics (1000008)**	**CO1**	to become more aware of their surroundings, society, social problems and their sustainable solutions	3	3.00	3	**3**	3	3	3	**3**	**3**	2	Attained	-
			CO2	to become sensitive to their commitment towards what they believe in (humane values. humane relationships and humane society).	3	3.00	3	**3**	3	3	3	**3**	**3**	2	Attained	-
			CO3	to apply what they have learnt to their own self in different day-to-day settings in real life.	3	3.00	3	**3**	3	3	3	**3**	**3**	2	Attained	-
			CO4	to sustain human relationships and human nature in mind.	2.5	3.00	3	**2.9**	3	3	3	**3**	**2.9**	2	Attained	-
			CO5	to have better critical ability	2.3	2.00	2.5	**2.3**	2.8	2	2.5	**2.5**	**2.3**	2	Attained	-
			CO6	to negotiate living in harmony with self and others	2	2.00	2.5	**2.3**	2.5	1.9	2	**2.1**	**2.3**	2	Attained	-
Mrs. Geetika Hazra	**AIML 7th**	**Universal Human Values & Professional Ethics (1000008)**	**CO1**	to become more aware of their surroundings, society, social problems and their sustainable solutions	3	3.00	3	**3**	3	3	3	**3**	**3**	2	Attained	-
			CO2	to become sensitive to their commitment towards what they believe in (humane values. humane relationships and humane society).	3	3.00	3	**3**	3	3	3	**3**	**3**	2	Attained	-
			CO3	to apply what they have learnt to their own self in different day-to-day settings in real life.	3	3.00	3	**3**	3	3	3	**3**	**3**	2	Attained	-

Centre for Artificial Intelligence

CO attainment with Gap Analysis and action taken (AIR, AIDS and AIML) for July-Dec. 2024

					Direct Attainment				Indirect Attainment							
Faculty Name	**Branch & Semester**	**Cource name & Code**		**Course Outcome Statements**	**CO attainment levels from Quiz/ Assignment**	**CO attainment Levels from Mid Sem (Avg. of mid sem I & II)**	**CO attainment Levels from End Sem**	**CO direct attainment levels**	**CO indirect attainment Levels from End Smester Seminar**	**CO indirect attainment Levels from one minute paper writing**	**CO indirect attainment Levels from CO Feedback**	**CO indirect attainment levels**	**Overall CO attainment**	**Target (To be set for Overall CO Attainment)**	**Attained/not attained**	**Action taken for Not Attained**
			CO4	to sustain human relationships and human nature in mind.	2.5	3.00	3	**2.9**	3	3	3	**3**	**2.9**	2	Attained	-
			CO5	to have better critical ability	2.3	2.00	2.5	**2.3**	2.8	2	2.5	**2.5**	**2.3**	2	Attained	-
			CO6	to negotiate living in harmony with self and others	2	2.00	2.5	**2.3**	2.5	1.9	2	**2.1**	**2.3**	2	Attained	-
Mrs. Geetika Hazra	**AIDS 7th**	**Universal Human Values & Professional Ethics (1000008)**	**CO1**	to become more aware of their surroundings, society, social problems and their sustainable solutions	3	3.00	3	**3**	3	3	3	**3**	**3**	2	Attained	-
			CO2	to become sensitive to their commitment towards what they believe in (humane values. humane relationships and humane society).	3	3.00	3	**3**	3	3	3	**3**	**3**	2	Attained	-
			CO3	to apply what they have learnt to their own self in different day-to-day settings in real life.	3	3.00	3	**3**	3	3	3	**3**	**3**	2	Attained	-
			CO4	to sustain human relationships and human nature in mind.	2.5	3.00	3	**2.9**	3	3	3	**3**	**2.9**	2	Attained	-
			CO5	to have better critical ability	2.3	2.00	2.5	**2.3**	2.8	2	2.5	**2.5**	**2.3**	2	Attained	-
			CO6	to negotiate living in harmony with self and others	2	2.00	2.5	**2.3**	2.5	1.9	2	**2.1**	**2.3**	2	Attained	-
Dr. Abhishek Bhatt	**AIR 5th**	**Data Science (2240522)**	**CO1**	Define the concepts and importance of data science	2.91	1.31	2.7	**2.4**	3	3	3	**3**	**2.5**	2.5	Attained	-
			CO2	Describe and investigate the data.	3	2.3	2.8	**2.7**	1.8	3	3	**2.7**	**2.7**	2.5	Attained	-
			CO3	Implement descriptive and inferential statistics approach on real world data	3	1	3	**2.5**	2.73	2.7	3	**2.9**	**2.6**	2.5	Attained	-
			CO4	Develop real world solutions using supervised and unsupervised learning methods.	3	3	2.42	**2.7**	2.6	3	3	**2.9**	**2.7**	2.5	Attained	-
			CO5	Evaluate the best performing algorithms based on performance metrics.	3	1.56	2.7	**2.5**	3	2.6	3	**2.9**	**2.6**	2.5	Attained	-
			CO6	Examine the stability of machine learning based models.	2.67	3	2.43	**2.6**	2.8	2.2	3	**2.8**	**2.6**	2.5	Attained	-
Dr. Hardev Singh Pal	**AIR 5th**	**Soft Computing Techniques (2240525)**	**CO1**	define basic concepts of neural networks and fuzzy systems	3	2.8	2.8	**2.9**	3	3	2.1	**2.6**	**2.8**	2	Attained	-
			CO2	compare solutions by applying various soft computing approaches on a given problem	3	2.5	2.6	**2.7**	2.8	3	2.4	**2.7**	**2.7**	2	Attained	-
			CO3	develop and train different supervised and unsupervised learning	3	2.6	2.4	**2.6**	2.8	2.8	2.4	**2.6**	**2.6**	2	Attained	-
			CO4	classify various nature inspired algorithms according to their application aspect.	2.9	2.5	2.6	**2.7**	3	2.6	2.5	**2.7**	**2.7**	2	Attained	-
			CO5	compare the efficiency of various hybrid systems	3	2.7	2.8	**2.8**	3	2.8	2.5	**2.7**	**2.8**	2	Attained	-
			CO6	design a soft computing model for solving real world problems.	2.7	2.3	2.2	**2.4**	2.7	2.6	2.4	**2.5**	**2.4**	2	Attained	More HOT question will be added in assignments
Dr. Pawan Dubey	**AIR 5th**	**Robot Operating System (2240524)**	**CO1**	demonstrate knowledge of operating system dedicated to Robot	**3.00**	**1.37**	**3.00**	**2.6**	**3**	**3**	**3**	**3**	**2.7**	**2**	Attained	Taregt level will be increased
			CO2	analyze various case studies of ROS application	**3.00**	**1**	**3.00**	**2.5**	**2.95**	**2.95**	**3**	**3**	**2.6**	**2**	Attained	Taregt level will be increased
			CO3	apply spatial transformation to obtain forward and inverse kinematics through programming	**2.46**	**1.98**	**3.00**	**2.6**	**3**	**3**	**3**	**3**	**2.7**	**2**	Attained	Taregt level will be increased
			CO4	solve robot dynamics problems, generate joint trajectory for path planning and Programming	**3.00**	**3**	**3.00**	**3**	**1.85**	**3**	**3**	**2.7**	**2.9**	**2**	Attained	Taregt level will be increased
			CO5	apply working principle of various ROS debugging process	**1.00**	**2.71**	**2.95**	**2.4**	**3**	**2.71**	**3**	**2.9**	**2.5**	**2**	Attained	Taregt level will be increased
			CO6	identify applications of robots in industry	**2.22**	**3**	**2.71**	**2.7**	**2.95**	**3**	**3**	**3**	**2.8**	**2**	Attained	Taregt level will be increased
Dr. Sanjeev Kumar Dwivedi	**AIR 5th**	**Theory of Computation (2240523)**	**CO1**	explain the basic concepts of switching and finite automata theory & languages.	2.9	2.75	2.9	**2.9**	2.8	2.9	2.38	**2.6**	**2.8**	2	Attained	-
			CO2	relate practical problems to languages, automata, computability and complexity	2.85	3	2.85	**2.9**	2.55	2.65	2.31	**2.5**	**2.8**	2	Attained	-
			CO3	construct abstract models of computing and check their power to recognize the languages.	2.75	2.1	2.25	**2.3**	2.4	2.5	2.35	**2.4**	**2.3**	2	Attained	-
			CO4	analyze the grammar, its types, simplification and normal form	2.9	3	2.6	**2.8**	2.6	2.75	2.35	**2.5**	**2.7**	2	Attained	-
			CO5	interpret rigorously formal mathematical methods to prove properties of languages, grammars and automata	2.7	3	2.5	**2.7**	2.5	2.4	2.31	**2.4**	**2.6**	2	Attained	-

Centre for Artificial Intelligence

CO attainment with Gap Analysis and action taken (AIR, AIDS and AIML) for July-Dec. 2024

					Direct Attainment				Indirect Attainment							
Faculty Name	**Branch & Semester**	**Cource name & Code**		**Course Outcome Statements**	**CO attainment levels from Quiz/ Assignment**	**CO attainment Levels from Mid Sem (Avg. of mid sem I & II)**	**CO attainment Levels from End Sem**	**CO direct attainment levels**	**CO indirect attainment Levels from End Smester Seminar**	**CO indirect attainment Levels from one minute paper writing**	**CO indirect attainment Levels from CO Feedback**	**CO indirect attainment levels**	**Overall CO attainment**	**Target (To be set for Overall CO Attainment)**	**Attained/not attained**	**Action taken for Not Attained**
			CO6	develop an overview of how automata theory, languages and computation are applicable in engineering applications.	1	1	1	**1**	2.4	1	2.27	**2**	**1.2**	1	Attained	-
Dr. Shweta Chauhan	**AIR 5th**	**Disaster Management (1000006)**	**CO1**	Identify disaster prevention and mitigation approaches.	2.40	2.50	2.40	**2.4**	2.50	2.70	2.40	**2.5**	**2.4**	2.5	Not Attained	-
			CO2	Chassify global and national disasters, their trends and profiles	2.20	2.60	2.71	**2.6**	2.60	2.50	2.71	**2.6**	**2.6**	2.5	Attained	-
			CO3	Determine the impacts of various disasters	2.20	2.70	2.81	**2.6**	2.50	2.70	2.81	**2.7**	**2.6**	2.5	Attained	-
			CO4	Apply Disaster Risk Reduction in management	2.30	2.40	2.61	**2.5**	2.50	2.70	2.61	**2.6**	**2.5**	2.5	Attained	-
			CO5	Infer the linkage between disasters, environment and development.	2.50	2.80	2.51	**2.6**	2.60	2.70	2.51	**2.6**	**2.6**	2.5	Attained	-
Ms. Pooja Tripathi	**AIR 5th**	**Software Engineering (2240521)**	**CO1**	Explain the concept of Software Engineering	2.4	2.6	2	**2.3**	2.4	2	2.6	**2.4**	**2.2**	2	Attained	-
			CO2	Develop the concepts related to Software design & Analysis	2.2	2	2.6	**2.4**	2.2	2.4	2	**2.2**	**2.4**	2	Attained	-
			CO3	Compare the techniques for software project management & Estimation	2.4	2.5	2	**2.2**	2.4	2	2.6	**2.1**	**2.2**	2	Attained	-
			CO4	Choose an appropriate software developement model for a real life software project	2.3	2	2.3	**2.2**	2.4	2	2.6	**2.4**	**2.2**	2	Attained	-
			CO5	Design software using modern tools and technologies	2	2.2	2.4	**2.3**	2	2.1	2	**2**	**2.2**	2	Attained	-
			CO6	Test the software through different approaches	2.1	2	2.4	**2.2**	2	2.4	2.3	**2.3**	**2.2**	2	Attained	-
Dr. Hardev Singh Pal	**AIML 5th**	**Soft Computing Techniques (2280525)**	**CO1**	define basic concepts of neural networks and fuzzy systems	2.9	2.4	2.8	**2.7**	3	3	2.7	**2.9**	**2.7**	2	Attained	-
			CO2	compare solutions by applying various soft computing approaches on a given problem	3	2.3	2.6	**2.6**	3	3	2.7	**2.9**	**2.7**	2	Attained	-
			CO3	develop and train different supervised and unsupervised learning	3	2.5	2.4	**2.6**	2.8	3	2.8	**2.9**	**2.7**	2	Attained	-
			CO4	classify various nature inspired algorithms according to their application aspect.	2.8	2.3	2.6	**2.6**	2.8	3	2.7	**2.8**	**2.6**	2	Attained	-
			CO5	compare the efficiency of various hybrid systems	3	2.2	2.8	**2.7**	3	3	2.7	**2.9**	**2.7**	2	Attained	-
			CO6	design a soft computing model for solving real world problems.	2.6	2.1	2.5	**2.4**	2.6	2	2.7	**2.5**	**2.4**	2	Attained	-
Dr. Neelam Arya	**AIML 5th**	**Statistical Programming with R (2280524)**	**CO1**	Compare and contrast traditional and computational statistics, explaining the role of computation as a tool of discovery	2	2	2	**2.3**	2.5	2	2	**2.3**	**2.3**	2	Attained	-
			CO2	Implement computational statistics techniques using the software R.	3	2.2	2.4	**3**	2.5	2	2	**2.3**	**2.9**	2.5	Attained	-
			CO3	Estimate statistical functions or parameters by selecting and implementing appropriate computational statistics techniques	3	2	2.4	**2.8**	2	3	3	**2.8**	**2.8**	2.5	Attained	-
			CO4	Evaluate the choice of applying a specific computational statistics technique to a given problem.	3	2	2.4	**2.8**	2.6	3	3	**3**	**2.8**	2.5	Attained	-
			CO5	Apply randomization techniques to extract information from large data sets.	1	2	2	**1.8**	2	2	2	**2**	**1.8**	2	Not Attained	Extra lab exercises, practice problems, remedial classes
			CO6	Generate graphical displays as a tool for analyzing both large data sets and computational statistics techniques.	2	2	2	**2**	2.6	3	2	**2.5**	**2.1**	2	Attained	-
Dr. Sanjeev Kumar Dwivedi	**AIML 5th**	**Theory of Computation (2280523)**	**CO1**	explain the basic concepts of switching and finite automata theory & languages.	2.8	3	2.95	**2.9**	2.9	2.9	2.54	**2.7**	**2.9**	2	Attained	-
			CO2	relate practical problems to languages, automata, computability and complexity	2.9	3	2.7	**2.8**	2.6	2.55	2.46	**2.5**	**2.7**	2	Attained	-
			CO3	construct abstract models of computing and check their power to recognize the languages.	2.7	1.97	2.4	**2.4**	2.3	2.5	2.61	**2.5**	**2.4**	2	Attained	-
			CO4	analyze the grammar, its types, simplification and normal form	2.8	1.58	2.5	**2.3**	2.7	2.6	2.5	**2.6**	**2.4**	2	Attained	-
			CO5	interpret rigorously formal mathematical methods to prove properties of languages, grammars and automata	2.6	2.36	2.7	**2.6**	2.4	2.4	2.43	**2.4**	**2.6**	2	Attained	-
			CO6	develop an overview of how automata theory, languages and computation are applicable in engineering applications.	1	1	1	**1**	1	1	2.36	**1.7**	**1.1**	1	Attained	-
Dr. Shubha	**AIML 5th**	**Data Mining**	**CO1**	Explain basics of data mining and data warehousing	2.8	2.6	2.3	**2.5**	2.7	2.7	2.7	**2.7**	**2.5**	2	Attained	-

Centre for Artificial Intelligence

CO attainment with Gap Analysis and action taken (AIR, AIDS and AIML) for July-Dec. 2024

					Direct Attainment				Indirect Attainment							
Faculty Name	**Branch & Semester**	**Cource name & Code**		**Course Outcome Statements**	**CO attainment levels from Quiz/ Assignment**	**CO attainment Levels from Mid Sem (Avg. of mid sem I & II)**	**CO attainment Levels from End Sem**	**CO direct attainment levels**	**CO indirect attainment Levels from End Smester Seminar**	**CO indirect attainment Levels from one minute paper writing**	**CO indirect attainment Levels from CO Feedback**	**CO indirect attainment levels**	**Overall CO attainment**	**Target (To be set for Overall CO Attainment)**	**Attained/not attained**	**Action taken for Not Attained**
Mishra		**& Warehousing (2280521)**	**CO2**	classify database systems and data models / schemas of data warehouses	2.3	2.3	2.4	**2.4**	2.8	3	2.5	**2.7**	**2.5**	2	Attained	-
			CO3	compare methods for storing & retrieving data from different data sources/repositories	2.6	2.4	2	**2.3**	2.2	2.5	2.3	**2.3**	**2.3**	2	Attained	-
			CO4	apply data mining techniques for knowledge extraction from large amounts of data	2.5	2.6	2.3	**2.4**	2.3	2.6	2.7	**2.6**	**2.4**	2	Attained	-
			CO5	predict trends to make informed decisions.	2.8	2.7	2.6	**2.7**	2.2	2.9	2.5	**2.5**	**2.7**	2	Attained	-
			CO6	develop real world applications using data mining techniques	2.7	2.6	2.4	**2.5**	2.5	2.8	2.3	**2.5**	**2.5**	2	Attained	-
Dr. Shweta Chauhan	**AIML 5th**	**Disaster Management (1000006)**	**CO1**	Identify disaster prevention and mitigation approaches.	2.60	2.70	2.40	**2.4**	2.50	2.70	2.40	**2.5**	**2.4**	2.5	Attained	-
			CO2	Chassify global and national disasters, their trends and profiles	2.80	2.60	2.71	**2.6**	2.60	2.50	2.71	**2.6**	**2.6**	2.5	Attained	-
			CO3	Determine the impacts of various disasters	2.70	2.50	2.81	**2.6**	2.50	2.70	2.81	**2.7**	**2.6**	2.5	Attained	-
			CO4	Apply Disaster Risk Reduction in management	2.80	2.40	2.45	**2.5**	2.50	2.70	2.61	**2.6**	**2.5**	2.5	Attained	-
			CO5	Infer the linkage between disasters, environment and development.	2.70	2.30	2.22	**2.6**	2.60	2.70	2.51	**2.6**	**2.6**	2.5	Attained	-
Dr. Sunil Kumar Shukla	**AIML 5th**	**Data Science (2280522)**	**CO1**	Explain the concept of Software Engineering	2.4	2.6	2	**2.3**	2.4	2	2.6	**2.4**	**2.2**	2	Attained	-
			CO2					**0**				**0**	**0**		Please Set Target	-
			CO3					**0**				**0**	**0**		Please Set Target	-
			CO4					**0**				**0**	**0**		Please Set Target	-
			CO5					**0**				**0**	**0**		Please Set Target	-
			CO6					**0**				**0**	**0**		Please Set Target	-
Dr. Neelam Arya	**AIDS 5th**	**Statistical Programming with R (2270524)**	**CO1**	Compare and contrast traditional and computational statistics, explaining the role of computation as a tool of discovery	2	2.4	2	**2.1**	3	2	2	**2.3**	**2.1**	2	Attained	-
			CO2	Implement computational statistics techniques using the software R.	3	2.5	2.3	**2.5**	3	2	2	**2.3**	**2.5**	2.5	Attained	-
			CO3	Estimate statistical functions or parameters by selecting and implementing appropriate computational statistics techniques	3	2	2.4	**2.5**	2	3	3	**2.8**	**2.6**	2.5	Attained	-
			CO4	Evaluate the choice of applying a specific computational statistics technique to a given problem.	3	2	2.4	**2.5**	3	3	3	**3**	**2.6**	2.5	Attained	-
			CO5	Apply randomization techniques to extract information from large data sets.	1	2	2	**1.8**	2	2	2	**2**	**1.8**	2	Not Attained	Extra lab exercises, practice problems, remedial classes
			CO6	Generate graphical displays as a tool for analyzing both large data sets and computational statistics techniques.	2	2	2	**2**	3	3	2	**2.5**	**2.1**	2	Attained	-
Dr. Sanjeev Kumar Dwivedi	**AIDS 5th**	**Theory of Computation (2270523)**	**CO1**	explain the basic concepts of switching and finite automata theory & languages.	2.85	1.82	2.95	**2.6**	2.85	2.9	2.54	**2.7**	**2.6**	2	Attained	-
			CO2	relate practical problems to languages, automata, computability and complexity	2.7	1.82	2.65	**2.5**	2.5	2.75	2.46	**2.5**	**2.5**	2	Attained	-
			CO3	construct abstract models of computing and check their power to recognize the languages.	2.9	1	2.4	**2.2**	2.4	2.6	2.61	**2.6**	**2.3**	2	Attained	-
			CO4	analyze the grammar, its types, simplification and normal form	2.65	1	2.3	**2.1**	2.75	2.6	2.5	**2.6**	**2.2**	2	Attained	-
			CO5	interpret rigorously formal mathematical methods to prove properties of languages, grammars and automata	2.75	1.57	2.2	**2.2**	2.5	2.3	2.43	**2.4**	**2.2**	2	Attained	-
			CO6	develop an overview of how automata theory, languages and computation are applicable in engineering applications.	1	1	1	**1**	1	1	2.36	**1.7**	**1.1**	1	Attained	-
Dr. Shubha Mishra	**AIDS 5th**	**Data Mining & Warehousing (2270521)**	**CO1**	Explain basics of data mining and data warehousing	2.8	2.6	2.3	**2.5**	2.7	2.9	2.7	**2.8**	**2.6**	2	Attained	-
			CO2	classify database systems and data models / schemas of data warehouses	2.3	2.3	2.4	**2.4**	2.8	3	2.5	**2.7**	**2.5**	2	Attained	-
			CO3	compare methods for storing & retrieving data from different data sources/repositories	2.6	2.4	2	**2.3**	2.1	2.5	2.3	**2.3**	**2.3**	2	Attained	-
			CO4	apply data mining techniques for knowledge extraction from large amounts of data	2.5	2.6	2.3	**2.4**	2.3	2.8	2.7	**2.6**	**2.4**	2	Attained	-
			CO5	predict trends to make informed decisions.	2.8	2.7	2.6	**2.7**	2.2	2.9	2.5	**2.5**	**2.7**	2	Attained	-

Centre for Artificial Intelligence

CO attainment with Gap Analysis and action taken (AIR, AIDS and AIML) for July-Dec. 2024

					Direct Attainment				Indirect Attainment							
Faculty Name	**Branch & Semester**	**Cource name & Code**		**Course Outcome Statements**	**CO attainment levels from Quiz/ Assignment**	**CO attainment Levels from Mid Sem (Avg. of mid sem I & II)**	**CO attainment Levels from End Sem**	**CO direct attainment levels**	**CO indirect attainment Levels from End Smester Seminar**	**CO indirect attainment Levels from one minute paper writing**	**CO indirect attainment Levels from CO Feedback**	**CO indirect attainment levels**	**Overall CO attainment**	**Target (To be set for Overall CO Attainment)**	**Attained/not attained**	**Action taken for Not Attained**
			CO6	develop real world applications using data mining techniques	2.4	2.2	2.4	**2.4**	2.5	2.8	2.4	**2.5**	**2.4**	2	Attained	-
Dr. Shweta Chauhan	**AIDS 5th**	**Soft Computing Techniques (2270525)**	**CO1**	define basic concepts of neural networks and fuzzy systems.	3	2.8	2.8	**2.9**	3	3	2.1	**2.6**	**2.8**	2.5	Attained	-
			CO2	compare solutions by applying various soft computing approaches on a given problem	2.4	2.6	2.6	**2.6**	2.8	3	2.4	**2.7**	**2.6**	2.5	Attained	-
			CO3	develop and train different supervised and unsupervised learning.	3	2.6	2.4	**2.6**	2.8	2.8	2.4	**2.6**	**2.6**	2.5	Attained	-
			CO4	classify various nature inspired algorithms according to their application aspect	2.4	2.5	2.6	**2.5**	3	2.6	2.5	**2.7**	**2.5**	2.5	Attained	-
			CO5	compare the efficiency of various hybrid systems	2.8	2.7	2.8	**2.8**	3	3	2.7	**2.9**	**2.8**	2.5	Attained	-
			CO6	design a soft computing model for solving real world problems	2.8	2.4	2.4	**2.8**	2.7	2.5	2.6	**2.6**	**2.8**	2.5	Attained	-
Dr. Neeraj Mishra / (Dr. Bhagat Singh Raghuvanshi)	**AIR 3rd**	**Robot Kinematics (3240323)**	**CO1**	illustrate the significance, social impact and future prospects of robotics and automation in various engineering applications.	2.2	2	2.5	**2.3**	2.2	2.3	2.5	**2.4**	**2.3**	2.3	Attained	-
			CO2	describe the components and anatomy of robotic systems and basics of robotics.	2.3	2.4	2.6	**2.5**	2.3	2.3	2.6	**2.5**	**2.5**	2.4	Attained	-
			CO3	explain different motions of a robotic system through kinematic modeling.	2.1	2.3	2.6	**2.4**	2.2	2.5	3	**2.7**	**2.5**	2.5	Attained	-
			CO4	employ a suitable path planning of end-effectors for a given robotics application.	2.6	2.2	2.5	**2.5**	2.4	2.4	3	**2.7**	**2.5**	2.5	Attained	-
			CO5	develop the dynamic model for a robot manipulator.	2.6	2.5	2.3	**2.4**	2.5	2.5	3	**2.8**	**2.5**	2.5	Attained	-
			CO6	apply robotic control to solve real-world industrial problems.	2.8	2.2	2.2	**2.4**	2.5	2.3	2.6	**2.5**	**2.4**	2.4	Attained	-
Dr. Rahul Kumar	**AIR 3rd**	**Probability and Random Process (3250106)**	**CO1**	Interpret the theory of Probability and its distributions	2.5	2.7	2.3	**2.5**	2.5	2.5	2.7	**2.8**	**2.6**	2.5	Attained	-
			CO2	Evaluate the Skewness, Kurtosis, curve fitting, correlation and regression	2	2.3	2.4	**2.4**	2.5	3	2.5	**2.7**	**2.5**	2.5	Attained	-
			CO3	Analyze the test of hypothesis	2.5	2.4	2	**2.3**	2.5	2.5	2.3	**2.3**	**2.3**	2	Attained	-
			CO4	Acquire the knowledge of random variables	2.5	2.6	2.3	**2.4**	2.5	2.8	2.7	**2.6**	**2.4**	2	Attained	-
			CO5	Determine the random process	2.5	2.7	2.7	**2.7**	2.5	2.9	2.5	**2.5**	**2.7**	2.5	Attained	-
			CO6					**0**				**0**	**0**		Please Set Target	-
Dr. Shipra Shukla	**AIR 3rd**	**Design and Analysis of Algorithms (3240321)**	**CO1**	demonstrate a familiarity with major algorithms and data structures.	2.8	2.9	2.3	**2.6**	3	3	3	**3**	**2.7**	2.5	Attained	-
			CO2	identify important algorithmic design paradigms and methods of analysis.	2.5	2.3	2.3	**2.4**	3	3	3	**3**	**2.5**	2.5	Attained	-
			CO3	analyze the performance of algorithms.	2.8	2.3	2.1	**2.3**	2.4	2.3	3	**2.7**	**2.4**	2.3	Attained	-
			CO4	compare various algorithm design techniques.	2.5	2.4	2.4	**2.4**	2.7	3	3	**2.9**	**2.5**	2.5	Attained	-
			CO5	select the design technique to solve any real world problem.	2.7	2.5	2.6	**2.6**	2.7	2.3	3	**2.8**	**2.6**	2.5	Attained	-
			CO6	design efficient algorithm using various design techniques.	2.4	2.2	2.3	**2.3**	3	2.8	3	**3**	**2.4**	2.2	Attained	-
Mr. Ashish Singh	**AIR 3rd**	**Python Programming (3240322)**	**CO1**	define basics syntax and features of python programming language	3	3	3	**3**	3	3	3	**3**	**3**	2.7	Attained	-
			CO2	solve computational problems using python language.	3	3	2.5	**2.8**	3	2	2.5	**2.5**	**2.7**	2.5	Attained	-
			CO3	take part in online coding platforms.	2	2	2	**2**	2	2	3	**2.5**	**2.1**	2	Attained	-
			CO4	inspect the python program for errors.	3	3	3	**3**	3	3	2.5	**2.8**	**3**	2.5	Attained	-
			CO5	design a program using the features of object oriented concepts.	3	3	3	**3**	2	3	3	**2.8**	**3**	2.7	Attained	-
			CO6	construct the python code for real world problem using the libraries.	2	2	3	**2.5**	2	2	2	**2**	**2.4**	2.2	Attained	-
Ms. Aditi Samadhiya	**AIR 3rd**	**Operating Systems (3240324)**	**CO1**	illustrate the basic concepts of operating systems.	3	3	3	**3**	3	3	2	**2.5**	**2.9**	2	Attained	-
			CO2	explain the working procedure of operating systems.	2	3	2	**2.3**	2	2	2	**2**	**2.2**	2	Attained	-
			CO3	analyze various operating system problems and issues.	3	3	3	**3**	2	3	3	**2.8**	**3**	2.5	Attained	-
			CO4	develop the solutions for various operating system problems and issues.	2	2	2	**2**	2	3	2	**2.3**	**2.1**	2	Attained	-
			CO5	evaluate the performance of various scheduling and allocating techniques.	3	2	2	**2.3**	2	2	2	**2**	**2.2**	2	Attained	-

Centre for Artificial Intelligence

CO attainment with Gap Analysis and action taken (AIR, AIDS and AIML) for July-Dec. 2024

					Direct Attainment				Indirect Attainment							
Faculty Name	**Branch & Semester**	**Cource name & Code**		**Course Outcome Statements**	**CO attainment levels from Quiz/ Assignment**	**CO attainment Levels from Mid Sem (Avg. of mid sem I & II)**	**CO attainment Levels from End Sem**	**CO direct attainment levels**	**CO indirect attainment Levels from End Smester Seminar**	**CO indirect attainment Levels from one minute paper writing**	**CO indirect attainment Levels from CO Feedback**	**CO indirect attainment levels**	**Overall CO attainment**	**Target (To be set for Overall CO Attainment)**	**Attained/not attained**	**Action taken for Not Attained**
			CO6	test the working of various scheduling and aloocating techniques.	2	2	2	**2**	2	2	2	**2**	**2**	2	Attained	-
Dr. Bhagat S. Raghuwanshi	**AIML 3rd**	**Computer Networks (3280324)**	**CO1**	explain the fundamental concepts of computer networks.	2	3	2	**2.3**	3	2	2	**2.3**	**2.3**	2	Attained	-
			CO2	illustrate the basic taxonomy & terminologies of computer networks.	3	3	3	**3**	3	2	2	**2.3**	**2.9**	2.5	Attained	-
			CO3	identify various parameters for affecting the performance of computer networks	3	2	3	**2.8**	2	3	3	**2.8**	**2.8**	2.5	Attained	-
			CO4	analyze the concepts of communication using various layers of the OSI model.	3	2	3	**2.8**	3	3	3	**3**	**2.8**	2.5	Attained	-
			CO5	evaluate the performance of computer networks in congestion and the Internet.	1	2	2	**1.8**	2	2	2	**3**	**2**	2	Attained	-
			CO6	design the network environment and applications for implementation of computer networking concepts.	2	2	2	**2**	3	3	2	**2.5**	**2.1**	2	Attained	-
Dr. Rahul Kumar	**AIML 3rd**	**Probability and Random Process (3250106)**	**CO1**	Interpret the theory of Probability and its distributions	2.5	2.7	2.3	**2.5**	2.5	2.9	2.7	**2.8**	**2.6**	2.5	Attained	-
			CO2	Evaluate the Skewness, Kurtosis, curve fitting, correlation and regression	2	2.3	2.4	**2.4**	2.5	3	2.5	**2.7**	**2.5**	2.5	Attained	-
			CO3	Analyze the test of hypothesis	2.5	2.4	2	**2.3**	2.5	2.5	2.3	**2.3**	**2.3**	2	Attained	-
			CO4	Acquire the knowledge of random variables	2.5	2.6	2.3	**2.4**	2.5	2.8	2.7	**2.6**	**2.4**	2	Attained	-
			CO5	Determine the random process	2.5	2.7	2.7	**2.7**	2.5	2.9	2.5	**2.5**	**2.7**	2.5	Attained	-
			CO6					**0**				**0**	**0**		Please Set Target	-
Dr. Shipra Shukla	**AIML 3rd**	**Design and Analysis of Algorithms (3280321)**	**CO1**	demonstrate a familiarity with major algorithms and data structures.	2.7	2.6	2.2	**2.4**	3	3	3	**3**	**2.5**	2.5	Attained	-
			CO2	identify important algorithmic design paradigms and methods of analysis.	2.4	2.2	2.4	**2.4**	3	3	3	**3**	**2.5**	2.5	Attained	-
			CO3	analyze the performance of algorithms.	2.8	2.3	2	**2.3**	2.3	2.5	3	**2.7**	**2.4**	2.3	Attained	-
			CO4	compare various algorithm design techniques.	2.5	2.6	2.4	**2.5**	2.8	3	3	**3**	**2.6**	2.5	Attained	-
			CO5	select the design technique to solve any real world problem.	2.7	2.4	2.8	**2.7**	2.7	2.2	3	**2.7**	**2.7**	2.5	Attained	-
			CO6	design efficient algorithm using various design techniques.	2.5	2.2	2.3	**2.3**	3	3	3	**3**	**2.4**	2.2	Attained	-
Mr. Ashish Singh	**AIML 3rd**	**Python Programming (3280322)**	**CO1**	define basics syntax and features of python programming language	3	3	3	**3**	3	3	3	**3**	**3**	2.7	Attained	-
			CO2	solve computational problems using python language.	3	3	2.5	**2.8**	3	2	2.5	**2.5**	**2.7**	2.5	Attained	-
			CO3	take part in online coding platforms.	2	2	2	**2**	2	2	3	**2.5**	**2.1**	2	Attained	-
			CO4	inspect the python program for errors.	3	3	3	**3**	3	3	2.5	**2.8**	**3**	2.5	Attained	-
			CO5	design a program using the features of object oriented concepts.	3	3	3	**3**	2	3	3	**2.8**	**3**	2.7	Attained	-
			CO6	construct the python code for real world problem using the libraries.	2	2	3	**2.5**	2	2	2	**2**	**2.4**	2.2	Attained	-
Mr. Ramnaresh Sharma	**AIML 3rd**	**Database Management System (3280323)**	**CO1**	demonstrate the concepts of different types of database systems.	3	3	2	**2.5**	3	3	2	**2.5**	**2.5**	2.5	Attained	-
			CO2	apply relational algebra concepts to design database systems	2	2	2	**2**	2	3	2	**2.3**	**2.1**	2	Attained	-
			CO3	make use of queries to design and access database systems	3	2	2	**2.3**	1	3	2	**2**	**2.2**	2	Attained	-
			CO4	analyze the evaluation of transaction processing and concurrency control	3	2	2	**2.3**	3	2	2	**2.3**	**2.3**	2	Attained	-
			CO5	determine the normal form of the relation	3	3	3	**3**	3	3	3	**3**	**3**	2.5	Attained	-
			CO6	design a ER diagram/database system for a real world application	3	2	2	**2.3**	3	2	2	**2.3**	**2.3**	2.2	Attained	-
Dr. Bhagat S. Raghuwanshi	**AIDS 3rd**	**Computer Networks (3270324)**	**CO1**	explain the fundamental concepts of computer networks.	2	3	2	**2.3**	3	2	2	**2.3**	**2.3**	2	Attained	-
			CO2	illustrate the basic taxonomy & terminologies of computer networks.	3	3	3	**3**	3	2	2	**2.3**	**2.9**	2.5	Attained	-
			CO3	identify various parameters for affecting the performance of computer networks	3	2	2.5	**2.5**	2	3	3	**2.8**	**2.6**	2.5	Attained	-

Centre for Artificial Intelligence

CO attainment with Gap Analysis and action taken (AIR, AIDS and AIML) for July-Dec. 2024

					Direct Attainment				Indirect Attainment							
Faculty Name	**Branch & Semester**	**Cource name & Code**		**Course Outcome Statements**	**CO attainment levels from Quiz/ Assignment**	**CO attainment Levels from Mid Sem (Avg. of mid sem I & II)**	**CO attainment Levels from End Sem**	**CO direct attainment levels**	**CO indirect attainment Levels from End Smester Seminar**	**CO indirect attainment Levels from one minute paper writing**	**CO indirect attainment Levels from CO Feedback**	**CO indirect attainment levels**	**Overall CO attainment**	**Target (To be set for Overall CO Attainment)**	**Attained/not attained**	**Action taken for Not Attained**
			CO4	analyze the concepts of communication using various layers of the OSI model.	3	2	3	**2.8**	3	3	3	**3**	**2.8**	2.5	Attained	-
			CO5	evaluate the performance of computer networks in congestion and the Internet.	1	2	2	**1.8**	2	2	2	**3**	**2**	2	Attained	-
			CO6	design the network environment and applications for implementation of computer networking concepts.	2	2	2	**2**	3	3	2	**2.5**	**2.1**	2	Attained	-
Dr. Mir Shahnawaz Ahmad	**AIDS 3rd**	**Design and Analysis of Algorithms (3270321)**	**CO1**	demonstrate a familiarity with major algorithms and data structures	2.8	2.7	2.3	**2.5**	2.7	2.9	2.7	**2.8**	**2.6**	2.5	Attained	-
			CO2	identify important algorithmic design paradigms and methods of analysis.	2.3	2.3	2.4	**2.4**	2.8	3	2.5	**2.7**	**2.5**	2.5	Attained	-
			CO3	analyze the performance of algorithms.	2.7	2.4	2	**2.3**	2.1	2.5	2.3	**2.3**	**2.3**	2	Attained	-
			CO4	compare various algorithm design techniques.	2.5	2.6	2.3	**2.4**	2.3	2.8	2.7	**2.6**	**2.4**	2	Attained	-
			CO5	select the design technique to solve any real world problem.	2.8	2.7	2.7	**2.7**	2.2	2.9	2.5	**2.5**	**2.7**	2.2	Attained	-
			CO6	design efficient algorithm using various design techniques	2.4	2.2	2.4	**2.4**	2.5	2.8	2.4	**2.5**	**2.4**	2	Attained	-
Dr. Rahul Kumar	**AIDS 3rd**	**Probability and Random Process (3250106)**	**CO1**	Interpret the theory of Probability and its distributions	2.5	2.7	2.3	**2.5**	2.5	2.9	2.7	**2.8**	**2.6**	2.5	Attained	-
			CO2	Evaluate the Skewness, Kurtosis, curve fitting, correlation and regression	2	2.3	2.4	**2.4**	2.5	3	2.5	**2.7**	**2.5**	2.5	Attained	-
			CO3	Analyze the test of hypothesis	2.5	2.4	2	**2.3**	2.5	2.5	2.3	**2.3**	**2.3**	2	Attained	-
			CO4	Acquire the knowledge of random variables	2.5	2.6	2.3	**2.4**	2.5	2.8	2.7	**2.6**	**2.4**	2	Attained	-
			CO5	Determine the random process	2.5	2.7	2.7	**2.7**	2.5	2.9	2.5	**2.5**	**2.7**	2.5	Attained	-
			CO6												Please Set Target	-
Mr. Ramnaresh Sharma	**AIDS 3rd**	**Database Management System (3270323)**	**CO1**	demonstrate the concepts of different types of database systems.	3	2	2	**2.3**	3	3	2	**2.5**	**2.3**	2.2	Attained	-
			CO2	apply relational algebra concepts to design database systems	2	2	2	**2**	2	2	2	**2**	**2**	2	Attained	-
			CO3	make use of queries to design and access database systems	3	2	2	**2.3**	2	3	2	**2.3**	**2.3**	2	Attained	-
			CO4	analyze the evaluation of transaction processing and concurrency control	3	2	2	**2.3**	3	2	2	**2.3**	**2.3**	2.2	Attained	-
			CO5	determine the normal form of the relation	3	3	3	**3**	3	3	3	**3**	**3**	2.5	Attained	-
			CO6	design a ER diagram/database system for a real world application	3	2	2	**2.3**	2	3	2	**2.3**	**2.3**	2.2	Attained	-
					Excellent (3)	**Very Good (2)**	**Good (1)**									
				Attainment Levels	**70%**	**60%**	**50%**									

Total CO Attainment = 80% of Direct CO Attainment + 20% of Indirect CO Attainment

ANNEXURE-VI

Curriculum Feedback from various Stakeholders, its Analysis and Impact Report for the Courses Taught in B. Tech. III, V, VII Semester [Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning] (July-December 2024 Session)

Action Taken on Student Feedback of Course Curriculum: July-Dec 2024

Based on the feedback data received from total **416** students (3rd, 5th and 7th semester of AIDS, AIML and AIR) for the academic session July-Dec 2024, following points have been analysed:

- It has been observed that, majority of the students of AIML, AIDS and AIR (3rd, 5th and 7th semester) are strongly agreed, some of the students are agreed and none 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 should be one course on Probability Statistics for ML needs to be added so that it would be easier to meet current needs
    II. There is a need to remove Exception handling, loops, File handling of text in Python Programming needs to be removed
    III. Remove the Anova in Probability and Random Process
    IV. Course content of Robot Operating System needs to be updated.

The above mentioned suggestions were analysed by respective course committees and the actions taken for each is given in the below table.

COURSE CURRICULUM FEEDBACK (by Students on MOODLE)

(Responses to Student Feedback Comments)

Branch/ Semester	Subject Name	Student Feedback (Comments)		Response to student comments/ Analysis
AIDS 3rd Semester	Probability and Random Process (3250106)	**Mention the course / contents which in your opinion is outdated & needs to be removed.**	Anova Topic	This topic is useful in understanding the basic concept of hypothesis testing
		Name course / contents which needs to be updated.	Statistical Tool	The suggestions have been forwarded to the relevant course committee for further action.
		Is any new course required to meet current needs?	Probability Statistics for ML	Already part of syllabus and will cover in upcoming semester
	Python Programming (3270322)	**Mention the course / contents which in your opinion is outdated & needs to be removed.**	Exception handling, loops part, Eng environment, FIle handling of text	This topic is useful in understanding the basic concept of Programming
		Name course / contents which needs to be updated.	If else statements part, file handling, Libraries	The suggestions have been forwarded to the relevant course committee for further action.
		Is any new course required to meet current needs?	CP in python, Machine learning in python, PYTHON LIBRARIES like Numpy, pandas, seaburn etc.	Already part of syllabus and will cover in upcoming semester
		(i) Honours:	C programming and assembly language or data structure	The suggestions have been forwarded to the relevant course committee for further action.

		(ii) Minor specialization:	Cyber security, Data science	Suggested course is a core category course and cannot be added to Minor specialization.
		(III) Departmental electives:	Software Engineering, Computer vision	Already part of syllabus and will cover in upcoming semester
		(iv) Open electives:	Digital Marketing, Business Analytics	The suggestions have been forwarded to the relevant course committee for further action.
	Database Management System (3270323)	**(i) Honours:**	Artificial intelligence and machine learning, computer vision	Suggested course is a core category course and cannot be added to Honours
		(ii) Minor specialization:	Data science, Cyber security	Suggested course is a core category course
		(III) Departmental electives:	Computer Graphics, Algorithm for data science	The suggestions have been forwarded to the relevant course committee for further action.
		(iv) Open electives:	Business Analytics, Creative writing	The suggestions have been forwarded to the relevant course committee for further action.
AIML 3rd Semester	**Probability and Random Process (3250106)**	**Mention the course / contents which in your opinion is outdated & needs to be removed.**	Anova Topic	This topic is useful in understanding the basic concept of hypothesis testing
		Name course / contents which needs to be updated.	Statistical Tool	The suggestions have been forwarded to the relevant course committee for further action.

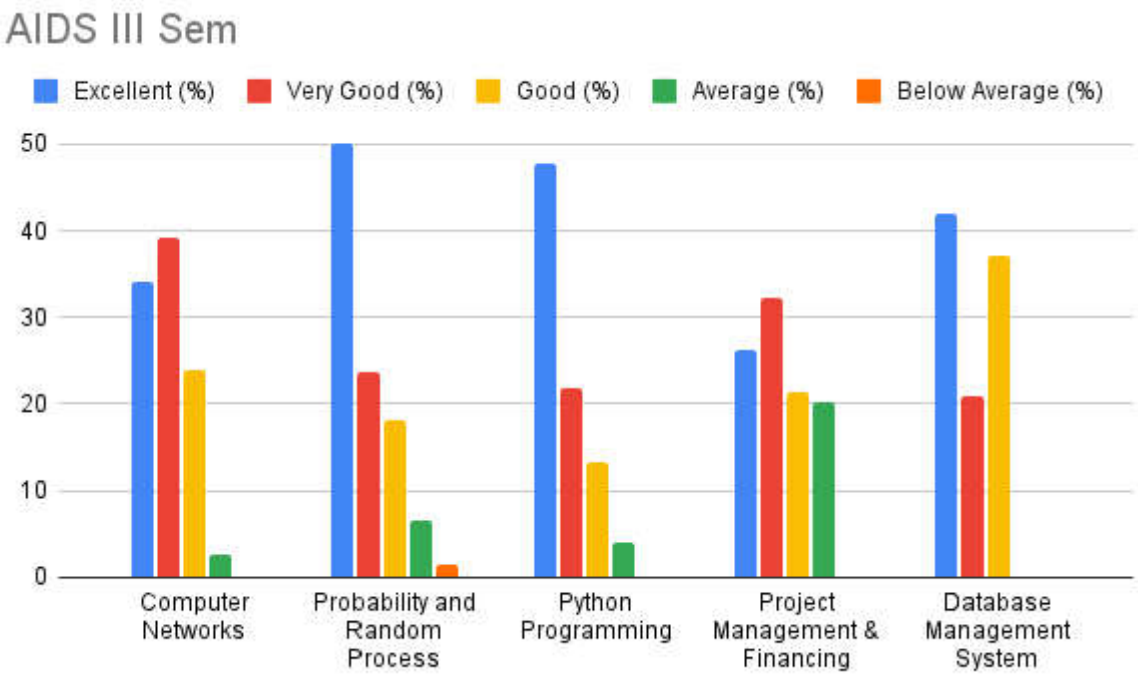
		Is any new course required to meet current needs?	Probability Statistics for ML	Already part of syllabus and will cover in upcoming semester
	Database Management System (3280323)	**(i) Honours:**	Artificial Intelligence	Suggested course is a core category course
		(ii) Minor specialization:	Introduction to Machine Learning	Suggested course is a core category course
		(III) Departmental electives	Data Analytics with Python	The suggestions have been forwarded to the relevant course committee for further action.
AIR 5th Sem	**Robot Operating System (2240524)**	**Mention the course / contents which in your opinion is outdated & needs to be removed.**	I guess this course needs to be more structured	The suggestions have been forwarded to the relevant course committee for further action.

Course-wise Analysis of Curriculum Feedback by Students (3rd Semester)

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

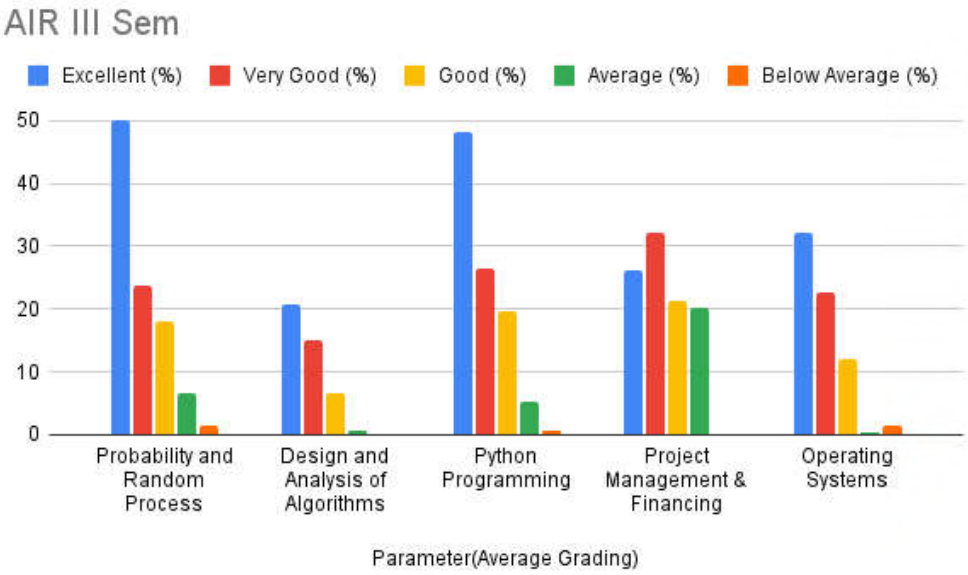
Artificial intelligence and Data Science 3rd Semester							
Subject code/name	**1 .The course is well designed**	**2. The units are balanced**	**3. The learning material was available to you**	**4. The content was clear and easy to understand**	**5.The course was relevant and updated for present needs**	**6.The course meets your career expectations**	**7. The course will be useful to meet your higher studies/future aspirations.**
Computer Networks (3270324)	3.89	4.03	4	3.96	4.11	4.07	4.28
Probability and Random Process (3250106)	4.17	4.13	4.17	4.10	4.13	4.06	4.23
Python Programming (3270322)	4.16	4.07	4.22	4.20	4.10	4.10	4.19
Project Management & Financing (1000005)	3.42	3.92	3.67	3.75	3.66	3.58	3.50
Database Management System (3270323)	4	4.04	4.04	4.17	4	4.06	4.02

Artificial intelligence and Data Science 3rd Semester								
Parameter(Average Grading)				Excellent (%)	Very Good (%)	Good (%)	Average (%)	Below Average (%)
Subject Code	Subject Name	Semester	Faculty Name					
3270324	Computer Networks	3	Dr. Bhagat Singh Raghuwanshi	34.18	39.29	23.98	2.55	0.00
3250106	Probability and Random Process	3	Dr. Rahul Kumar	50.00	23.81	18.10	6.67	1.43
3270322	Python Programming	3	Dr. Vibha tiwari	47.83	21.74	13.25	4.14	0
1000005	Project Management & Financing	3	Pof. Khemchand Shakywar	26.19	32.14	21.43	20.24	0.00
3270323	Database Management System	3	Pof. Ramnaresh Sharma	41.96	20.83	37.20	0.00	0.00



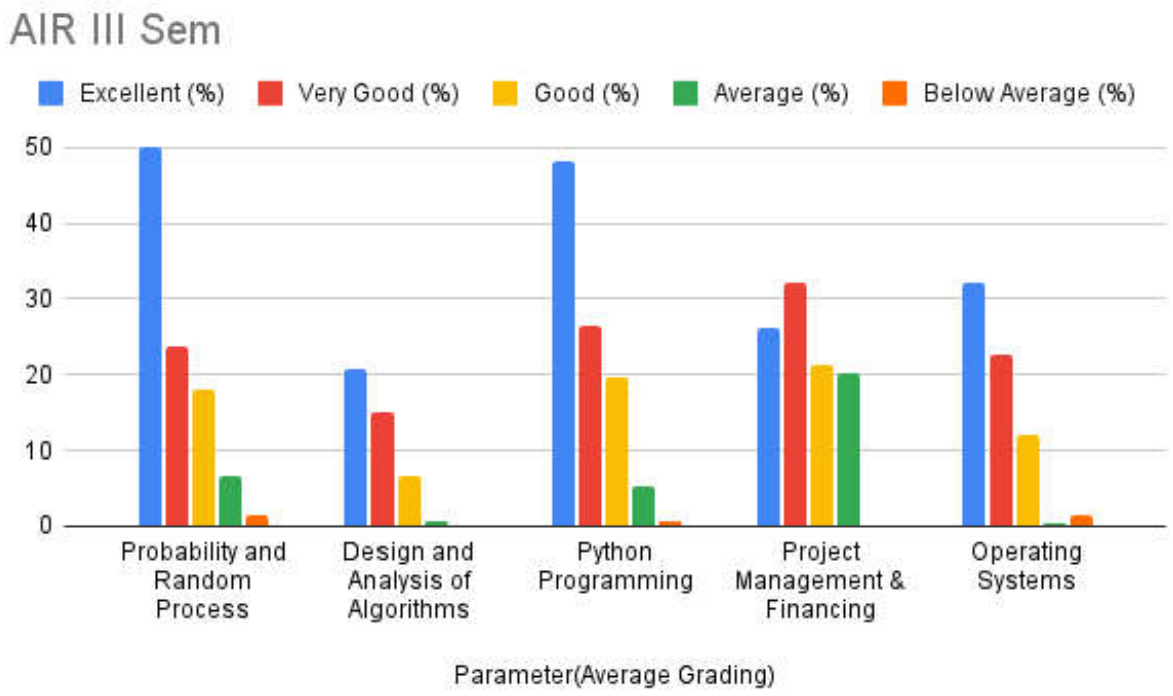
Artificial intelligence and Machine Learning 3rd Semester							
Subject code/name	**1 .The course is well designed**	**2. The units are balanced**	**3. The learning material was available to you**	**4. The content was clear and easy to understand**	**5.The course was relevant and updated for present needs**	**6.The course meets your career expectations**	**7. The course will be useful to meet your higher studies/future aspirations .**
Computer Networks (3280324)	4.11	4.23	4.23	4.08	4.19	4.19	4.30
Probability and Random Process (3250106)	4.17	4.13	4.17	4.10	4.13	4.07	4.23
Design and Analysis of Algorithms (3280321)	4.00	3.96	4.04	4	3.92	4.04	4.04
Python Programming (3280322)	3.54	3.69	3.77	3.77	3.62	3.77	3.69
Database Management System (3280323)	3.69	3.84	3.84	3.84	3.84	3.88	3.88
Project Management & Financing (1000005)	3.7	3.7	3.4	3.5	3.5	3.4	3.6

Artificial intelligence and Machine Learning 3rd Semester								
Parameter(Average Grading)				Excellent (%)	Very Good (%)	Good (%)	Average (%)	Below Average (%)
Subject Code	Subject Name	Semester	Faculty Name					
3280324	Computer Networks	3	Dr. Bhagat Singh Raghuwanshi	40.11	34.62	28.57	22.53	0.00
3250106	Probability and Random Process	3	Dr. Rahul Kumar	50.00	23.81	18.10	6.67	1.43
3280321	Design and Analysis of Algorithms	3	Dr. Shipra Shukla	16.01	15.02	9.11	3.45	0.00
3280322	Python Programming	3	Prof.Ashish Singh	35.16	23.08	17.58	24.18	0.00
3280323	Database Management System	3	Prof. Ramnaresh Sharma	25.45	32.14	42.41	0.00	0.00
1000005	Project Management & Financing	3	Ms. Poojatripathi	26.00	37.00	34.00	3.00	0.00



Artificial intelligence and Robotics 3rd 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 .**
Probability and Random Process (3250106)	4.17	4.13	4.17	4.1	4.13	4.07	4.23
Design and Analysis of Algorithms (3240321)	4.28	4.16	4.24	4.28	4.36	4.28	4.44
Python Programming (3240322)	4.11	4.15	4.29	4.15	4.15	4.04	4.26
Project Management & Financing (1000005)	3.42	3.92	3.67	3.75	3.67	3.58	3.5
Operating Systems (3240324)	4.12	4.17	4.2	4.17	4.2	4.25	4.37

Artificial intelligence and Robotics 3rd Semester								
Parameter(Average Grading)				Excellent (%)	Very Good (%)	Good (%)	Average (%)	Below Average (%)
Subject Code	Subject Name	Semester	Faculty Name					
3250106	Probability and Random Process	3	Dr.Rahul Kumar	50.00	23.81	18.10	6.67	1.43
3240321	Design and Analysis of Algorithms	3	Dr. Shipra Shukla	20.69	15.02	6.65	0.74	0.00
3240322	Python Programming	3	Prof.Ashish Singh	48.15	26.46	19.58	5.29	0.53
1000005	Project Management & Financing	3	Prof. Khemchand Shakyawar	26.19	32.14	21.43	20.24	0.00
3240324	Operating Systems	3	Prof. Aditi Samadhiya	32.27	22.66	12.07	0.49	1.48

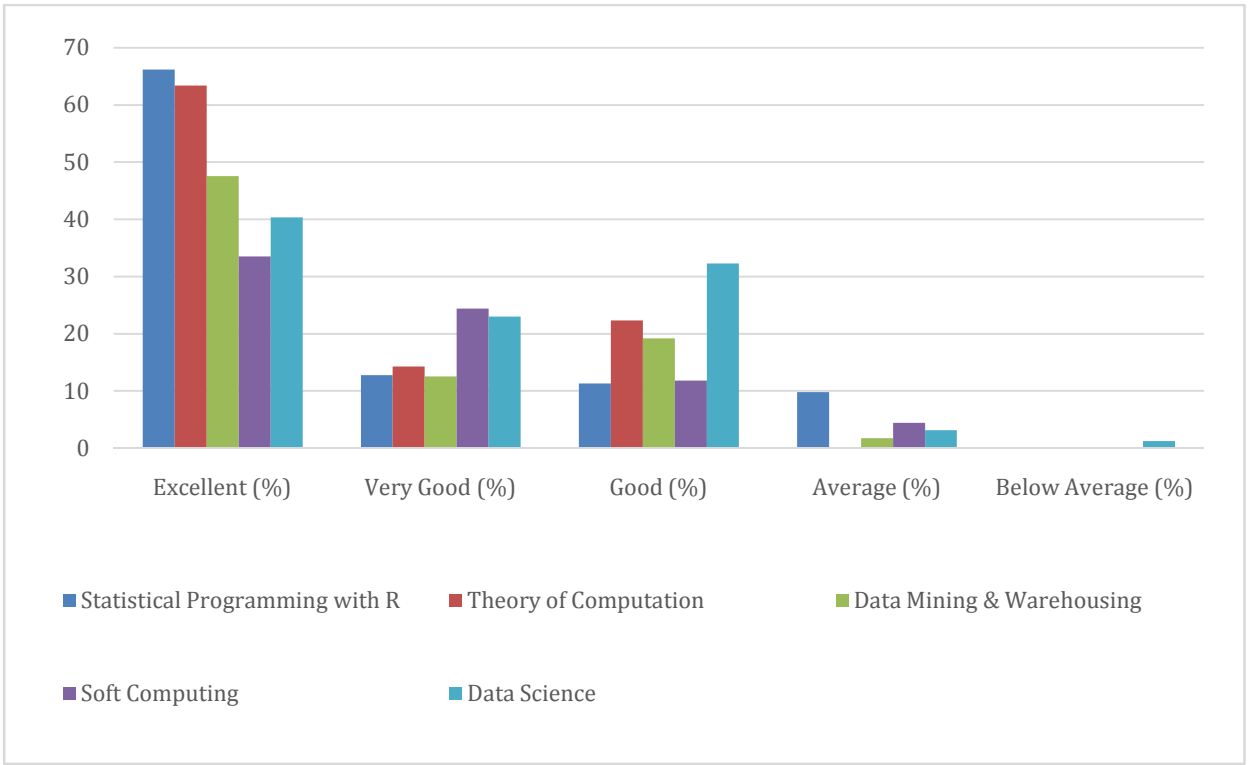


Course-wise Analysis of Curriculum Feedback by Students (5th Semester)

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

Artificial intelligence and Data Science 5th 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 .**
Statistical Programming with R (2270524)	4.42	4.37	4.37	4.37	4.32	4.32	4.32
Theory of Computation (2270523)	4.31	4.38	4.38	4.44	4.56	4.50	4.31
Data Mining & Warehousing (2270521)	4.30	4.28	4.34	4.32	4.32	4.30	4.30
Soft Computing Techniques (2270525)	4.14	4.09	4.16	4.19	4.21	4.16	4.26
Data Science (2270522)	4	3.9	4.1	4	4	4	3.9

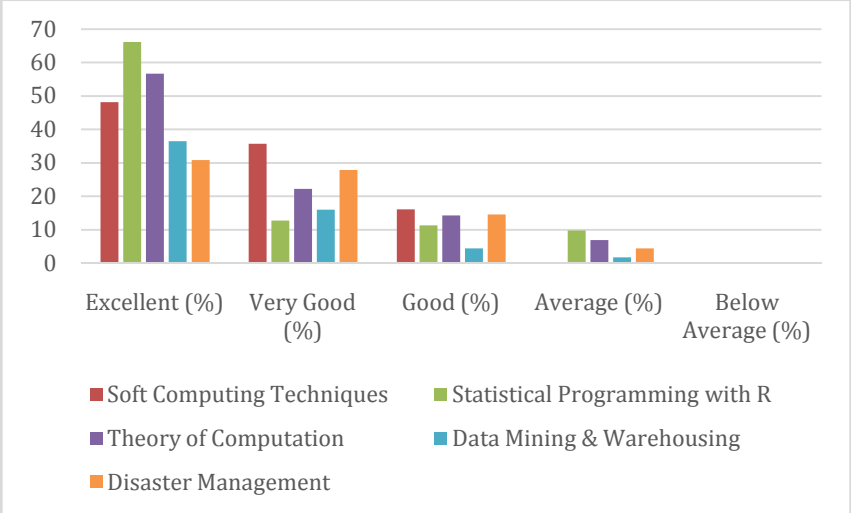
Artificial intelligence and Data Science 5th Semester								
Parameter(Average Grading)				Excellent (%)	Very Good (%)	Good (%)	Average (%)	Below Average (%)
Subject Code	Subject Name	Semester	Faculty Name					
Statistical Programming with R (2270524)	Statistical Programming with R	5	Dr. Neelam Arya	66.17	12.78	11.28	9.77	0.00
Theory of Computation (2270523)	Theory of Computation	5	Dr. Sanjeev Kumar Dwivedi	63.39	14.29	22.32	0.00	0.00
Data Mining& Warehousing (2270521)	Data Mining & Warehousing	5	Dr. Shubha Mishra	47.54	12.56	19.21	1.72	0.00
Soft Computing Techniques (2270525)	Soft Computing	5	Dr. Shweta Chauhan	33.50	24.38	11.82	4.43	0.00
Data Science (2270522)	Data Science	5	Dr. Sunil Shukla	40.37	22.98	32.3	3.11	1.24



AIDS 5th Semester

Artificial intelligence and Machine Learning 5th 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 .**
Soft Computing Techniques (2280525)	4.25	4.375	4.375	4.375	4.25	4.375	4.25
Statistical Programming with R (2280524)	4.46	4.50	4.46	4.46	4.42	4.42	4.46
Theory of Computation (2280523)	4.31	4.21	4.28	4.34	4.28	4.34	4.24
Data Mining & Warehousing (2280521)	4.56	4.50	4.56	4.53	4.44	4.35	4.47
Disaster Management (1000006)	4.02	4.07	4.07	4.09	4.04	4.18	4.20

Artificial intelligence and Machine Learning 5th Semester								
Parameter(Average Grading)				Excellent (%)	Very Good (%)	Good (%)	Average (%)	Below Average (%)
Subject Code	Subject Name	Semester	Faculty Name					
Soft Computing Techniques (2280525)	Soft Computing Techniques	5	Dr. Hardev Singh Pal	48.21	35.71	16.07	0.00	0.00
Statistical Programming with R (2280524)	Statistical Programming with R	5	Dr. Neelam Arya	66.17	12.78	11.28	9.77	0.00
Theory of Computation (2280523)	Theory of Computation	5	Dr. Sanjeev Kumar Dwivedi	56.65	22.17	14.29	6.90	0.00
Data Mining & Warehousing (2280521)	Data Mining & Warehousing	5	Dr. Shubha Mishra	36.45	16.01	4.43	1.72	0.00
Disaster Management (1000006)	Disaster Management	5	Dr. Shweta Chauhan	30.79	27.83	14.53	4.43	0.00

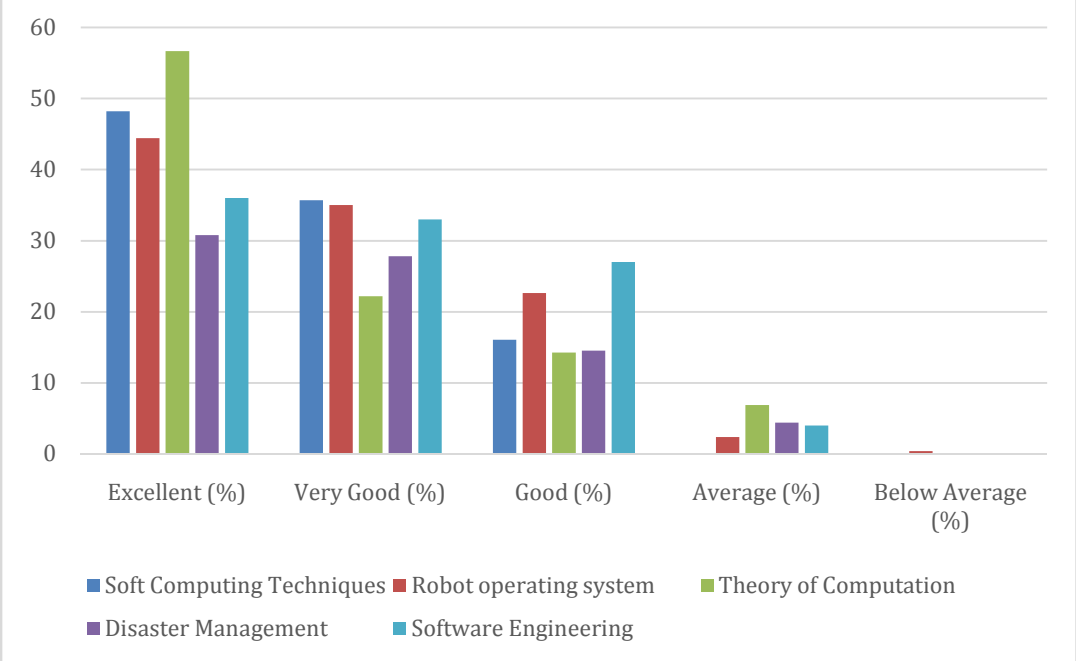


AIML 5th Semester

Artificial intelligence and Robotics 5th 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.**
Soft Computing Techniques (2240525)	4.25	4.375	4.375	4.375	4.25	4.375	4.25
Robot Operating System (2240524)	4.17	4.08	4.11	4.11	4.11	4.25	4.28
Theory of Computation (2240523)	4.31	4.21	4.28	4.34	4.28	4.34	4.24
Disaster Management (1000006)	4.02	4.07	4.07	4.09	4.04	4.18	4.20
Software Engineering (2240521)	3.7	3.7	3.4	3.5	3.5	3.4	3.6

Artificial intelligence and Robotics 5th Semester								
Parameter(Average Grading)				**Excellent (%)**	**Very Good (%)**	**Good (%)**	**Average (%)**	**Below Average (%)**
Subject Code	**Subject Name**	**Semester**	**Faculty Name**					
Soft Computing Techniques (2240525)	Soft Computing Techniques	5	Dr. Hardev Singh Pal	48.21	35.71	16.07	0.00	0.00

Robot Operating System (2240524)	Robot operating system	5	Dr. Pawan Dubey	44.44	35.02	22.62	2.38	0.40
Theory of Computation (2240523)	Theory of Computation	5	Dr. Sanjeev Kumar Dwivedi	56.65	22.17	14.29	6.90	0.00
Disaster Management (1000006)	Disaster Management	5	Dr. Shweta Chauhan	30.79	27.83	14.53	4.43	0.00
Software Engineering (2240521)	Software Engineering	5	Ms. Pooja Tripathi	36.00	33.00	27.00	4.00	0.00



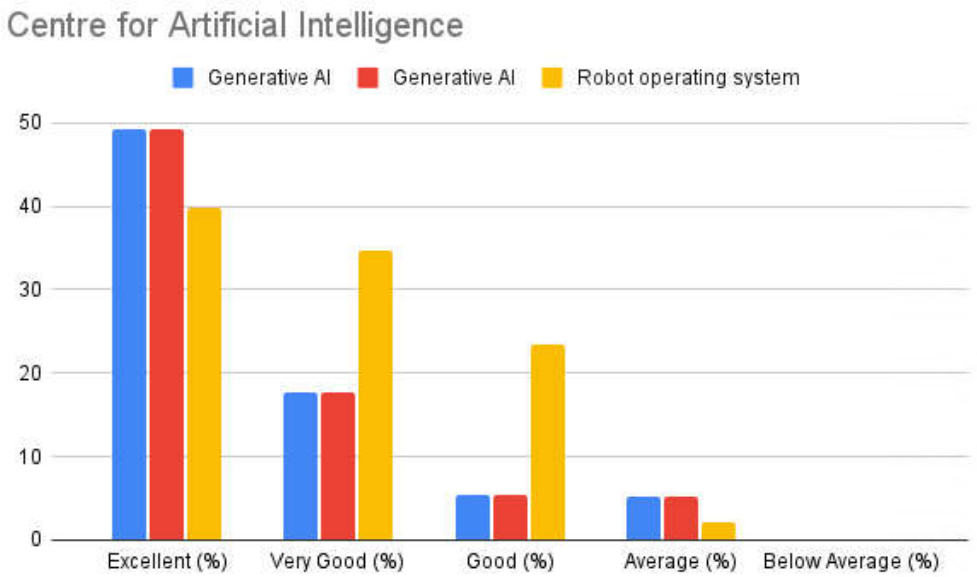
AIR 5th Semester

Course-wise Analysis of Curriculum Feedback by Students (7th Semester)

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

AIDS/AIML/AIR 7th 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**
Generative AI (270731)	4.49	4.42	4.44	4.40	4.38	4.47	4.42
Generative AI (280731)	4.49	4.42	4.44	4.40	4.38	4.47	4.42
Robot Operating System (240731)	4.14	4.14	3.93	4	4.14	4.21	4.28

AIDS/AIML/AIR 7th Semester								
Parameter(Average Grading)				**Excellent (%)**	**Very Good (%)**	**Good (%)**	**Average (%)**	**Below Average (%)**
Subject Code	**Subject Name**	**Semester**	**Faculty Name**					
Generative AI (270731)	Generative AI	7	Dr. Shweta Chauhan	49.26	17.73	5.42	5.17	0.00
Generative AI (280731)	Generative AI	7	Dr. Shweta Chauhan	49.26	17.73	5.42	5.17	0.00
Robot Operating System (240731)	Robot operating system	7	Dr. Pawan Dubey	39.80	34.69	23.47	2.04	0.00



AIDS/AIML/AIR 7th Semester

Course Curriculum feedback by faculty (July-Dec.-2024)

Analysis and Action Taken on Faculty Feedback of Course Curriculum: July-Dec 2024

Based on the feedback data received from **23** faculty members (3rd, 5th and 7th semester of AIML, AIDS and AIR) for the academic session July-Dec 2024, following was analysed:

As per the suggestions/feedback responses of faculty members, it clearly shows that most of the faculty members are satisfied with the course content, curriculum/syllabus and other related parameters. The curriculum is capable of inculcating lifelong learning abilities in students. Syllabus is updated as per the recent trends and also with respect to industry demand.

Analysis Report

S.No.	Faculty Name	Subject Name / Subject Code	1.The availability of books & E-learning material in the institute is good. (Please give your opinion)	2. The Courses and content are up to date. Please suggest if you feel any new course(s) need to be introduced to meet current needs & technological changes?	3. The course curriculum/syllabi are helpful in meeting the higher studies/ placement requirements according to present global trends. (Please give suggestions if any)	4. The course / contents in your domain/area are well designed and frequently updated, hence need no changes at present. [If you feel some changes (new content to be added or outdated content to be removed) are needed, please suggest]	5. The curriculum is capable of inculcating life-long learning abilities in students. (Any suggestions, please give below)
1	Prof. Ashish Singh	Project Management & Financing (1000005)	4	4	4	5	4
2	Prof. Pooja Tripathi	Project Management & Financing (1000005)	4	4	4	4	4
3	Prof. Khemchand Shakywar	Project Management & Financing (1000005)	5	4	5	4	4
4	Dr. Vibha Tiwari	Disaster Management (1000006)	3	5	5	5	5
5	Dr. Shweta Chauhan	Disaster Management	5	4	4	4	4

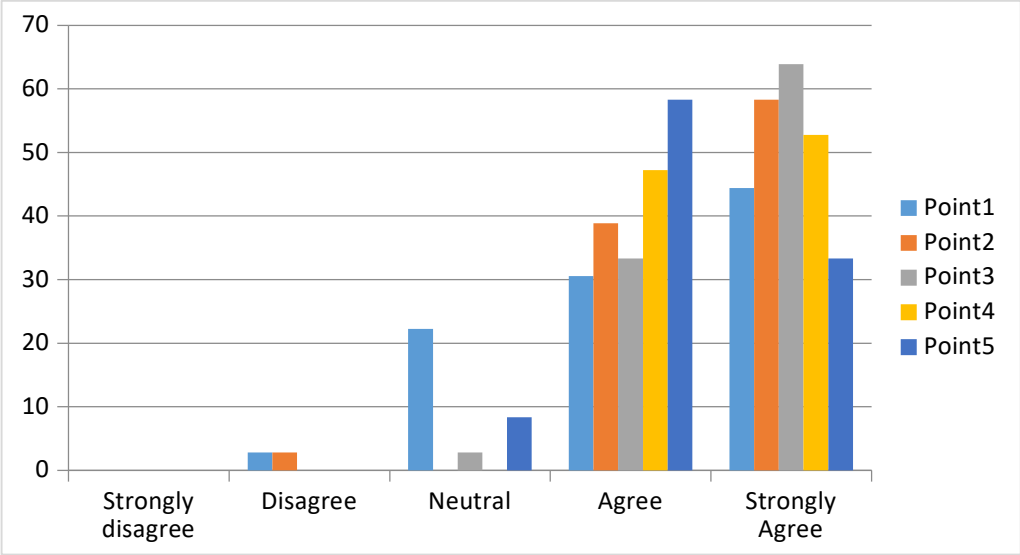
		(1000006)					
6	Prof. Geetika Hazra	Universal Human Values & Professional Ethics (1000008)	3	5	5	4	5
7	Prof. Aditi Samadhiya	Universal Human Values & Professional Ethics (1000008)	4	5	5	5	5
8	Prof. Pooja Tripathi	Software Engineering (2240521)	4	4	4	5	4
9	Dr. Abhishek Bhatt	Data Science(2240522)	5	5	5	5	5
10	Dr. Sanjeev Kumar Dwivedi	Theory of Computation (2240523)	5	5	5	5	4
11	Dr. Pawan Dubey	Robot Operating System (2240524)	3	5	4	4	4
12	Dr. Hardev Singh Pal	Soft Computing Techniques (2240525)	4	5	5	4	4
13	Dr. Shubha Mishra	Data Mining & Warehousing (2270521)	5	4	4	4	4
14	Dr. Sunil Kumar Shukla	Data Science (2270522)	4	4	5	4	3
15	Dr. Sanjeev Kumar Dwivedi	Theory of Computation (2270523)	5	5	5	5	4
16	Dr. Neelam Arya	Statistical Programming with R (2270524)	3	4	4	4	4

17	Dr. Hardev Singh Pal	Soft Computing Techniques (2270525)	5	4	3	4	4
18	Dr. Shweta Chauhan	Soft Computing Techniques (2270525)	4	4	5	4	4
19	Dr. Shubha Mishra	Data Mining & Warehousing (2280521)	5	2	4	4	4
20	Dr. Sunil Kumar Shukla	Data Science (2280522)	4	4	5	4	4
21	Dr. Sanjeev Kumar Dwivedi	Theory of Computation (2280523)	5	5	5	5	4
22	Dr. Neelam Arya	Statistical Programming with R (2280524)	2	4	4	4	4
23	Dr. Pawan Dubey	Robot Operating System (240731)	5	5	5	5	5
24	Dr. Neeraj Mishra	Humanoid Robotics (240732)	3	5	5	5	5
25	Dr.Shweta Chauhan	Generative AI (270731/280731)	5	5	5	5	5
26	Dr. Tej Singh	Pattern Recognition (270732/280732)	5	5	5	5	5
27	Dr Shipra Shukla	Design and Analysis of Algorithms (3240321)	4	5	5	5	5
28	Prof.Ashish Singh	Python Programming (3240322)	5	5	5	5	4

29	Dr. Neeraj Mishra	Robot Kinematics (3240323)	3	5	5	5	5
30	Prof. Aditi Samadhiya	Operating Systems (3240324)	3	5	4	5	5
31	Dr. Vibha Tiwari	Python Programming (3270322)	3	5	5	5	5
32	Prof. Ramnaresh Sharma	Database Management System (3270323)	5	5	5	4	4
33	Dr. Bhagat Singh Raghuwanshi	Computer Networks (3270324)	4	4	4	4	3
34	Dr Shipra Shukla	Design and Analysis of Algorithms (3280321)	5	5	5	5	4
35	Prof. Ashish Singh	Python Programming (3280322)	5	5	5	5	4
36	Dr. Bhagat Singh Raghuwanshi	Computer Networks (3280324)	4	4	4	4	3

Course Satisfaction Index (CSI) (on scale of 5) (5:Strongly Agree, 4:Agree, 3:Neutral, 2:Disagree, 1:Strongly disagree)

	Response in %				
Curriculum Evaluation Point	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1.The availability of books & E- learning material in the institute is good. (Please give your opinion) ***[Point-1]***	0.00	2.78	22.22	30.56	44.44
2. The Courses and content are up to date. Please suggest if you feel any new course(s) need to be introduced to meet current needs & technological changes ***[Point-2]***	0.00	2.78	0.00	38.89	58.33
3. The course curriculum/syllabi are helpful in meeting the higher studies/placement requirements according to present global trends. (Please give suggestions if any) ***[Point-3]***	0.00	0.00	2.78	33.33	63.89
4. The course / contents in your domain/area are well designed and frequently updated, hence need no changes at present.[If you feel some changes (new content to be added or outdated content to be removed) are needed, please suggest] ***[Point-4]***	0.00	0.00	0.00	47.22	52.78
5. The curriculum is capable of inculcating life-long learning abilities in students. (Any suggestions, please give below) ***[Point-5]***	0.00	0.00	8.33	58.33	33.33



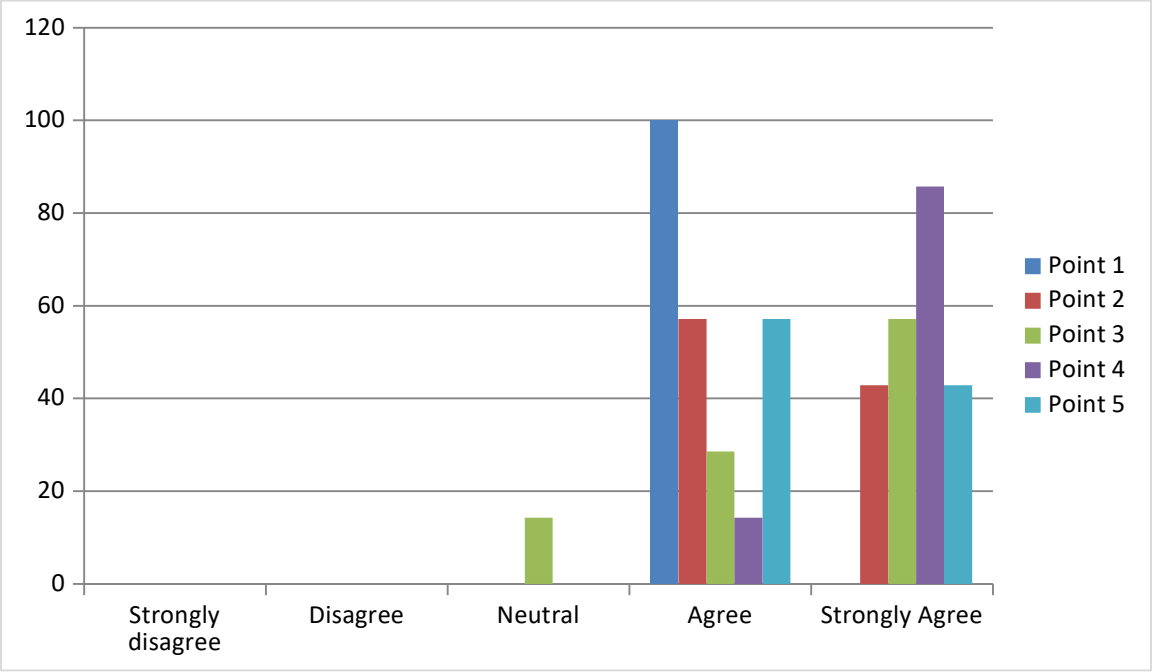
Course Curriculum feedback by Employer (July 2024-June-2025)

Action Taken:
As per the suggestions/feedback responses of employers, it clearly shows that most of the employers are satisfied with the course content, curriculum/syllabus and other related parameters. The curriculum is capable of inculcating technical knowledge, ability to explore new areas, ethical behaviour and social responsibility and team spirit. Syllabus is updated as per the recent trends and also with respect to industry demand.

Analysis Report

S.No.	1. Technical knowledge and contribution is at a good level	2. Ability to learn new areas, engage in professional development and adopt to technology changes	3. Deserves to be promoted/ has potential for elevation to higher level	4. Shows ethical behavior and social responsibility	Demonstrates ability to work well on a team
1	4	5	4	5	5
2	4	4	3	5	4
3	4	4	5	5	4
4	4	5	5	5	5
5	4	4	5	5	4
6	4	5	5	5	5
7	4	4	4	4	4
Employer Satisfaction Index (ESI) (on scale of 5) (5:Strongly Agree, 4:Agree, 3:Neutral, 2:Disagree, 1:Strongly disagree)					

	Response in %				
Employer Satisfaction Index	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1. Technical knowledge and contribution is at a good level ***[Point-1]***	0	0	0	100	0
2. Ability to learn new areas, engage in professional development and adopt to technology changes ***[Point-2]***	0	0	0	57.14	42.86
3. Deserves to be promoted/ has potential for elevation to higher level ***[Point-3]***	0	0	14.29	28.57	57.14
4. Shows ethical behavior and social responsibility ***[Point-4]***	0	0	0	14.29	85.71
5. Demonstrates ability to work well on a team ***[Point-5]***	0	0	0	57.14	42.86



Employer Satisfaction Survey

Feedback on Course & Curriculum

S.N.	1. Your employee (our alumni) demonstrates good knowledge of recent industrial trends and developments in the field	2.The course being offered at MITS and the contents delivered here are up to date	3. Please suggest an area/name catering to your specific requirement
1	Yes	Yes	GenAI, LLMs
2	Yes	Yes	Need some improvement on programming basics
3	Yes	Yes	-
4	Yes	Yes	Automation
5	Yes	Yes	-
6	Yes	Yes	Hands on practical for Cloud Computing & Artificial Intelligence
7	Yes	Yes	-

Alumni Feedback (IT-AIR Batch 2020-21) [Sample Size: 32]