SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

B.Tech – Artificial Intelligence and Data Science
&
M.Tech-Artificial Intelligence and Data Science

Minutes of 7th Board of Studies Meeting

Venue
GD Hall, Placement Office
Sri Manakula Vinayagar Engineering College
Madagadipet, Puducherry – 605 107

Date & Time
04.03.2024 & 11.00 AM Onwards

The Seventh Board of Studies meeting for Department of Artificial Intelligence and Data Science was held on 4th March 2024 at 11:00 A.M in the GD Hall, Training and Placement Cell, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting.

Sl. No.	Name of the Member	Designation
1. Head of the Department concerned (Chairperson)		
1	**Dr. J. Madhusudanan, M.E., Ph.D.,** Professor and Head Specialization: Ubiquitous and Edge Computing Years of Experience: 22 years Sri ManakulaVinayagar Engineering College hodaids@smvec.ac.in **+91 90037 39274**	Chairman
2. All faculty members of the Department		
2	Dr. M.Auxilia. Associate professor Specialization: Cloud Computing, Deep Learning Years of Experience:19 years Sri Manakula Vinayagar Engineering College auxiliaaids@smvec.ac.in 9994276112	Member Secretary
3	Dr.S.S. Boomiga Associate Professor, Specialization: IoT, Edge Computing	Member
4	Mr. K.Pragash, Assistant Professor, Specialization:Artificial Intelligence	Member
5	Mr. R.Rajan, Assistant Professor, Specialization: Machine Learning	Member
6	Mr.K.Muthukumaran, assistant Professor Specialization: Cloud Security	Member
7	Mrs. M.Maragadhavalli Meenakshi,Assistant Professor, Specialization: Data Science, Deep Learning	Member
8	Mrs. T. Geethalakshmi, Assistant Professor, Specialization: Machine Learning	Member
9	Ms.T,Shivaeeshwary, Assistant Professor, Specialization: Smart Computing	Member
10	Ms. S.Aishwarya Assistant Professor, Specialization: Machine Learning	Member

11	Mrs.S. Lakshmipriya, Assistant Professor, Specialization: Robotic Process Automation	Member
12	Mrs.P. Kanchanadevi, Assistant Professor, Specialization: Machine Learning, IoT	Member
13	Mrs.A.Ilakkiya Assistant Professor, Specialization: Smart Computing	Member
14	Mrs. V. Selvi, Assistant Professor Specialization: AI & ML	Member
15	Mrs.A. Keerthika, Assistant Professor Specialization:	Member
16	Mrs. N.Jayapratha, Assistant Professor Specialization: Networking	Member
17	Mrs. Subashini M, Assistant Professor Specialization:Wireless Communication	Member
18	Dr. M. Ganesan, Professor Specialization: Internet of Things	Member
19	Dr. T. Gayathri,Professor, Department of Maths,	Member
20	Dr. L. Martin,Associate Professor Department of Mechanical Engineering	Member
21	Dr. D. Jaichitra, Professor, Department of English, SMVEC	Member
22	Dr. T. Jayavarthanan, Professor Department of Physics	Member
3. Two subject experts from outside the Parent University are nominated by the Academic Council.		
23a	Dr.R.Srinivasa Perumal Professor SCOPE Vellore Institute of Technology, Chennai 8870537819 Mail id: r.srinivasaperumal@vit.ac.in	Subject Expert
23b	Dr. N. Bhalaji M.E., Ph.D Principal Rajalakshmi Institute of Technology (An Autonomous Instituition) Chennai Ph:95000 86801 Mail id: bhalajin@ssn.edu.in	Subject Expert
4. One expert is nominated by the Vice-Chancellor from a panel of six recommended by the Autonomous College Principal as a University Nominee.		
24	Dr.N.Sreenath Professor Department of CSE Puducherry Technological University Puducherry Ph: 9443289642 Mail id: nsreenath@ptuniv.edu.in	University Nominee
5. One representative from industry/corporate sector/allied areasis nominated by the Principal as a Industry Nominee.		
25	Mr. E. Marie Joseph Antony Patrick Lead Software Engineer Freshworks Chennai	Industry Expert

	Ph: 9677488961 Mail id: patrick.ernest@freshworks.com	
6. One member of the College alumni is nominated by the Principal.		
26	Ms. Madhu Srinvasan Engineer Director EMIS Health India Pvt. Ltd. Chennai Ph:99942 69567 Mail id: madhu_anusri@hotmail.com	Alumni
7. Experts from outside the Autonomous College, whenever special courses of studies are to be formulated, nominated by the Principal.		
27	Dr. V. Prasanna Venkatesan Professor Department of Banking Technology School of Management Pondicherry University prasanna.btm@pondiuni.edu.in +91 94887 34883	Member

AGENDA OF THE MEETING

1. To Apprise about Preamble of the College
2. To Apprise about College Highlights such as Infrastructure Facilities, Centre of Excellence, Idea Lab, Research and Development, Training and Placements, Accreditation details, etc.,
3. To Apprise about the Achievements of College and Department.
4. To Apprise about the Composition of Governing body, Academic Council and Finance Committee as per UGC Regulation 2018 and 2023
5. To Apprise about the Composition of Previous Board of Studies as per UGC Regulation 2018 and Details of Previous meetings held.
6. To Apprise about the Composition of New Board of Studies as per UGC Regulation 2023.
7. To Apprise about the Highlights of R-2020 Regulations, Curriculum and Syllabus
8. To Apprise about the Suggestions Received from previous meetings of BoS, Curriculum Advisory Committee and Stake holders for Revision of R-2020 Regulations, Curriculum and Syllabus
9. To Apprise about the Suggestions Received from previous meetings of BoS, Curriculum Advisory Committee and Stake holders for Revision of R-2020 Regulations, Curriculum and Syllabus
10. To Apprise about the minutes of 6th meeting of BoS
11. To discuss the Syllabi of III and IV semesters, under Autonomous Regulations R-2023 for the B. Tech – AI & DS students admitted from the Academic Year 2023-24.
12. To discuss the Syllabus of course offered in IV semester for Honor Degree Programme.
13. To approve the Academic Calendar for the Even semester of Academic year 2023-24.
14. To approve the online SWAYAM / MOOCS courses for the III-year (Batch: 2021 – 2025) and IV-year (Batch: 2020 – 2024) students under R-2020 Regulations.
15. To approve the Professional and Open Elective courses offered to the II-year (Batch: 2022 – 2026), III-year (Batch: 2021 – 2025) and IV-year (Batch: 2020 – 2024) students under R-2020 Regulations.
16. To approve the Certification Courses offered to the II-year (Batch: 2022 – 2026), III-year (Batch: 2021 – 2025) students under R-2020 regulations and I Year (Batch: 2023 – 2027) Students under R-2023 regulations.
17. To apprise the Result Analysis for the Academic year 2023-24.

18. To Discuss and Recommend the Panel of Examiners to the Academic Council.
19. Any other additional points to be discussed with the permission of Chair.

Minutes of the Meeting

Dr. J. Madhusudanan, Chairman, BoS opened the meeting by welcoming and introducing the external members, to the internal and co-opted members and thanked them for accepting to become the member of the Board of Studies and the meeting thereafter deliberated on items that had been approved by the Chairman.

BoS/7/2024/ AD /UG/7.1	The BoS Chairman apprised about the preamble of the college
BoS/7/2024/AD /UG/7.2	The BoS Chairman apprised about College Highlights such as Infrastructure Facilities, Centre of Excellence, Idea Lab, Research and Development, Training and Placements, Accreditation details, etc.,
BoS/7/2024/AD /UG/7.3	The BoS Chairman apprised about the Achievements of College and Department. He portrayed the achievement of students in terms of co-curricular activities and placement records
BoS/7/2024/AD /UG/7.5	The BoS Chairman apprised about the Composition of Governing body, Academic Council and Finance Committee as per UGC Regulation 2018 and 2023
BoS/7/2024/AD /UG/7.5	The BoS Chairman apprised about the Composition of Previous Board of Studies as per UGC Regulation 2018 and Details of Previous meetings held.
BoS/7/2024/AD /UG/7.6	The BoS Chairman apprised about the Composition of New Board of Studies as per UGC Regulation 2023.
BoS/7/2024/AD /UG/7.7	The BoS Chairman apprised about the Highlights of R-2020 Regulations, Curriculum and Syllabus
BoS/7/2024/AD /UG/7.8	The BoS Chairman apprised about the Suggestions Received from previous meetings of BoS, Curriculum Advisory Committee and

	Stake holders for Revision of R-2020 Regulations, Curriculum and Syllabus
BoS/7/2024/AD /UG/7.9	The BoS Chairman apprised about the Regulations, Curriculum Structure and Approved Syllabus (I and II Semester) of R-2023. The syllabus was showcased to the BoS members and got concurrence and approval.
BoS/7/2024/AD /UG/7.10	The BoS Chairman apprised about the minutes of 6th meeting of BoS.
BoS/7/2024/AD /UG/7.11	The curriculum and syllabus of III and IV semesters, under Autonomous Regulations R-2023 for the B. Tech – AI & DS students admitted from the Academic Year 2023-24 have been approved with the following suggestions

Sl.No	Regulation	Semester	Subject Name with Code	Unit	Particulars
1	R-2023	III	Basic Machine Learning Techniques Laboratory U23ADP304	-	The expert members suggested to order the experiments according to the use of the basic machine learning models. The changes have been done based on their suggestions. Refer Annexure I and II
2	R-2023	IV	Computer Networks and Security U23ADDC01	-	The expert members are suggested to change the subject name as Computer Networks and Security. The changes have been incorporated. Refer Annexure I and II

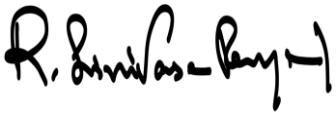
3	R-2023	IV	Linux Internals U23ADB402	I & III	The expert members have suggested to remove few topics related to semaphore and mutex from unit I and add those topics in unit III as they can be taught with respect to Linux OS. The suggestions have been incorporated. Refer Annexure I and II
4	R-2023	IV	Computer Networks and Security Laboratory U23ADP405	-	The expert members are suggested to change the subject name as Computer Networks and Security. The changes have been incorporated. Refer Annexure I and II
5	R-2023	IV	Advanced Machine Learning Techniques Laboratory U23ADP406	-	The expert members suggested to order the experiments according to the use of the basic machine learning models. The changes have been done based on their suggestions. Refer Annexure I and II

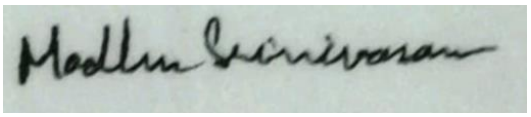
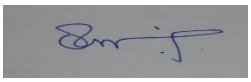
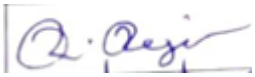
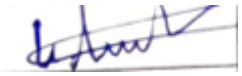
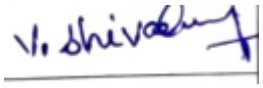
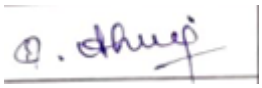
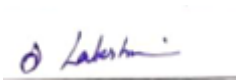
BoS/7/2024/AD /UG/7.12	The Syllabus of course offered in IV semester for Honour Degree programme has been approved by the expert members. The paper title and syllabus were appreciated by the members. Experts suggested to consider transferring of NPTEL / MOOC courses credits can be transferred. Refer Annexure I and II

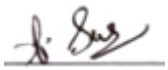
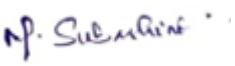
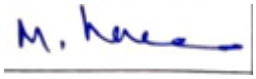
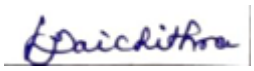
BoS/7/2024/ AD /UG/7.13	Academic Calendar for the Even semester of Academic year 2023-24 has been approved
BoS/7/2024/ AD /UG/7.14	The online SWAYAM / MOOCS courses for the III-year (Batch: 2021 – 2025) and IV-year (Batch: 2020 – 2024) students under R-2020 Regulations has been approved.
BoS / 7 / 2024 / AD / UG/7.15	The Professional and Open Elective courses offered to the II-year (Batch: 2022 – 2026), III-year (Batch: 2021 – 2025) and IV-year (Batch: 2020 – 2024) students under R-2020 Regulations have been approved.
BoS / 7 / 2024 / AD / UG/7.16	The Certification Courses offered to the II-year (Batch: 2022 – 2026), III-year (Batch: 2021 – 2025) students under R-2020 regulations and I Year (Batch: 2023 – 2027) Students under R-2023 regulations have been approved.
BoS / 7 / 2024 / AD / UG/7.17	The Result Analysis for the Academic year 2023-24 has been discussed.
BoS / 7 / 2024 / AD / UG/7.18	The Panel of Examiners has been shown and approved
BoS / 7 / 2024 / AD / UG/7.19	Professional elective papers for fourth semester have been approved by the experts. Other professional electives are suggested to be framed as domain specific buckets and the same can be submitted for approval in the upcoming BoS meetings. The equivalent papers of R-20 and R-23 have been explained to the board members and they approved it.

BoS/7/2024/ AD /PG/7.1	The BoS Chairman apprised the board regarding the minutes of 6th BoS
BoS/7/2024/AD /PG/7.2	The BoS Chairman apprised about the Highlights of R-2023 M.Tech Regulations.
BoS/7/2024/AD /PG/7.3	The BoS Chairman apprised about the curriculum of 1 to 4 Semesters
BoS/7/2024/AD /UG/7.4	The BoS Chairman apprised Third and Fourth Semester Syllabi and the expert members suggested the following corrections. 1. The professional elective papers can be organized in domain specific backets and syllabus can be fine-tuned. The suggestions are incorporated. Refer Annexure-III.
BoS/7/2024/AD /UG/7.5	The expert members approved the panel of examiners and also the project domains of M.Tech students.

The meeting was concluded at 2.15 PM with a vote of thanks by **Dr. J. Madhusudanan**, Head of Department, Artificial Intelligence and Data Science.

Sl. No.	Name of the Member	Designation	Signature
1	**Dr. J. Madhusudanan, M.E., Ph.D.,** Professor and Head Specialization: Ubiquitous and Edge Computing Years of Experience: 22 years Sri ManakulaVinayagar Engineering College hodaids@smvec.ac.in **+91 90037 39274**	Chairman	
2	Dr.N.Sreenath Professor Department of CSE Puducherry Technological University Puducherry Ph: 9443289642 Mail id: nsreenath@ptuniv.edu.in	University Nominee	
3	Dr.R.Srinivasa Perumal Professor SCOPE Vellore Institute of Technology, Chennai 8870537819 Mail id: r.srinivasaperumal@vit.ac.in	Subject Expert	
4	Dr. N. Bhalaji M.E., Ph.D Principal Rajalakshmi Institute of Technology (An Autonomous Instituition) Chennai Ph:95000 86801 Mail id: bhalajin@ssn.edu.in	Subject Expert	
5	Dr. V. Prasanna Venkatesan Professor Department of Banking Technology School of Management Pondicherry University prasanna.btm@pondiuni.edu.in +91 94887 34883	Member	
6	Mr. E. Marie Joseph Antony Patrick Lead Software Engineer Freshworks Chennai Ph:9677488961 Mail id: patrick.ernest@freshworks.com	Industry Expert	

7	Ms. Madhu Srinvasan Engineer Director EMIS Health India Pvt. Ltd. Chennai Ph:99942 69567 Mail id: madhu_anusri@hotmail.com	Alumni	
8	Dr. M. Auxilia. Associate professor Specialization: Cloud Computing, Deep Learning Years of Experience:19 years Sri Manakula Vinayagar Engineering College auxiliaaids@smvec.ac.in 9994276112	Member Secretary	
9	Dr.S.S. Boomiga Associate Professor, Specialization: IoT, Edge Computing	Member	
10	Mr. K.Pragash, Assistant Professor, Specialization:Artificial Intelligence	Member	
11	Mr. R.Rajan, Assistant Professor, Specialization: Machine Learning	Member	
12	Mr.K.Muthukumaran, assistant Professor Specialization: Cloud Security	Member	
13	Mrs. M.Maragadhavalli Meenakshi,Assistant Professor, Specialization: Data Science, Deep Learning	Member	
14	Mrs. T. Geethalakshmi, Assistant Professor, Specialization: Machine Learning	Member	
15	Ms.T,Shivaeeshwary, Assistant Professor, Specialization: Smart Computing	Member	
16	Ms. S.Aishwarya Assistant Professor, Specialization: Machine Learning	Member	
17	Mrs.S. Lakshmipriya, Assistant Professor, Specialization: Robotic Process Automation	Member	
18	Mrs.P. Kanchanadevi, Assistant Professor, Specialization: Machine Learning, IoT	Member	
19	Mrs.A.Ilakkiya Assistant Professor, Specialization: Smart Computing	Member	
20	Mrs. V. Selvi, Assistant Professor Specialization: AI & ML	Member	

21	Mrs.A. Keerthika, Assistant Professor Specialization:	Member	
22	Mrs. N.Jayapratha, Assistant Professor Specialization: Networking	Member	
23a	Mrs. Subashini M, Assistant Professor Specialization:Wireless Communication	Member	
23 b	Dr. M. Ganesan, Professor Specialization: Internet of Things	Member	
24	Dr. T. Gayathri,Professor, Department of Maths,	Member	
25	Dr. L. Martin,Associate Professor Department of Mechanical Engineering	Member	
26	Dr. D. Jaichitra, Professor, Department of English, SMVEC	Member	
27	Dr. T. Jayavarthanan, Professor Department of Physics	Member	

B.Tech and M.Tech Curriculum
R-2023

B.TECH CURRICULUM

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC01	Engineering Mathematics – I	BS	2	2	0	4	25	75	100
2	U23ESTC03	Basics of Electrical and Electronics Engineering	ES	3	2	0	3	25	75	100
3	U23CSTC01	Programming In C	ES	3	0	0	3	25	75	100
4	U23ADT101	Digital System Design	ES	3	0	0	3	25	75	100
5	U23ADT102	Fundamental of Data Science	PC	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ENBC01	Communicative English -I	HS	2	0	2	3	50	50	100
Practical										
7	U23CSPC01	Programming in C Laboratory	ES	0	0	2	1	50	50	100
8	U23ESPC03	Engineering Graphics using AutoCAD	ES	0	0	2	1	50	50	100
9	U23ADP101	Fundamental of Data Science Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Courses										
10	U23ADC1XX	Certification Course-I	AEC	0	0	4	0	100	-	100
Mandatory Course										
11	U23ADM101	Induction Programme	MC	2 Weeks			0	-	-	-
							22	425	575	1000

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC02	Engineering Mathematics – II	BS	2	2	0	4	25	75	100
2	U23BSTC01	Physical Science for Engineers	ES	2	2	0	3	25	75	100
3	U23ADTC01	Programming in Python	ES	3	0	0	3	25	75	100
4	U23CSTC03	Data Structures	ES	3	0	0	3	25	75	100
5	U23ADT203	Database Technologies	PC	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ENBC02	Communicative English -II	HS	2	0	2	3	50	50	100
Practical										
7	U23ESPC02	Design Thinking and Idea Lab	ES	0	0	2	1	50	50	100
8	U23ADPC01	Programming in Python Laboratory	ES	0	0	2	1	50	50	100
9	U23CSPC02	Data Structures Laboratory	ES	0	0	2	1	50	50	100
10	U23ADP202	Database Technologies Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Courses										
11	U23ADC2XX	Certification Course-II	AEC	0	0	4	0	100	-	100
Mandatory Course										
12	U23ADM202	Sports Yoga and NSS	MC	0	0	2	0	100	-	100
							23	575	625	1200

**** Certification Courses are to be selected from the list given in Annexure III***

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC03	Probability and Statistics	BS	2	2	0	4	25	75	100
2	U23ADT304	Software Engineering and Agile software Development	ES	3	0	0	3	25	75	100
3	U23ADT305	Artificial Intelligence & Expert System	PC	3	0	0	3	25	75	100
4	U23ADT306	Basic Machine Learning Techniques	PC	3	0	0	3	25	75	100
5	U23HSTC01	Universal Human Values-II	HS	3	0	0	2	25	75	100
Theory cum Practical										
6	U23ADB301	Design and Analysis of Algorithm	ES	2	0	2	3	50	50	100
Practical										
7	U23ENPC02	General Proficiency – I	HS	0	0	2	1	50	50	100
8	U23MAPC01	Engineering Mathematics Laboratory	BS	0	0	2	1	50	50	100
9	U23ADP303	Artificial Intelligence& Expert System Laboratory	PC	0	0	2	1	50	50	100
10	U23ADP304	Basic Machine Learning Techniques Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Courses										
11	U23ADC3XX	Certification Course-III	AEC	0	0	4	-	100	-	100
12	U23ADS301	Skill Enhancement Course-I*	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23ADM303	Climate Change	MC	0	0	2	-	100	-	100
							22	675	625	1300

SEMESTER – IV										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC05	Discrete Mathematics	BS	2	2	0	4	25	75	100
2	U23ADDC01	Computer Networks and Security	ES	3	0	0	3	25	75	100
3	U23ITTCO3	Programming in Java	ES	3	0	0	3	25	75	100
4	U23ADT408	Advanced Machine Learning Techniques	PC	3	0	0	3	25	75	100
5	U23ADE4XX	Professional Elective – I#	PE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ADB402	Linux Internals	ES	2	0	2	3	50	50	100
Practical										
7	U23ENPC02	General Proficiency – II	HS	0	0	2	1	50	50	100
8	U23ADP405	Computer Networks and Security Laboratory	ES	0	0	2	1	50	50	100
9	U23ITPCO3	Programming in Java Laboratory	ES	0	0	2	1	50	50	100
10	U23ADP406	Advanced Machine Learning Techniques Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Courses										
11	U23ADC4XX	Certification Course-IV	AEC	0	0	4	-	100	-	100
12	U23ADS402	Skill Enhancement Course-II	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23ADM404	Right to Information and Good Governance	MC	0	0	2	-	100	-	100
							23	675	625	1300

 # Professional Elective Courses are to be selected from the list given in Annexure I

****Skill Enhancement Courses (1 and 2) are to be selected from the list given in Annexure IV***

SEMESTER – V										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC02	Research Methodology	HS	2	0	0	2	25	75	100
2	U23ADT509	Cloud Computing and Architectures for Management of Large Datasets	PC	3	0	0	3	25	75	100
3	U23ADT510	Deep Learning	PC	3	0	0	3	25	75	100
4	U23ADT511	Data Visualization	PC	3	0	0	3	25	75	100
5	U23ADE5XX	Professional Elective – II	PE	3	0	0	3	25	75	100
6	U23ADO5XX	Open Elective – I	OE	3	0	0	3	25	75	100
Practical										
7	U23ADP507	Cloud Computing Architectures for Management of Large Datasets Laboratory	PC	0	0	2	1	50	50	100
8	U23ADP508	Deep Learning Laboratory	PC	0	0	2	1	50	50	100
9	U23ADP509	Data Visualization Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23ADW501	Micro project	PA	0	0	2	1	100	-	100
Ability Enhancement Courses										
11	U23ADC5XX	Certification Course-V	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23ADM505	Essence of Indian Traditional Knowledge	MC	0	0	2	-	100	-	100
							21	600	600	1200

SEMESTER – VI										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23ADT612	NLP and Chatbot	PC	3	0	0	3	25	75	100
2	U23ADT613	Robotic Process Automation – UI Path	PC	3	0	0	3	25	75	100
3	U23ADT614	Web Technology	PC	3	0	0	3	25	75	100
4	U23ADE6XX	Professional Elective – III	PE	3	0	0	3	25	75	100
5	U23ADO6XX	Open Elective – II $	OE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ADB603	Blockchain and Cryptography	PC	2	0	2	3	50	50	100
Practical										
7	U23ADP610	NLP and Chatbot Laboratory	PC	0	0	2	1	50	50	100
8	U23ADP611	Robotic Process Automation – UI Path Laboratory	PC	0	0	2	1	50	50	100
9	U23ADP612	Web Technology Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23ADW602	Mini project	PW	0	0	2	1	100		100
Ability Enhancement Course										
11	U23ADC6XX	Certification Course – VI	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23ADM606	Gender Equality	MC	0	0	2	-	100	-	100
							22	625	575	1200

$ Choose any one Open Elective Course from the list given in Annexure II

SEMESTER – VII										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23ADT715	Intelligent Systems and Control	PC	3	0	0	3	25	75	100
2	U23ADT716	IoT Systems and Analytics	PC	3	0	0	3	25	75	100
3	U23ADT717	Image Processing and Computer Vision	PC	3	0	0	3	25	75	100
4	U23ADE7XX	Professional Elective – IV	PE	3	0	0	3	25	75	100
5	U23ADO7XX	Open Elective – III	OE	3	0	0	3	25	75	100
Practical										
6	U23ADP713	Intelligent Systems and Control Laboratory	PC	0	0	2	1	50	50	100
7	U23ADP714	IoT Systems and Analytics Laboratory	PC	0	0	2	1	50	50	100
Project Work										
8	U23ADW703	Project Phase – I	PA	0	0	4	2	50	50	100
9	U23ADW704	Internship / In plant Training	PA	0	0	2	1	100	-	100
							20	375	525	900

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC03	Entrepreneurship and Business Management	HS	3	0	0	3	25	75	100
2	U23ADE8XX	Professional Elective – V	PE	3	0	0	3	25	75	100
3	U23ADE8XX	Professional Elective – VI	PE	3	0	0	3	25	75	100
Project Work										
4	U23ADW805	Project Phase – II	PA	0	0	16	8	50	100	150
							17	125	325	450

ANNEXURE - I

PROFESSIONAL ELECTIVE COURSES (18 CREDITS)

Sl. No.	Course Code	Course Title
Professional Elective – I (Offered in Semester IV)		
1	U23CSDC01	Automata and Compiler Design
2	U23ADE401	AI in Smart Cities
3	U23ADE402	Ethics In Data Science
4	U23ADE403	Genetic Algorithm
5	U23ADE404	User Experience Design
Professional Elective – II (Offered in Semester V) *		
1	U23ADE505	Advanced Java Programming
2	U23ADE506	Speech Processing and Analytics
3	U23ADE507	Web Frameworks
4	U23ADE508	Reinforcement Learning
5	U23ADE509	Network Security and Ethical Hacking
Professional Elective – III (Offered in Semester VI) *		
1	U23ADE610	R Programming
2	U23ADE611	Time Series Analysis and Forecasting
3	U23ADE612	App Development
4	U23ADE613	Optimization Techniques
5	U23ADE615	Cloud Services and Data Management
Professional Elective – IV (Offered in Semester VII) *		
1	U23CSEC01	Go Programming
2	U23ADE716	Exploratory Data Analysis
3	U23ADE717	Augmented Reality and Virtual Reality
4	U23ADE718	Quantum Computing / Industrial Robotics
5	U23ADE719	Cloud Automation Tools and Applications
Professional Elective – V (Offered in Semester VIII) *		
1	U23ADE820	Stream Processing
2	U23ADE821	Supply Chain Analytics
3	U23ADE822	Game Development
4	U23ADE823	AI and Embedded Systems
5	U23ADE824	Cloud – Based Machine Learning Platforms
Professional Elective – VI (Offered in Semester VIII) *		
1	U23ADE825	ML OPS
2	U23ADE826	Augmented Analytics
3	U23ADE827	Modern Cryptography
4	U23ADE828	Ethics and AI
5	U23ADE829	AI in E-commerce

ANNEXURE - II

OPEN ELECTIVE COURSES (09 CREDITS)

S. No	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective – I / Open Elective-II (Offered in Semester V/VI) (Offered in Semester V for **CSE, IT, MECH, Mechatronics, AI&DS**) (Offered in Semester VI for **EEE, ECE, ICE, CIVIL, BME, CCE, FT**)				
1	U23ADDC02	Principles of Artificial Intelligence and Machine Learning	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics
2	U23ADOCO2	Introduction to Data Science	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics
Open Elective – II (Offered in Semester VII)				
3	U23ADOC03	Data science Application of Vision	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE
4	U23ADOC04	Artificial Intelligence Applications	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics

ANNEXURE - III

ABILITY ENHANCEMENT COURSES-(A) CERTIFICATION COURSES

S. No	Course Code	Course Title	Certified By
1	U23XXCX01	Adobe Photoshop	Adobe
2	U23XXCX02	Adobe Animate	Adobe
3	U23XXCX03	Adobe Dreamweaver	Adobe
4	U23XXCX04	Adobe After Effects	Adobe
5	U23XXCX05	Adobe Illustrator	Adobe
6	U23XXCX06	Adobe InDesign	Adobe
7	U23XXCX07	Autodesk AutoCAD -ACU	Autodesk
8	U23XXCX08	Autodesk Inventor - ACU	Autodesk
9	U23XXCX09	Autodesk Revit - ACU	Autodesk
10	U23XXCX10	Autodesk Fusion 360 - ACU	Autodesk
11	U23XXCX11	Autodesk 3ds Max - ACU	Autodesk
12	U23XXCX12	Autodesk Maya - ACU	Autodesk
13	U23XXCX13	Cloud Security Foundations	AWS
14	U23XXCX14	Cloud Computing Architecture	AWS

15	U23XXCX15	Cloud Foundation	AWS
16	U23XXCX16	Cloud Practitioner	AWS
17	U23XXCX17	Cloud Solution Architect	AWS
18	U23XXCX18	Data Engineering	AWS
19	U23XXCX19	Machine Learning Foundation	AWS
20	U23XXCX20	Robotic Process Automation / Medical Robotics	Blue Prism
21	U23XXCX21	Advance Programming Using C	CISCO
22	U23XXCX22	Advance Programming Using C ++	CISCO
23	U23XXCX23	C Programming	CISCO
24	U23XXCX24	C++ Programming	CISCO
25	U23XXCX25	CCNP Enterprise: Advanced Routing	CISCO
26	U23XXCX26	CCNP Enterprise: Core Networking	CISCO
27	U23XXCX27	Cisco Certified Network Associate - Level 2	CISCO
28	U23XXCX28	Cisco Certified Network Associate- Level 1	CISCO
29	U23XXCX29	Cisco Certified Network Associate- Level 3	CISCO
30	U23XXCX30	Fundamentals Of Internet of Things	CISCO
31	U23XXCX31	Internet Of Things / Solar and Smart Energy System with IoT	CISCO
32	U23XXCX32	Java Script Programming	CISCO
33	U23XXCX33	NGD Linux Essentials	CISCO
34	U23XXCX34	NGD Linux I	CISCO
35	U23XXCX35	NGD Linux II	CISCO
36	U23XXCX36	Advance Java Programming	Ethnotech
37	U23XXCX37	Android Programming / Android Medical App Development	Ethnotech
38	U23XXCX38	Angular JS	Ethnotech
39	U23XXCX39	Catia	Ethnotech
40	U23XXCX40	Communication Skills for Business	Ethnotech
41	U23XXCX41	Coral Draw	Ethnotech
42	U23XXCX42	Data Science Using R	Ethnotech
43	U23XXCX43	Digital Marketing	Ethnotech
44	U23XXCX44	Embedded System Using C	Ethnotech
45	U23XXCX45	Embedded System with IOT / Arduino	Ethnotech
46	U23XXCX46	English For IT	Ethnotech
47	U23XXCX47	Plaxis	Ethnotech
48	U23XXCX48	Sketch Up	Ethnotech
49	U23XXCX49	Financial Planning, Banking and Investment Management	Ethnotech

50	U23XXCX50	Foundation Of Stock Market Investing	Ethnotech
51	U23XXCX51	Machine Learning / Machine Learning for Medical Diagnosis	Ethnotech
52	U23XXCX52	IOT Using Python	Ethnotech
53	U23XXCX53	Creo (Modelling & Simulation)	Ethnotech
54	U23XXCX54	Soft Skills, Verbal, Aptitude	Ethnotech
55	U23XXCX55	Software Testing	Ethnotech
56	U23XXCX56	MX-Road	Ethnotech
57	U23XXCX57	CLO 3D	Ethnotech
58	U23XXCX58	Solid works	Ethnotech
59	U23XXCX59	Staad Pro	Ethnotech
60	U23XXCX60	Total Station	Ethnotech
61	U23XXCX61	Hydraulic Automation	Festo
62	U23XXCX62	Industrial Automation	Festo
63	U23XXCX63	Pneumatics Automation	Festo
64	U23XXCX64	Agile Methodologies	IBM
65	U23XXCX65	Block Chain	IBM
66	U23XXCX66	Devops	IBM
67	U23XXCX67	Artificial Intelligence	ITS
68	U23XXCX68	Cloud Computing	ITS
69	U23XXCX69	Computational Thinking	ITS
70	U23XXCX70	Cyber Security	ITS
71	U23XXCX71	Data Analytics	ITS
72	U23XXCX72	Databases	ITS
73	U23XXCX73	Java Programming	ITS
74	U23XXCX74	Networking	ITS
75	U23XXCX75	Python Programming	ITS
76	U23XXCX76	Web Application Development (HTML, CSS, JS)	ITS
77	U23XXCX77	Network Security	ITS & Palo alto
78	U23XXCX78	MATLAB	MathWorks
79	U23XXCX79	Azure Fundamentals	Microsoft
80	U23XXCX80	Azure AI (AI-900)	Microsoft
81	U23XXCX81	Azure Data (DP -900)	Microsoft
82	U23XXCX82	Microsoft 365 Fundamentals (SS-900)	Microsoft
83	U23XXCX83	Microsoft Security, Compliance and Identity (SC-900)	Microsoft
84	U23XXCX84	Microsoft Power Platform (PI-900)	Microsoft

85	U23XXCX85	Microsoft Dynamics Fundamentals 365 – CRM	Microsoft
86	U23XXCX86	Microsoft Excel	Microsoft
87	U23XXCX87	Microsoft Excel Expert	Microsoft
88	U23XXCX88	Securities Market Foundation	NISM
89	U23XXCX89	Derivatives Equinity	NISM
90	U23XXCX90	Research Analyst	NISM
91	U23XXCX91	Portfolio Management Services	NISM
92	U23XXCX92	Cyber Security	Palo alto
93	U23XXCX93	Cloud Security	Palo alto
94	U23XXCX94	PMI – Ready	PMI
95	U23XXCX95	Tally – GST & TDS	Tally
96	U23XXCX96	Advance Tally	Tally
97	U23XXCX97	Associate Artist	Unity
98	U23XXCX98	Certified Unity Programming	Unity
99	U23XXCX99	VR Development	Unity

ANNEXURE - IV

ABILITY ENHANCEMENT COURSES-(B) SKILL ENHANCEMENT COURSES

Sl. No.	Course Code	Course Title
1.	U23ADS301	**SKILL ENHANCEMENT COURSE 1**
		a) Clean code
		b) Exploring of GITHUB
		c) Aptitude - I
2.	U23ADS402	**SKILL ENHANCEMENT COURSE 2**
		a) API design - I
		b) Exploring of Research Tools
		c) Aptitude - II

**** Choose any one SKILL ENHANCEMENT COURSE in the list for SEC 1, SEC 2***

Annexure – V

HONOURS PROGRAMME – GENERATIVE AI

COURSE DETAILS											
Sl. No.	**Semester**	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
					L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory											
1	IV	U23ADH401	Data Handling and Preprocessing	PC	3	1	0	4	25	75	100
2	V	U23ADH502	Designing ML Systems	PC	3	1	0	4	25	75	100
3	VI	U23ADH603	Understanding Image and Audio Processing	PC	3	1	0	4	25	75	100
4	VII	U23ADH704	Advanced NLP	PC	3	1	0	4	25	75	100
5	VIII	U23ADH805	Generative Models	PC	3	1	0	4	25	75	100
	Total							**20**	**125**	**375**	**500**
Equivalent NPTEL courses[##]											
1	Quantum Computing							**3**	**12 Weeks Course**		
2	Reinforcement Learning							**3**			
3	Applied Accelerated Artificial Intelligence							**3**			
4	Natural Language Processing							**3**			
5	Deep Learning for Computer Vision							**3**			

[##] The student shall be given an option to earn 3 credits through one equivalent 12-week NPTEL course instead of any one course listed for honours degree programme that should be completed before the commencement of eighth semester. The equivalent courses are subject to change based on its availability as per NPTEL course list.

Department	**Mathematics**				Programme: **B.Tech.**			
Semester	**I**				Course Category: **BS**		End Semester Exam Type: **TE**	
Course Code	**U23MATC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Engineering Mathematics – I**	**3**	**1**	**-**	**4**	**25**	**75**	**100**
(Common to ALL Branches Except CSBS)								

Prerequisite	Basic Mathematics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the concept of Eigen values and Eigen vectors, Diagonalization of a Matrix	**K3**
	CO2 Solve higher order differential equations	**K3**
	CO3 Understand the different types of partial differential equations	**K3**
	CO4 Know about the Applications of double and triple integrals	**K3**
	CO5 Gain the knowledge about Vector Calculus and its Applications	**K3**

UNIT – I	**Matrices**	**Periods:12**	
Rank of a Matrix – Systems of Linear Equations – Characteristic equation – Cayley Hamilton Theorem – Eigen values and Eigen vectors of a real Matrix – Diagonalization of Matrices.			**CO1**
UNIT – II	**Differential Equations (Higher Order)**	**Periods:12**	
Linear Differential equations of higher order with constant coefficients – Euler's linear equation of higher order with variable coefficients – Method of Variation of parameters.			**CO2**
UNIT – III	**Functions of Several Variables**	**Periods:12**	
Partial derivatives – Total derivatives – Maxima and Minima of two variables – Lagrange's Method of multipliers.			**CO3**
UNIT – IV	**Multiple Integrals**	**Periods:12**	
Multiple Integrals – Change of order of integration (Cartesian form). Applications: Area as a double integral (Cartesian form) – Volume as a triple integral (Cartesian form).			**CO4**
UNIT – V	**Vector Calculus**	**Periods:12**	
Gradient – Divergence and Curl – Directional derivatives – Irrotational and Solenoidal vector fields – Properties (Statement only) – Gauss Divergence Theorem and Stoke's Theorem (without proofs).			**CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods:**	**Total Periods: 60**

Text Books

1. M.K. Venkataraman, "Engineering Mathematics", The National Publishing Company, 2nd Edition Chennai, 2016.
2. N. P Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Lakshmi Publications, New Delhi, 9th Edition, 2018.
3. S.Narayanan and T.K. Manickavasagam Pillay," Differential Equations and Its Applications", Viswanathan. S, Printers & Publishers Pvt Ltd, 2009.

Reference Books

1. G. Balaji, "Matrices and Calculus (Engineering Mathematics – I)" Balaji Publications, 9th Edition June 2023.
2. A. Singaravelu, "Engineering Mathematics – I", Meenakshi publications, 1998.
3. Erwin Kreyszig, "Advanced Engineering Mathematics ", Wiley, 10th Edition, 2019.
4. B.V. Ramana," Higher Engineering Mathematics", Tata McGraw – Hill, New Delhi, 6th Edition, 2018.
5. C W. Evans, "Engineering Mathematics", A Programmed Approach, 3rd Edition, 2019.

Web References

1. http://www.yorku.ca/yaoguo/math1025/slides/chapter/kuttler-linearalgebra –slides- systems of equation-handout.pdf
2. http://www.math.cum.edu/~wn0g/2ch6a.pdf
3. https://nptel.ac.in/courses/122/104/122104017/
4. https://nptel.ac.in/courses/111/106/111106051/
5. https://nptel.ac.in/courses/111/108/111108081/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	2	1	1	-	-	-	-	1	3	-	-
2	3	2	1	1	-	1	1	-	-	-	-	1	3	-	-
3	3	2	1	1	-	1	1	-	-	-	-	1	3	-	-
4	3	2	1	1	-	1	1	-	-	-	-	1	3	-	-
5	2	2	1	-	-	-	1	-	-	-	-	1	3	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	EEE and ECE	Programme: **B.Tech.**						
Semester	I/II	Course Category : **ES**				End Semester Exam Type: **TE**		
Course Code	U23ESTC03	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Basics of Electrical and Electronics Engineering**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

(Common to CSE, IT, MECH, CIVIL, MCTR, CCE, AI&DS, FT and CSBS Branches)

Prerequisite	**Mathematics and Physics**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Apply the basic concepts and various laws in DC circuits.	**K3**
	CO2 Analyze the AC circuits and develop resonance conditions for transmitter and receiver circuits.	**K3**
	CO3 Gain the knowledge of power system components, importance of electrical safety measures and real time applications of transformer and motor.	**K2**
	CO4 Understand the operator of semiconductor diode and its applications.	**K2**
	CO5 Explain the characteristics and operation of BJT and FET.	**K2**
	CO6 Relate and Explain Different Communication Systems.	**K2**

Section A – Electrical Engineering

UNIT - I	**DC Circuits**	**Periods: 8**
Concept of Potential Difference, Current, Resistance, Inductance and Capacitance, Work, Power, Energy, Current and Voltage sources - ideal and practical sources - concept of dependent and independent sources, Ohm's law, Kirchhoff's law, Series parallel combination of R, L, C components, Voltage Divider and Current Divider Rules, Mesh and Nodal analysis, Star/Delta transformation, Network Theorems - Superposition, Thevenin, Norton and Maximum Power Transfer.		**CO1**
UNIT - II	**AC Circuits**	**Periods: 8**
AC waveform definitions - form factor, peak factor, R-L, R-C, RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, Resonance in series and parallel circuits, band-width and quality factor, Three Phase balanced AC Circuits (Y-Δ and Y-Y) - Power Measurement – Two Wattmeter method.		**CO2**
UNIT - III	**Electrical Safety and Electrical Machines**	**Periods: 7**
Layout of electrical power system and its functions, Wiring Accessories, Types of domestic wiring, Necessity of earthing, insulators and cables, Safety devices - fuse, relay and circuit breaker - Sensors and its types. Faraday's Law of electromagnetic induction, Fleming's Right and Left hand rule - DC Generator and DC Motor - construction, principle, load test and performance characteristics - Auto transformer, Single phase transformer- construction, principle, load test - Single phase capacitor start and run induction motor – Load test.		**CO3**

Section B – Electronics Engineering

UNIT - IV	**Semiconductor Diodes And Applications**	**Periods: 7**
Introduction semiconductor materials – Doping - Intrinsic and Extrinsic Semiconductor – PN junction diode, structure, characteristics - diffusion and depletion capacitance - Rectifier, Half wave and Full wave rectifier - zener diode characteristics - zener diode as regulator – Light Emitting Diode (LED) - Solar Cell.		**CO4**
UNIT - V	**Transistors**	**Periods: 7**
Bipolar Junction Transistor - construction – operation - Common Base, Common Emitter, Common collector Configuration – characteristics – Biasing - numerical application. Junction Field Effect Transistor (JFET), Metal oxide semiconductor Field Effect Transistor, EMOSFET-DMOSFET operation characteristics - Numerical application.		**CO5**
UNIT - VI	**Communication Systems**	**Periods: 8**
Need for Modulation – Block diagram of analog communication System - AM, FM, PM Definitions and Waveforms – Comparison of digital and analog communication system- Block diagram of digital communication system – Electromagnetic Spectrum. Wired and wireless Channel – Block diagram of communication systems – satellite communication – Cellular Mobile Communication – Fibre Optical Communication System.		**CO6**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods:**	**Total Periods: 45**

Text Books

1. R. K. Rajput, "Basic Electrical and Electronics Engineering", University Science Press, 2nd Edition, 2017.

2. Dr. R. Saravanakumar, Dr.V. Jegathesan, Dr. K. Vinoth Kumar, Dr. K. Kowsalya, "Basic Electrical and Electronics Engineering", Wiley Publisher, 2nd Edition, 2022.
3. R. Muthusubramaniam, S. Salivahanan and K. A. Mureleedharan, "Basic Electrical Electronics and Computer Engineering", Tata McGraw Hill, 2018.

Reference Books

1. A. Sudhakar and S. P. Shyam Mohan, "Circuits and Networks: Analysis and Synthesis", Tata McGraw Hill Publishing Company Ltd., New Delhi, 4th Edition, 2017.
2. D. P. Kothari and I. J. Nagrath, "Electric Machines", Tata McGraw Hill, New Delhi, 5th Edition, 2017.
3. B. L. Theraja, A. K. Theraja, "A Textbook of Electrical Technology – Volume - II", S Chand & Co. Ltd., New Delhi, 23rd Edition, 2009.
4. David. A. Bell, "Electronic Devices and Circuits", PHI Learning Private Ltd, India, 4th Edition, 2020
5. Wayne Tomasi, "Electronic Communication Systems- Fundamentals Theory Advanced", Pearson Education, 6th Edition, 2018.

Web References

1. https://nptel.ac.in/courses/108/108/108108076/
2. https://www.electrical4u.com/
3. https://nptel.ac.in/courses/108/102/108102146/
4. https://onlinecourses.nptel.ac.in/noc21_ee55/
5. https://nptel.ac.in/courses/117/102/117102059

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
2	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
3	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
4	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
5	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**I/II**	Course Category: **ES**			End Semester Exam Type: **TE**			
Course Code	**U23CSTC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming in C**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

(Common to All Branches)

Prerequisite	NIL	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Comprehend the basics of Computers.	**K2**
	CO2 Illustrate the concepts of control structures and looping.	**K2**
	CO3 Implement programs using arrays and functions.	**K3**
	CO4 Demonstrate programs using Structure and Pointers.	**K3**
	CO5 Build the programs using Union and File management Operations.	**K3**

UNIT-I	**Introduction**	**Periods: 09**
Generation and Classification of Computers - Block Diagram of a Computer –Categories of Software – Network Structure - Number System – Binary – Decimal – Conversion – Algorithm – Pseudo code – Flow Chart.		**CO1**
UNIT-II	**C Programming Basics**	**Periods: 09**
Introduction to ' C' Programming – Basic structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements.		**CO2**
UNIT-III	**Arrays and Functions**	**Periods: 09**
Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations- Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion		**CO3**
UNIT-IV	**Structure and Pointers**	**Periods: 09**
Structure Introduction – Structure definition – Structure declaration – Structure within a structure –Self Referential Structure. Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays -Pointer to Function –Pointer and Structure- Simple programs.		**CO4**
UNIT-V	**Unions and Files**	**Periods: 09**
Union Introduction - Programs Using Structures and Unions – Introduction to File - File Operations - File Input and Output Functions - Random Access to Files - File System Functions - Command Line Arguments- Storage Classes - Pre-Processor Directives- Dynamic Memory Functions.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods:**	**Total Periods: 45**

Text Books

1. Balagurusamy. E, "Programming in ANSI C", Tata McGraw Hill, 8th Edition, 2019.
2. YashvantKanetkar, "Let us C", BPB Publications, 16th Edition, 2017
3. Herbert Schildt," C: The Complete Reference", McGraw Hill, 4th Edition, 2014

Reference Books

1. Vikas B. Agarwal Jyoti P. Mirani, "Computer Fundamentals" , Nirali Prakashan, 2019,
2. Ashok N Kamthane, "Computer Programming", Pearson education, 2nd Impression, 2012.
3. VikasVerma, "A Workbook on C ", Cengage Learning, 2nd Edition, 2012.
4. P.Visu, R.Srinivasan and S.Koteeswaran, "Fundamentals of Computing and Programming", 4th Edition, Sri Krishna Publications, 2012.
5. PradipDev, ManasGhoush, "Programming in C", 2nd Edition, Oxford University Press, 2011.

Web References

1. https://www.programiz.com/c-programming
2. https://www.geeksforgeeks.org/c-language-set-1-introduction/
3. https://www.tutorialspoint.com/cprogramming
4. https://www.assignment2do.wordpress.com/.../solution-programming-in-ansi-c
5. https://nptel.ac.in/courses/106/104/106104128/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
2	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
3	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
4	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
5	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **ES**				End Semester Exam Type: **TE**		
Course Code	**U23ADT101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Digital System Design**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

(Common to All Branches)

Prerequisite	NIL	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Review the knowledge of Number systems and simplifications of Boolean functions.	**K2**
	CO2 Design and understand the various combinational logic circuits.	**K3**
	CO3 Design and understand the various sequential circuits.	**K3**
	CO4 Analyze and design the reconfiguration circuits.	**K3**
	CO5 Review the knowledge of Number systems and simplifications of Boolean functions.	**K3**

UNIT-I	**Review of Number Systems**	**Periods: 9**	
Review of Number systems – Conversion of Number systems – Binary addition and subtractions – Binary representation: Signed magnitude representation and Compliment representations – Binary codes – Boolean Algebra – Boolean functions – canonical forms.			**CO1**
UNIT-II	**Boolean Function and Combinational Logic Design**	**Periods: 9**	
Simplifications of Boolean function: Theorems and laws – K"Map and QuineMcCluskey method – Introduction to combinational circuits – Design procedures of Combinational circuits – Adders - Subtractors – Binary parallel Adder – Decoder – Encoder – Priority Encoder. Multiplexer – Demultiplexer.			**CO2**
UNIT-III	**Sequential Logic Design**	**Periods: 9**	
Introduction to Sequential Circuits – Latches – Types of Latches: SR Latch and D Latch – Flip-Flop – Types of Flip-Flops: RS, JK, D, and T Flip-Flops – Excitation table of Flip-Flops. Counters: Asynchronous Counters – Synchronous counters – Mod counters. Shift registers – Types of Shift registers.			**CO3**
UNIT-IV	**Reconfiguration Digital Circuits**	**Periods: 9**	
Introduction to Reconfiguration Digital Circuits – Memory – Hierarchy of Memory – RAM – Types of Ram – Memory Decoding of RAM – ROM. Programmable Logic Devices: Programmable Logic Array – Programmable Array Logic – Implementation of combinational circuits using RAM, ROM, PLA and PAL.			**CO4**
UNIT-V	**VHDL**	**Periods: 9**	
Introduction to Hardware Description Language and VHDL – Design flow – Entity, architecture, process, configuration and package declarations – Signals and data types.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. M. Morris Mano and Michael Ciletti, “Digital Design”, Pearson India Education Services, Pvt. Ltd., Sixth Edition, 2018.
2. Stephen Brown and ZvonkoVranesic, "Fundamentals of Digital Logic with VHDL Design", Tata McGraw Hill Education Pvt. Ltd., 3rd Edition, 2012.
3. Charles H Roth, "Fundamentals of Logic Design", Thomas Publication Company, 7th Edition, 2011.

Reference Books

1. Tocci R J and Widmer N S, "Digital Systems - Principles and Applications", Prentice Hall of India, 11th Edition, 2010.
2. John.F.Wakerly, "Digital Design Principles and Practices", Pearson Education, 4th Edition, 2006.
3. Roger Tokhiem, "Schaum's Outline of Digital Principles", McGraw Hill publication, 3rd Edition, 1994.
4. John. M. Yarbrough, “Digital Logic: Applications and Design”, Cengage Learning, Reprint 2009.
5. Godse A.P.Godse, “Digital System Design”, Technical Publications, 1st edition, 2008.

Web References

1. https://nptel.ac.in/courses/117/105/117105080/1.
2. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
3. https://www.coursera.org/learn/digital-systems

4. https://academic.csuohio.edu/chu_p/rtl/chu_rtL_book/silde/chap01_1.pdf
5. https://bohr.wlu.ca/nznotinas/pc319/lectures/01%20digital_system_design.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	2	1	-	-	-	-	-	-	-	2	3	2
2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	2
3	3	3	3	3	3	-	-	-	-	-	-	-	2	2	2
4	3	3	3	3	3	-	-	-	-	-	-	-	2	3	3
5	2	2	2	2	1	-	-	-	-	-	-	-	3	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment *	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23ADT102**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Fundamental Of Data Science**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
AI & DS								
Prerequisite	NIL							

Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Infer the Real world data and information.	**K2**
	CO2 Applying Data Science using Excel.	**K3**
	CO3 Make use of Mathematical Knowledge for problem solving.	**K3**
	CO4 Interpret the various Tools and its advantage.	**K3**
	CO5 Illustrate the different opportunities in Industries.	**K3**

UNIT-I	**Introduction to Data Science**	**Periods: 9**	
Introduction to Data Science – History of Data Science – Relationship between Data Warehouse – Big Data and Data Science – Scope of Data Science – Data Science with other Fields – Relationship between Data Science and Information Science. Data: Data types – Structured vs Unstructured data – Quantitative vs Qualitative data – The four levels of data – Data Collection – Data Preprocessing.			**CO1**

UNIT-II	**Data Science in Excel**	**Periods: 9**	
Introduction to Excel basic functions – Data Collection and Preparation – Importing Data into Excel from Different Data Sources – Data Cleaning and Preliminary Data Analysis – Correlation and Importance of Variables Technical Requirements. Data Visualization in Excel – Pivot Tables and Charts – VLOOKUP – Dashboard in Excel.			**CO2**

UNIT-III	**Mathematical Preliminaries**	**Periods: 9**	
Probability: Probability vs. Statistics – Compound Events and Independence – Conditional Probability – Probability Distribution. Descriptive Statistics: Centrality Measures – Variability Measures – Interpreting Variance – Characterizing Distributions. Correlation Analysis: Correlation Coefficient – The Power and Significance – Detection Periodicities. Logarithms: Logarithms and Multiplying Probabilities – Logarithms and Ratios – Logarithms and Normalizing Skewed Distributions			**CO3**

UNIT-IV	**Data Science Tools**	**Periods: 9**	
Introduction to Data Science Tool – Data Cleaning Tools – Data Munging and Modelling Tools – Data Visualization Tools – Tools for Data Science.			**CO4**

UNIT-V	**Industrialization, Oppurtunities and Applications**	**Periods: 9**	
Data Economy and Industrialization – Introduction: Data Economy – Data Industry – Data Services – Data Science Application: Introduction – General Application Guidance – Different Domain – Advertising – Aerospace and Astronomy – Arts – Creative Design and Humanities – Bioinformatics – Consulting Services – Ecology and Environment – Ecommerce and Retail – Education – Engineering – Finance and Economy – Gaming.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Chirag Shah, “A Hands on Introduction to Data Science”, Cambridge University Press, 2020.
2. SinanOzdemir, “Principles of Data Science”, Packt Publication, 2016.
3. Julio Cesar Rodriguez Martino, “Hands-on Machine Learning with Microsoft Excel”, Packt Publication, 2019.

Reference Books

1. Hector Guerrero, “Excel Data Analysis: Modeling and Simulation”, Springer International Publishing, 2nd Edition, 2019.
2. Paul Curzon, Peter W. McOwan, “The Power of Computational Thinking”, World Scientific Publishing, 2017.
3. Steven S. Skiena, “Data Science Design Manual”, Spring International Publication, 2017.
4. RajendraAkerkar, PritiSrinivasSajja, “Intelligence Techniques for Data Science”, Spring International Publication, 2016.
5. Longbing Cao “Data Science Thinking: The Next Scientific, Technological and Economic Revolution”, Spring International Publication, 2018.

Web References

1. https://www.coursera.org/learn/excel-data-analysis
2. https://www.tutorialspoint.com/excel_data_analysis/index.htm
3. https://www.coursera.org/learn/open-source-tools-for-data-science
4. https://www.jeremyjordan.me/data-science
5. https://www.ngdata.com/top-data-science-resourrces

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	1	1	-	-	-	-	-	-	-	2	2	2
2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
4	2	2	2	2	3	-	-	-	-	-	-	-	2	2	2
5	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**English**	Programme: **B.Tech.**						
Semester	**I**	Course Category : **HS**			End Semester Exam Type: **TE**			
Course Code	**U23ENBC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Communicative English - I**	**2**	**-**	**2**	**3**	**50**	**50**	**100**

(Common to ALL Branches except CSBS)

Prerequisite	Basics of English Language	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the communication flow in organization and its objectives	**K2**
	CO2 Write the technical contents with grammatically precise sentences	**K2**
	CO3 Articulate with correct pronunciation and overcome vernacular impact in speaking	**K3**
	CO4 Express opinions confidently in formal and informal communicative contexts	**K2**
	CO5 Attend interview with assertiveness	**K3**

UNIT- I	**Work stead Communication**	**Periods:10**	
Communication, Definition, Process, Channels, Barriers, Strategies for Effective Communication,, Verbal and Nonverbal Communication - Listening, Types, Barriers, Enhancing Listening Skills - Bibliography: Book, Journal and Internet References			**CO1**
UNIT- II	**Common Errors in Writing and Comprehension Strategies**	**Periods:10**	
Subject Verb Agreement, Misplaced Modifiers, Squinting Modifiers, Dangling Modifier, Fused Sentence, Comma Splice, Sentence Fragment - Reading Comprehension: Technical passage, Strategies: Skimming, Scanning, Intensive and Extensive Reading, Prediction, and Contextual Meaning			**CO2**
UNIT- III	**Phonetics**	**Periods:10**	
Pronunciation Guidelines to consonants and vowels, Sounds Mispronounced, Silent and Non-silent Letters, Intonation, Spelling Rules and Words often misspelled, Mother Tongue Influence (MTI), Various Techniques for Neutralization of Mother Tongue			**CO3**
UNIT- IV	**Communication Practice-I**	**Periods:15**	
List of Exercises **Listening**: Self Introduction videos **Speaking**: Self-Introduction, Extempore, and Role Play **Reading**: Non-Technical Comprehension Passage **Writing:** Common Errors in Writing			**CO4**
UNIT-V	**Interpersonal Communication-I**	**Periods:15**	
List of Exercises **Listening:** Speech Sounds, Interview Videos **Speaking**: Debate, Structured Group Discussion, and Conversation **Reading**: Commonly Confused Words **Writing:** Transcription			**CO5**

Lecture Periods: 30	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 60**

Text Books

1. Richa Mishra , RatnaRao, “A textbook of English Language Communication Skills”, Macmillan Publishers India Private Ltd., Revised Edition 2021.
2. Rizvi M. Ashraf, “Effective Technical Communication”, New Delhi: Tata-McGraw-Hill Publishing Company Limited, 4th Edition, 2010.
3. Balasubramanian T, “English Phonetics for Indian students workbook”, 2nd Edition, Trinity Press, 2016.

Reference Books

1. N.P.Sudharshana, C. Savitha,” English for Engineers”, Cambridge University Press, 2018.

2. Raman, Meenakshi, and Sharma, Sangeetha, "Technical Communication - Principles and Practice", 3rd Edition, Oxford University Press, 2017.
3. Comfort, Jeremy,etal., "Speaking Effectively: Developing Speaking Skills for Business English", Cambridge University Press, Cambridge, Reprint 2011.
4. Wren & Martin, "High School English Grammar and Composition", S Chandh &Co. Ltd, 2015.
5. Boove, Courtland L, "Business Communication Today", Pearson Education, New Delhi, 2002.

Web References

1. https://lemongrad.com/subject-verb-agreement-rules/
2. https://opentextbc.ca/advancedenglish/chapter/misplaced-and-dangling-modifiers/
3. https://www.hitbullseye.com/Reading-Comprehension-Tricks.php
4. https://www.softwaretestinghelp.com/how-to-crack-the-gd/
5. https://worldscholarshipvault.com/neutralize-mother-tongue-interference/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
5	1	-	-	-	-	-	-	-	1	3	-	1	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Theory						
Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Attendance		
Marks	5	5	5	5	75	60
	20(to be weighted for 10 marks)				(to be weighted for 50 marks)	

Practical				
Continuous Assessment Internal Evaluation		End Semester Internal Evaluation		Total Marks
30(to be weighted for 10 marks)		30 marks		40
Listening (L)*	10	Listening (L)*	10	
Speaking(S)	5	Speaking(S)	5	
Reading(R)*	10	Reading(R)*	10	
Writing(W)*	5	Writing(W)*	5	

- **LRW components of Practical can be evaluated through Language Lab Software**

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**I/II**	Course Category: **ES**			End Semester Exam Type: **LE**			
Course Code	**U23CSPC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming in C Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to All Branches)								
Prerequisite	NIL							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Implement logical formulations to solve simple problems leading to specific applications.	**K3**
	CO2 Execute C programs for simple applications making use of basic constructs, arrays and strings.	**K3**
	CO3 Experiment C programs involving functions, recursion, pointers, and structures.	**K3**
	CO4 Demonstrate applications using sequential and random access file processing.	**K3**
	CO5 Build solutions for online coding challenges.	**K3**

List of Exercises

1. Write a C program to find the Area of the triangle.
2. Develop a C program to read a three digit number and produce output like
   1 hundreds
   7 tens
   2 units
   For an input of 172.
3. Write a C program to check whether a given character is vowel or not using Switch – Case statement.
4. Write a C program to print the numbers from 1 to 10 along with their squares.
5. Demonstrate do—While loop in C to find the sum of ‘n’ numbers.
6. Find the factorial of a given number using Functions in C.
7. Write a C program to check whether a given string is palindrome or not?
8. Write a C program to check whether a value is prime or not?
9. Develop a C program to swap two numbers using call by value and call by reference.
10. Construct a C program to find the smallest and largest element in an array.
11. Implement matrix multiplication using C program.
12. Write a C program to perform various string handling functions like strlen, strcpy, strcat, strcmp.
13. Develop a C program to remove all characters in a string except alphabets.
14. Write a C program to find the sum of an integer array using pointers.
15. Write a C program to find the Maximum element in an integer array using pointers.
16. Construct a C program to display Employee details using Structures
17. Write a C program to display the contents of a file on the monitor screen.
18. Write a File by getting the input from the keyboard and retrieve the contents of the file using file operation commands.
19. Write a C program to create two files with a set of values. Merge the two file contents to form a single file
20. Write a C program to pass the parameter using command line arguments.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Zed A Shaw,"Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C)", Addison Wesley, 2016.
2. Anita Goel and Ajay Mittal, "Computer Fundamentals and programming in C", Pearson Education, 1st edition, 2011.
3. Maureen Sprankle,Jim Hubbard," Problem Solving and Programming Concepts," Pearson, 9th Edition, 2011.
4. Yashwanth Kanethkar, "Let us C", BPB Publications, 13th Edition, 2008.
5. B.W.Kernighan and D.M. Ritchie, "The C Programming Language", Pearson Education, 2nd Edition, 2006.

Web References

1. https://alison.com/course/introduction-to-c-programming
2. https://www.geeksforgeeks.org/c-programming-language/
3. http://cad-lab.github.io/cadlab_data/files/1993_prog_in_c.pdf
4. https://www.tenouk.com/clabworksheet/clabworksheet.html
5. https://fresh2refresh.com/c-programming/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
2	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
3	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
4	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
5	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Mechanical Engineering**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **ES**				End Semester Exam Type: **LE**		
Course Code	**U23ESPC03**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Engineering Graphics using AutoCAD**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
	(Common to all Branches)							

Prerequisite			
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Familiarize with the fundamentals and standards of engineering graphics.	**K2**
	CO2	Perform drawing of basic geometrical constructions and multiple views of objects.	**K2**
	CO3	Visualize the isometric and perspective sections of simple solids.	**K3**
	CO4	Connect side view associate on front view.	**K4**
	CO5	Correlate sectional views and lateral surface developments of various solids.	**K4**

List of Experiments

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) –Creation of simple figures like polygon and general multi-line figures.
2. Drawing a Title Block with necessary text and projection symbol.
3. Drawing 2D sketch by applying modify tools like fillet, mirror, array, etc.,
4. Drawing front view and top view of simple solids like prism, pyramid, cylinder, cone, etc., and Dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. Simple stool, V-block, Mixie Base).
6. Drawing a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
8. Drawing lateral surface development of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creating 3D model of simple object and obtaining 2D multi-view drawings.
11. Note: Plotting of drawings must be made for each exercise and attached to the records written by Students.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. James D. Bethune, Engineering Graphics with AutoCAD A Spectrum book 1st edition, Macromedia Press, Pearson, 2020.
2. NS Parthasarathy and Vela Murali, Engineering Drawing, Oxford university press, 2015.
3. M.B Shah, Engineering Graphics, ITL Education Solutions Limited, Pearson **Education** Publication, 2011.
4. Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2017.
5. Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, Vikas Publishing House Pvt Ltd., 7th Edition, New Delhi, 2016.

6. C M Agrawal, Basant Agrawal, Engineering Graphics, McGraw Hill, 2012.
7. Dhananjay A. Jolhe, Engineering Drawing: With An Introduction To CAD McGraw Hill, 2016.
8. James Leach, AutoCAD 2017 Instructor, SDC Publications, 2016.

Web References

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/egraphics_lab/labs/index.php
2. http://www.nptelvideos.in/2012/12/computer-aided-design.html
3. https://mech.iitm.ac.in/meiitm/course/cad-in-manufacturing/
4. https://autocadtutorials.com
5. https://dwgmodels.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	-	-	3	-	-	-	3	-	-	2	3	3	3
2	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3
3	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3
4	3	1	-	-	3	-	-	-	3	-	-	2	3	3	3
5	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **PC**			End Semester Exam Type: **LE**			
Course Code	**U20ADP101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Fundamental Of Data Science Laboratory**	**0**	**0**	**2**	**1**	**25**	**75**	**100**

Prerequisite	NIL	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe common Excel functionality and features used for data science.	**K2**
	CO2 Analyze and construct the Data Visualization.	**K2**
	CO3 Configure the programming environment.	**K3**
	CO4 Analyze real time data set.	**K3**
	CO5 Implement Pivot tables and VLOOKUP functions.	**K3**

List of Exercises

1. Study of basic Function in Excel.
2. Working with Range Names and Tables.
3. Cleaning Data with Text Functions.
4. Cleaning data containing Data Values.
5. Working with VLOOKUP functions.
6. Demonstration of Data Visualization.
7. Importing Data from external source into Excel.
8. Creating a Data Model.
9. Exploring Data with PivotTables and Charts.
10. Create a Dash board for a given requirement.
11. Implement a data analytics for the real time data set.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Julio Cesar Rodriguez Martino, “Hands-on Machine Learning with Microsoft Excel”, Packt Publication, 2019.
2. Paul McFedries, “Excel Data Analysis for Dummies”, John Wiley and Sons, 2019.
3. Gordon S. Linoff, “Data Analysis Using SQL and Excel”, Wiley Publishing, 2008.
4. Hector Guerrero, “Excel Data Analysis: Modeling and Simulation”, Springer International Publishing, 2nd Edition, 2019.
5. Steven S. Skiena, “Data Science Design Manual”, Spring International Publication, 2017.

Web References

1. https://www.coursera.org/learn/excel-data-analysis
2. https://www.edx.org/course/introduction-to-data-analysis-using-excel-2
3. https://www.kaggle.com/datasets
4. https://www.tutorialspoint.com/excel_data_analysis/index.htm

COs/POs/PSOs Mapping

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	1	1	-	-	-	-	-	-	-	2	2	2
2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
4	2	3	2	3	2	-	-	-	-	-	-	-	3	3	3
5	3	2	3	2	2	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**I**	Course Category Code: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23ADC1XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ES E	TM
Course Name	**Ability Enhancement Courses**	**-**	**-**	**4**	**-**	**100**	**-**	**100**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**I**	Course Category : **MC**			End Semester Exam Type:			
Course Code	**U23ADM101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Induction Programme**	-	-	-	Non-Credit	-	-	-
Prerequisite	**-**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Develop holistic attitude and harmony in the individual, family, and Society	**K2**
	CO2 Acquire grammar skills and capable to write and speak English confidently	**K2**
	CO3 Understand the basic concepts in Mathematics and Programming	**K2**
	CO4 Know about the art and culture, language and literature of this vast secular nation	**K2**
	CO5 Identify the inherent talent and develop it professionally	**K3**

UNIT-I	**Universal Human Values**	**Periods: 12**
Welcome and Introductions - Getting to know each other, Aspirations and Concerns - Individual Academic and Career, Expectations of Family, Peers, Society, Nation, Fixing one's Goals, Self-Management - Self-confidence, Peer Pressure, Time Management, Anger, Stress Personality Development, Self-improvement, Health - Health issues, Healthy diet, Healthy lifestyle, Hostel life, Relationships - Home sickness, Gratitude towards Parents, Teachers and others Ragging and interaction, Competition and Cooperation, Peer Pressure, Society - Participation in Society, Natural Environment - Participation in Nature, Sum Up - Role of Education, Need for a Holistic Perspective, Self-evaluation and Closure - Sharing and feedback.		**CO1**

UNIT-II	**Proficiency in English**	**Periods: 12**
Communication skills -Prognostic test on Grammar -Synonyms, Antonyms, Tenses, Sentence Completion, Idioms and Phrases, One-word Substitution, Homophones, Homonyms, Use of Prepositions, Subject-verb Agreement -Writing - Paragraph writing, Letter writing, Essay writing, Story Development.		**CO2**

UNIT-III	**Bridge Course in Mathematics and C Programming**	**Periods: 12**
Mathematics: Fundamentals of differential and integral calculus: Theory and Practice, Limit of function - Fundamental results on limits - Continuity of a function - Concept of differentiation - Concept of derivative - Slope of a curve -Differentiation Techniques - Derivatives of elementary functions from first principle - Derivatives of inverse functions - Logarithmic differentiation - Method of substitution - Differentiation of parametric functions -Differentiation of implicit functions - Higher order derivatives. Integrals of functions containing linear functions -Method of integration (Decomposition method, method of substitution, integration by parts) - Definite integrals. Simple definite integrals - Properties of Definite integrals - Reduction formulae - Area and volume - Length of curve - surface area of a solid. **C Programming:** Features of C and its basic Structure - Keywords - constants - variables - operators - Data types - Formatted input and output statements - Control and Looping statement - Arrays - Functions - Strings - writing simple C programs.		**CO3**

UNIT-IV	**Literary Activities**	**Periods: 12**

Te Team building activities - Quiz - Oral Exercises - Group discussion, Debate, Extempore, Role play, சிறப்பு சொற்பொழிவு - தமிழர் மரபு மற்றும் தமிழர் தொழில்நுட்பம்.	**CO4**

UNIT-V	**Creative Arts**	**Periods: 12**

Introduction to painting and renowned artworks -Documentary and Short films -Music -Vocal, Instrumental - Dance - Classical, Cinematic - Mimicry - Mime.	**CO5**

Lecture Periods: 60	**Tutorial Periods:**	**Practical Periods:**	**Total Periods: 60**

Reference Books

1. R.R Gaur, R. Asthana, G.P. Bagaria," A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, 2nd Revised Edition, 2019.
2. Kumar Mohan R, "English Grammar for all (Functional and Applied Grammar)", Unicare Academy, 2022.
3. Seely, John," Oxford A-Z of Grammar and Punctuation, Oxford Publication, 2013.
4. B.V. Ramana," Higher Engineering Mathematics", Tata McGraw – Hill, New Delhi, 6th Edition, 2018.
5. Dr. A. Singaravelu, "Engineering Mathematics - I", Meenakshi publications, Tamil Nadu, 2019.
6. E. Balagurusamy, "PROGRAMMING IN ANSI C", Mc Graw Hill, 8th Edition, 2019.
7. Dr.K.K.Pillay,"Social Life of Tamils", A joint publication of TNTB & ESC and RMRL
8. R.Balakrishnan, "Journey of Civilization",Roja muthiah research publishers, 1st edition 2019
9. தமிழக வரலாறு - மக்களும் பண்பாடும், பிள்ளை, கே. கே. , சென்னை : உலகத் தமிழாராய்ச்சி நிறுவனம் , 2002.
10. கணினித்தமிழ் - முனைவர் இல.சுந்தரம், விகடன் பிரசுரம்.
11. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம், தமிழக தொல்லியல் துறை

Web References

1. http://www.newsociety.com/Books/S/Slow-isBeautiful
2. https://www.aplustopper.com/formal-letter/
3. https://www.javatpoint.com/c-programming-language-tutorial
4. http://www.math.cum.edu/~wn0g/2ch6a.pdf
5. https://education.nsw.gov.au/teaching-and-learning/curriculum/creative-arts

Department	**Mathematics**	Programme : **B.Tech.**						
Semester	**II**	Course Category: **BS**			End Semester Exam Type: **TE**			
Course Code	**U23MATC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Engineering Mathematics – II**	**3**	**1**	**-**	**4**	**25**	**75**	**100**

(Common to ALL Branches Except CSBS, FT)

Prerequisite	Basic Mathematics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Convert a periodic function into series form.	**K2**
	CO2 Compute Fourier transforms of various functions.	**K3**
	CO3 Solve Differential Equations using Laplace transforms.	**K3**
	CO4 Apply inverse Laplace transform of simple functions.	**K3**
	CO5 Solve difference equations using Z – transforms.	**K3**

UNIT – I	**Fourier Series**	**Periods:12**
Dirichlet's conditions – General Fourier series – Odd and Even functions – Half-Range sine series and cosine series – Change of intervals – Parseval's Identity.		**CO1**

UNIT – II	**Fourier Transforms**	**Periods:12**
Fourier Transforms and its inverse – Properties of Fourier Transform (without proof) – Fourier sine and cosine Transforms and their properties (excluding proof).		**CO2**

UNIT – III	**Laplace Transforms**	**Periods:12**
Laplace transforms of elementary functions and Periodic functions – Basic properties (excluding proof) – Laplace transforms of derivatives and integrals – Initial and final value theorems.		**CO3**

UNIT – IV	**Inverse Laplace Transforms**	**Periods:12**
Definition of inverse Laplace Transforms – Convolution theorem (excluding proof) – Solutions of Linear Ordinary Differential Equations of second order with constant coefficients.		**CO4**

UNIT – V	**Z – Transforms**	**Periods:12**
Z-transforms – Elementary Properties – Inverse Z-transforms (using partial fraction and Residues) – Solution of difference equations using Z - transform.		**CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods:**	**Total Periods: 60**

Text Books

1. T. Veerarajan, "Engineering Mathematics", Tata McGraw Hill, New Delhi, 3rd Edition, 2011.

2. C. P. Gupta, Shree Ram Singh. M. Kumar, “Engineering Mathematics for semester I & II”, Tata McGraw Hill, New Delhi, 2nd Edition, 2016.
3. H.K. Dass, “Advanced Engineering Mathematics”, S. Chand, New Delhi, 22nd, Edition 2019.

Reference Books

1. N.P. Bali and Dr. Manish Goyal, “A TEXTBOOK OF ENGINEERING MATHEMATICS”, UNIVERSITY SCIENCE PRESS, India, 8th Edition, 2016.
2. P. Sivaramakrishna Das and C. Vijayakumari, “Engineering Mathematics”, Pearson India Education services Pvt. Ltd, India 1st, 2017.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, New Delhi, 10th Edition, 2019.
4. G. Balaji, “Engineering Mathematics - Transforms and Partial Differential Equations”, G. Balaji Publishers, 18th Edition, 2022.
5. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill, New Delhi, 2017.

Web References

1. https://nptel.ac.in/courses/111105121/
2. https://nptel.ac.in/courses/111105035/
3. https://nptel.ac.in/courses/11110711
4. https://swayam.gov.in/nd1_noc20_ma17/preview
5. https://nptel.ac.in/courses/111/103*/111103021/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	1	-	-	-	-	-	1	1	-	-
2	3	2	1	1	-	1	-	-	-	-	-	1	3	-	-
3	3	2	1	1	-	1	-	-	-	-	-	1	3	-	-
4	3	2	1	1	-	1	-	-	-	-	-	1	3	-	-
5	3	2	1	1	-	1	-	-	-	-	-	1	3	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Physics / Chemistry**	Programme: **B.Tech.**						
Semester	**I/II**	Course Category: **BS**			End Semester Exam Type: **TE**			
Course Code	**U23BSTC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Physical Science for Engineers**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

(Common to all Branches)

Prerequisite	Physics of 12th standard or equivalent / Chemistry of 12th standard or equivalent.	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the basic of properties of magnetic, dielectric and superconductors.	**K2**
	CO2 Identify the wave nature of the particles, physical significance of wave functions	**K3**
	CO3 Understand the basic principles of laser and fiber optics communication	**K2**
	CO4 Understand and familiar with the water treatment.	**K2**
	CO5 Understand the electrode potential for its feasibility in electrochemical reaction and uses of various batteries.	**K2**
	CO6 Understand the specific operating condition under which corrosion occurs and suggest a method to control corrosion.	**K2**

SECTION A - PHYSICS

UNIT-I	**Magnetic. Dielectric, and Superconducting Materials**	**Periods: 8**
Introduction to magnetic materials, Ferromagnetism- Domain theory-Types of energy-Hysteresis-Hard and Soft magnetic materials-ferrites-Dielectric materials-Types of polarization – Langevin-Debye equation-Frequency effects on polarization-Dielectric breakdown- Ferroelectric materials-Superconducting materials and their properties.		**CO1**

UNIT-II	**Quantum Mechanics**	**Periods: 7**
Matter Waves - de Broglie Wavelength - Uncertainty Principle –Physical Significance of wave functions - Schrodinger wave Equation - Time Dependent - Time Independent - Application to Particle in a One Dimensional Box - Tunnel Diode.		**CO2**

UNIT-III	**Laser and Fiber Optics**	**Periods: 7**
Lasers - Principles of Laser - Spontaneous and Stimulated Emissions - Einstein's Coefficients - Population Inversion and Laser Action –components of laser - Types of Lasers - NdYAG, CO_2 laser, GaAs Laser Fiber Optics - Principle and Propagation of light in optical fiber - Numerical aperture and acceptance angle - Types of optical fibers (material, refractive index, mode)		**CO3**

SECTION B – CHEMISTRY

UNIT-IV	**Water and its Treatment**	**Periods: 8**
Water: Sources and impurities, Water quality parameters: Definition and significance of-color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD. Desalination of brackish water: Reverse osmosis-disadvantages of using hard water in boiler - Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning) and External treatment–Ion exchange demineralization and zeolite process.		**CO4**

UNIT-V	Electrochemical Cells and Storage Devices	Periods: 8	
Galvanic cells, single electrode potential, standard electrode potential, electrochemical series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes-hydrogen, calomel and Ag/AgCl. Batteries and fuel cells: Types of batteries- alkaline battery-lead storage battery- nickel-cadmium battery- fuel cell H_2 -O_2 fuel cell-applications.			**CO5**
UNIT-VI	**Corrosion**	**Periods: 7**	
Corrosion –Introduction - factors – types – chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control – material selection and design aspects – electrochemical protection – sacrificial anode method and impressed current cathodic method. Uses of inhibitors, metallic coating – anodic coating, cathodic coating. Metal cladding, Electroplating of Copper and electroless plating of nickel.			**CO6**
Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods:**	**Total Periods: 45**

Text Books

1. V Rajendran, "Engineering Physics", 2nd Edition, TMH, New Delhi 2011.
2. S.S Dara – "A text book of Engineering Chemistry" - 15th Edition, 2021. S.Chand Publications.
3. C.Jain, Monica Jain, —"Engineering Chemistryll" 17th Ed. Dhanpat Rai Pub. Co., New Delhi, (2015).

Reference Books

1. R.Murugeshan, "Modern Physics", S. Chand &Co, New Delhi 2006.
2. William D Callister Jr., "Material Science and Engineering", 6th Edition, John Wiley and sons, 2009.
3. Jain & Jain "Engineering chemistry", 23rd Edition, DhanpatRai Publishing Company. 2022
4. Mars Fontana "Corrosion Engineering", July 2017
5. JinaRedlin, "Handbook of Electrochemistry", March 28, 2005

Web References

1. https://www.sciencedaily.com/terms/materials_science.htm.
2. https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/materials science.html.
3. https://study.com/academy/lesson/semiconductors-superconductors-definition-properties.html
4. https://mechanicalc.com/reference/engineering-materials
5. http://ndl.ethernet.edu.et/bitstream/123456789/89589/1/%5BPerez_N.%5D_Electrochemistry_and_corrosion%28BookZZ.org%29.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
2	3	2	3	2	-	-	-	-	-	-	-	-	-	-	-
3	3	2	3	2	-	-	-	-	-	-	-	-	-	-	-
4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment *	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech**						
Semester	**II**	Course Category : **ES**				End Semester Exam Type: **TE**		
Course Code	**U23ADTC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming in Python**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
	(Common to All Branches)							
Prerequisite	NIL							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Interpret the basic concepts of Python programs.	**K3**
	CO2 Articulate the concepts of Sets, Dictionaries and Object-Oriented concepts.	**K3**
	CO3 Experiment with Numpy package.	**K3**
	CO4 Apply and analyze Data Manipulation with Pandas.	**K3**
	CO5 Illustrate programming concept for Visualization with Matplotlib.	**K3**

UNIT-I	**Introduction to Python**	**Periods: 9**
Structure of Python Program – Underlying mechanism of Module Execution – Branching and Looping – Problem Solving Using Branches and Loops – Functions – Lambda Functions – Lists and Mutability – Problem Solving Using Lists and Functions.		**CO1**
UNIT-II	**Sequence Datatypes and Object-Oriented Programming**	**Periods: 9**
Sequences – Mapping and Sets – Dictionaries. Classes: Classes and Instances – Inheritance – Exception Handling – Introduction to Regular Expressions using “re” module.		**CO2**
UNIT-III	**Using Numpy**	**Periods: 9**
Basics of NumPy – Computation on NumPy – Aggregations – Computation on Arrays – Comparisons – Masks and Boolean Arrays – Fancy Indexing – Sorting Arrays – Structured Data: NumPy’s Structured Array.		**CO3**
UNIT-IV	**Data Manipulation with Pandas**	**Periods: 9**
Introduction to Pandas Objects – Data indexing and Selection – Operating on Data in Pandas – Handling Missing Data – Hierarchical Indexing – Combining Data Sets. Aggregation and Grouping – Pivot Tables –Vectorized String Operations – Working with Time Series – High Performance Pandas – eval() and query().		**CO4**
UNIT-V	**Visualization With Matplotlib**	**Periods: 9**

Basic functions of Matplotlib – Simple Line Plot – Scatter Plot – Density and Contour Plots – Histograms – Binnings and Density – Customizing Plot Legends – Colour Bars – Three-Dimensional Plotting in Matplotlib.	**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Jake VanderPlas, “Python Data Science Handbook - Essential Tools for Working with Data”, O’Reily Media Inc, 2016.
2. Zhang.Y, “An Introduction to Python and Computer Programming”, Springer Publications, 2016.
3. Wesley J Chun, “Core Python Programming”, Pearson Education, 2nd Edition, 2006.

Reference Books

1. John Paul Mueller, Luca Massaron, “Python for Data Science for Dummies”, 2nd Edition, John Wiley& Sons, 2019.
2. Jesus Rogel-Salazar, “Data Science and Analytics with Python”, CRC Press Taylor and Francis Group, 2017.
3. Brian Draper, “Python Programming A Complete Guide for Beginners to Master and Become an Expert in Python Programming Language”, CreateSpace Independent Publishing Platform, 2016.
4. Mark Lutz, Laura Lewin, Frank Willison, “Programming Python”, O'Reilly Media, 3rd Edition, 2006.
5. Gowrishankar S, Veena A, “Introduction to Python Programming”, CRC Press, 2018.

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1. https://nptel.ac.in/courses/106/106/106106212/
2. https://www.geeksforgeeks.org/data-analysis-visualization-python/
3. https://www.coursera.org/learn/python-data-analysis
4. https://www.python.org/
5. https://www.programiz.com/python-programming

COs/POs/PSOs Mapping

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
2	2	2	1	3	-	-	-	-	-	-	-	2	2	2	3
3	3	2	2	3	-	-	-	-	-	-	-	2	3	2	3
4	3	3	2	3	-	-	-	-	-	-	-	3	3	3	3
5	3	3	2	3	-	-	-	-	-	-	-	2	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	CAT 1	**CAT 2**	**Model Exam**	**Assignment***	**Attendance**		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**II/III**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23CSTC03**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Data Structures**	3	-	**-**	**3**	**25**	**75**	**100**
(Common to all Branches)								
Prerequisite	Any Programming Knowledge							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Compute time and space complexity for given problems	**K3**
	CO2 Demonstrate stack, queue and its operation.	**K3**
	CO3 Illustrate the various operations of linked list.	**K3**
	CO4 Use the concepts of tree for various applications.	**K3**
	CO5 Outline the various Tables, Graphs and Sets techniques.	**K3**

UNIT-I	**Basic Terminologies of Data Structures**	**Periods: 9**
Introduction: Basic Terminologies – Asymptotic Notations: Complexity analysis. Array and its operations - Searching: Linear Search and Binary Search Techniques. Sorting: Bubble Sort – Selection Sort – Insertion Sort – Heap Sort – Shell Sort. Performance and Comparison among the sorting methods.		**CO1**
UNIT-II	**Stack and Queue Operations**	**Periods: 9**
Stacks and Queues: ADT Stack and its operations. Applications of Stacks: Expression Conversion and evaluation. ADT Queue and its operations. Types of Queue: Simple Queue – Circular Queue – Priority Queue – Deque.		**CO2**
UNIT-III	**Linked List Operations**	**Periods: 9**
Linked Lists: Singly linked list: Representation in memory. Algorithms of several operations: Traversing – Searching – Insertion – Deletion. Linked representation of Stack and Queue. Doubly linked list: operations. Circular Linked Lists: operations.		**CO3**
UNIT-IV	**Trees**	**Periods: 9**
Trees: Basic Tree Terminologies. Different types of Trees: Binary Tree – Threaded Binary Tree – Binary Search Tree – Binary Tree Traversals – AVL Tree- Red Black Tree.		**CO4**
UNIT-V	**Graphs, Tables and Sets**	**Periods: 9**

Graph: Basic Terminologies and Representations – Graph traversal algorithms. Tables: Different types of tables – Hash Table and its operations - Applications. Sets: Representation of Sets- Operations and its applications.	**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods:**	**Total Periods: 45**

Text Books

1. Ellis Horowitz, Sartaj Sahni," Fundamentals of Data Structures", Illustrated Edition, Computer Science Press, 2018.
2. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI, 3rd edition, 2010.
3. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, "Data Structures and Algorithms", 4th Edition, 2009.

Reference Books

1. D.Samanta, "Classic Data Structures", Prentice-Hall of India, 2nd edition, 2012.
2. Robert Kruse, C.L. Tondo and Bruce Leung, "Data Structures and Program Design in c", Prentice-Hall of India, 2nd Edition, 2007.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, Second. Edition, 2006.
4. Mark Allen Weiss," Algorithms, Data Structures and Problem Solving with C++", Illustrated Edition, Addison-Wesley Publishing Company, 1995.
5. Mark Allen Weiss," Algorithms, Data Structures and Problem Solving with C++", Addison-Wesley Publishing Company, Illustrated Edition, 1995.

Web References

1. https://www.geeksforgeeks.org/data-structures/
2. https://www.javatpoint.com/data-structure-tutorial/
3. https://www.studytonight.com/data-structures/
4. https://www.tutorialspoint.com/data_structures_algorithms/
5. https://www.w3schools.in/data-structures-tutorial/intro/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
3	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
5	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**II**	Course Category Code: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23ADT203**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Database Technologies**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI & DS								
Prerequisite	NIL							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Develop conceptual data model using Entity Relationship Diagram	**K3**
	CO2 Analyze and design Relational Database	**K3**
	CO3 Understand and realize Transaction and Concurrency control	**K2**
	CO4 Build Non-Relational Databases	**K3**
	CO5 Understand and Analyze Emerging Trends in database technologies	**K2**

UNIT-I	**Introduction**	**Periods: 09**	
Database System Application – Purpose of Database Systems – View of Data – Database Languages – Relational Database – Database Design – System Structure – Database Architecture. Database Design and E-R Model: Overview of the Design Process – The E-R Model – Constraints – E-R Diagrams – E-R Design Issues –Extended E-R features – Reduction to Relational Schemas – Other aspects of Database Design			**CO1**
UNIT-II	**Relational Database Management Systems (RDBMS) and Design**	**Periods: 09**	
Relational database concepts: Tables, rows, columns, keys, constraints- Fundamental Relational Algebra Operations – Extended Relational Algebra Operations- SQL (Structured Query Language) fundamentals- Features of Good Relational Designs – Database Dependencies-1NF – 2NF – 3NF – 4NF			**CO2**
UNIT-III	**Transaction and Concurrency Control**	**Periods: 09**	

Transaction Management: Transaction Concept – Storage Structure – Transaction Atomicity and Durability – Transaction Isolation and Atomicity – Serializability – Recoverability – Transaction Isolation Levels – Implementation of Isolation Levels. Concurrency Control: Lock Based Protocols – Timestamp Based Protocols – Validation Based Protocols. Recovery System: Failure Classification – Remote Backup Systems.		**CO3**
UNIT-IV	**Non-relational databases (NOSQL)**	**Periods: 09**
Introduction to NoSQL databases: MongoDB-Cassandra- Redis-Key-value stores-document stores-column-family stores-graph databases		**CO4**
UNIT-V	**Emerging Trends and Technologies**	**Periods: 09**
New database technologies and trends- Blockchain databases-Time-series databases: Time Series Data- A New World for Time Series Databases- Storing and Processing Time Series Data-Time Series Tools		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Abraham Silberschatz, Henry F Korth, S Sudharshan, "Database System Concepts", McGraw-Hill 7th Edition, 2021.
2. Ted Dunning and Ellen Friedman, "Time Series Databases New Ways to Store and Access Data", Pearson Education, 3rd Edition, 2019.
3. Dan Sullivan," NoSQL for Mere Mortals", O'Rielly Media, 2nd Edition, 2019.

Reference Books

1. Date CJ, Kannan A, Swamynathan S, "An Introduction to Database System", Pearson Education, 8th Edition, 2006.
2. Raghu Ramakrishna, Johannes Gehrke, "Database Management Systems", McGraw Hill, 3rd Edition, 2014.
3. G.K.Gupta, "Database Management Systems", Tata McGraw Hill, 2011.
4. Jeffrey D. Ullman, "Principles of database systems", Computer Science Press, 1982.
5. Imran Bashir, "Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more", PACKT Publisher, 2020.

Web References

1. https://nptel.ac.in/courses/106/106/106106095/
2. https://docs.oracle.com/cd/E11882_01/server.112/e41084/toc.htm MySQL Online Documentation
3. http://dev.mysql.com/doc/
4. http://www.rjspm.com/PDF/BCA-428%20Oracle.pdf
5. https://www.tutorialspoint.com/dbms/index.htm

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	1	2	-	-	-	-	-	-	-	3	3	3
2	3	2	2	1	2	-	-	-	-	-	-	-	3	3	3
3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
4	3	3	2	2	3	-	-	-	-	-	-	-	3	3	3
5	3	3	3	1	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**English**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **HS**			End Semester Exam Type: **TE**			
Course Code	**U23ENBC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Communicative English - II**	**2**	**-**	**2**	**3**	**50**	**50**	**100**
(Common to ALL Branches except CSBS)								
Prerequisite	Basics of English Language							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Draft effective written communication in professional environment	**K2**
	CO2 Apply the mechanics of creative writing with precision and clarity	**K3**
	CO3 Acquire language skills professionally to groom the overall personality through sensitizing various etiquettes in real time situation	**K2**
	CO4 Develop language fluency and gain self-confidence	**K3**
	CO5 Express thoughts and ideas with clarity and focus	**K2**

UNIT-I	**Business Correspondence**	**Periods:10**	
Business Writing: Circular, Agenda, Memoranda, Notice, Instruction, Minutes, Email Writing ,Report Writing- Official and Demi Official Letters : Applying for Educational / Car / Home Loans / Joining Report, Leave Letter, Industrial Visit, In plant Training, Letter to the Editor, Calling for a quotation, Placing Order, Letter of Complaints, Letter seeking Clarification, Resume', Job Application Letter, Bio-data, CV			**CO1**
UNIT-II	**Functional Writing Skills**	**Periods:10**	
Four Modes of Writing, Sentence Structure , Art of condensation: Summary Writing and Note Making, Use of phrase and clause in sentence, Principles of paragraph writing, Techniques of Essay Writing, Jumbled Sentence, Paraphrasing			**CO2**
UNIT-III	**Etiquettes**	**Periods:10**	
Etiquette: Meaning, Kinds: Corporate Etiquette, Meeting Etiquette, Telephone Etiquette, Email Etiquette, Social Media Etiquette, Dining Etiquette, Communication Etiquette			**CO3**
UNIT-IV	**Communication Practice-II**	**Periods:15**	
List of Exercises Listening: Letter writing tips			**CO4**

Speaking: Just a Minute, Impromptu Speech, Contemporary Issues Reading: Variety of examples for Modes of Writing Writing: Different types of letters			
UNIT-V	**Interpersonal Communication-II**	**Periods:15**	
List of Exercises Listening: Videos on different types of Etiquettes Speaking: Team Presentation, Negotiation Skills Reading: Phrases and Clauses Writing: Free writing on any given topic, Paraphrasing Practice			**CO5**
Lecture Periods: 30	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 60**

Text Books

1. PC Das, "Letter Writing including Official and Business Letters", New Central Book Agency, 2020.
2. Kumar, Sanjay, Pushpalatha," Communication Skills". Oxford University Press, 2018.
3. Raman, Meenakshi&Sangeetha Sharma," Communication Skills", New Delhi: OUP, 2018.

Reference Books

1. Sahukar, Nimeran , Bhalla, Prem,, "The book of Etiquettes and Manners".PustakMahal Publisher, New Delhi; 1st Edition 2009.
2. Gerson Sharon J, Steven M. Gerson, "Technical Writing Process and Product", Pearson Education Pvt. Ltd. 3rd Edition, 2009.
3. Grussendorf, Marion, "English for Presentations". Oxford University Press, Oxford, 2007.
4. Seely John, "The Oxford Guide to Writing and Speaking", Oxford University Press, 2006.
5. R.C. Sharma, Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw Hill &Co.Ltd., New Delhi, 2001.

Web References

1. https://www.indeed.com/career-advice/finding-a-job/how-to-write-an-application-letter
2. https://owlcation.com/humanities/Four-Types-of-Writing
3. https://targetstudy.com/languages/english/paragraph-writing.html
4. https://www.businessnewsdaily.com/8262-email-etiquette-tips.html
5. https://www.youtube.com/watch?v=UOceysteIjo

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Theory						
Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Attendance		
Marks	5	5	5	5	75	60
	20(to be weighted for 10 marks)				(to be weighted for 50 marks)	

Practical

Continuous Assessment Internal Evaluation		End Semester Internal Evaluation		Total Marks
30(to be weighted for 10 marks)		30 marks		40
Listening (L)*	10	Listening (L)*	10	
Speaking(S)	5	Speaking(S)	5	
Reading(R)*	10	Reading(R)*	10	
Writing(W)*	5	Writing(W)*	5	

- **LRW components of Practical can be evaluated through Language Lab Software**

Department	**Mechanical Engineering**			Programme: **B.Tech.**					
Semester	**I / II**			Course Category: **ES**			End Semester Exam Type: **LE**		
Course Code	**U23ESPC02**			Periods/Week			Credit	Maximum Marks	
				L	T	P	C	CAM	ESE	TM
Course Name	**Design Thinking and Idea Lab**			**-**	**-**	**2**	**1**	**50**	**50**	**100**
(Common to ALL Branches)										
Prerequisite	Basic Knowledge of Science									
Course Outcomes	**On completion of the course, the students will be able to**									BT Mapping (Highest Level)
	CO1	Demonstrate a comprehensive understanding of the tools and inventory associated with the IDEA Lab.								**K2**
	CO2	Develop proficiency in ideation techniques to generate creative and innovative solutions for various design challenges and problems								**K3**
	CO3	Acquire practical knowledge of mechanical and electronic fabrication processes, including hands-on experience with machinery, tools, and techniques used in the manufacturing and assembly of physical components.								**K3**
	CO4	Cultivate the skills necessary for developing innovative and desirable products, including the ability to integrate user needs, market trends, and technological advancements into the design process.								**K4**
	CO5	Apply iterative design methodologies to refine and improve solutions based on feedback, user testing, and evaluation of functional, aesthetic, and usability aspects								**K4**

Design process: Traditional design, Design thinking, Existing sample design projects, Study on designs around us, Compositions/structure of a design, Innovative design: Breaking of patterns, Reframe existing design problems, Principles of creativity Empathy: Customer Needs, Insight-leaving from the lives of others/standing on the shoes of others, Observation

Design team-Team formation, Conceptualization: Visual thinking, Drawing/sketching, New concept thinking, Patents and Intellectual Property, Concept Generation Methodologies, Concept Selection, Concept Testing, Opportunity identification Prototyping: Principles of prototyping, Prototyping technologies, Prototype using simple things, Wooden model, Clay model, 3D printing; Experimenting/testing.

Sustainable product design, Ergonomics, Semantics, Entrepreneurship/business ideas, Product Data Specification, Establishing target specifications, Setting the final specifications. Design projects for teams.

List of Lab Activities and Experiments

1. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2. Machining of 3D geometry on soft material such as softwood or modelling wax.
3. 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4. 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5. 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6. Familiarity and use of welding equipment.
7. Familiarity and use of normal and wood lathe.
8. Embedded programming using Arduino and/or Raspberry Pi.
9. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.
10. Discussion and implementation of a mini project.
11. Documentation of the mini project (Report and video).

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Text Books

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd.
2. Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing.

Reference Books

1. Ulrich and Eppinger, Product Design and Development, 3rd Edition, McGraw Hill, 2004
2. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018.
3. The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan, Weldon Owen; 2017.
4. The Art of Electronics. 3rd Edition. Paul Horowitz and Winfield Hill. Cambridge University Press.
5. Practical Electronics for Inventors. 4th Edition. Paul Sherz and Simon Monk. McGraw Hill.
6. Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards. Simon Monk and Duncan Amos. McGraw Hill Education.
7. Programming Arduino: Getting Started with Sketches. 2nd Edition. Simon Monk. McGraw Hill.
8. Venuvinod, PK., MA. W., Rapid Prototyping – Laser Based and Other Technologies, Kluwer
9. Chapman W.A.J, “Workshop Technology”, Volume I, II, III, CBS Publishers and Distributors, 5th Edition, 2002.

Web References

1. https://onlinecourses.nptel.ac.in/noc23_mg72

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	2	-	-	2	-	3	2	-	-	-
2	3	3	3	2	2	2	-	-	2	-	3	2	-	-	-
3	3	3	3	2	3	2	-	-	2	-	3	2	-	-	-
4	3	3	3	2	3	2	-	-	2	-	3	2	-	-	-
5	3	3	3	2	3	2	-	-	2	-	3	2	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				

Marks	15	5	5	15	10	50	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech**						
Semester	**II**	Course Category : **ES**			End Semester Exam Type:**LE**			
Course Code	**U23ADPC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming in Python Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
	(Common to All Branches)							
Prerequisite	NIL							

Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe common Python functionality and features used for data science.	**K2**
	CO2 Query Data Frame structures for cleaning and processing.	**K2**
	CO3 Configure your programming environment	**K3**
	CO4 Experiment the concept using data visualization.	**K3**
	CO5 Analyze real time datasets,	**K3**

List of Exercises

1. Build a python program to implement Fibonacci series.
2. Build a python program to get a range of numbers from user and to separate even numbers and odd numbers respectively.
3. Build a function in Python to check duplicate letters. It must accept a string, i.e., a sentence. The function should return True if the sentence has any word with duplicate letters, else return False.
4. Build a program to perform arithmetic operations using lambda function.
5. Build a Python program that takes a list of numbers as input and returns a new list containing only the even numbers from the input list.
6. Build a python program to create a class called Car with attributes Company, model, and year. Implement a method that returns the age of the car in years.
7. Build a python program to create a base class called Shape that has a method called area which returns the area of the shape (set it to 0 for now). Then, create two derived classes Rectangle and Circle that inherit from the Shape class to calculate the area of derived classes.
8. Build a python program to implement aggregation using Numpy.
9. Build a python program to perform Indexing and Sorting.
10. Build a python program to perform Handling of missing data.
11. Build a python program to perform usage of Pivot table using Titanic datasets
12. Build a python program to perform use of eval () and query ()
13. Build a python program to perform Scatter Plot
14. Build a python program to perform 3D plotting
15. Implement an application to process a real time data.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Chirag Shah, “A Hands-On Introduction to Data Science”, Cambridge University Press, 2020.
2. Siddhartha Chatterjee, Michal Krystyanczuk, “Python Social Media Analytics”, Packt Publishing, 2017.
3. Jake VanderPlas, “Python Data Science Handbook - Essential Tools for Working with Data”, O’Reily Media Inc, 2016.
4. Zhang.Y, “An Introduction to Python and Computer Programming”, Springer Publications, 2016.
5. Wesley J Chun, “Core Python Programming”, Pearson Education, 2nd Edition, 2006.

Web References

1. https://nptel.ac.in/courses/106/106/106106212/
2. https://www.geeksforgeeks.org/data-analysis-visualization-python/
3. https://www.coursera.org/learn/python-data-analysis
4. https://www.python.org/
5. https://www.programiz.com/python-programming

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	1	3	-	-	-	-	-	-	-	2	2	2
2	2	3	2	2	3	-	-	-	-	-	-	-	2	3	2
3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**II/III**	Course Category: **ES**			End Semester Exam Type: **LE**			
Course Code	**U23CSPC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Data Structures Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to all Branches)

Prerequisite	Basic Programming Knowledge	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Analyse the algorithm's / program's efficiency in terms of time and space complexity.	**K3**
	CO2 Solve the given problem by identifying the appropriate Data Structure.	**K3**
	CO3 Solve the problems of searching and sorting techniques.	**K3**
	CO4 Solve problems in linear Data Structures.	**K4**
	CO5 Solve problems in non-linear Data Structures.	**K4**

List of Experiments

1. Write a C program to implement recursive and non-recursive i) Linear search ii) Binary Search.
2. Write a C program to implement i) Bubble sort ii) Selection sort iii) Insertion sort iv) Shell sort v) Heap sort.
3. Write a C program to implement the following using an array. a) Stack ADT b) Queue ADT
4. Write a C program to implement list ADT to perform following operations a) Insert an element into a list. a) Delete an element from list b) Search for a key element in list c) count number of nodes in list.
5. Write a C program to implement the following using a singly linked list. a) Stack ADT b) Queue ADT.
6. Write a C program to implement the dequeue (double ended queue) ADT using a doubly linked list and an array.
7. Write a C program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.
8. Write a C program that use recursive functions to traverse the given binary tree in
   a) Preorder b) Inorder c) Postorder.
9. Write a C program to perform the AVL tree operations.
10. Write a C program to implement Graph Traversal Techniques.
11. Write a C program to implement the Set operations.
12. a) Union b) Intersection c) Difference.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Yashavant Kanetkar, "Data Structures through C", BPB Publications, 3rd Edition, 2019.
2. Tenebaum Aaron M, "Data Structures using C', Pearson Publisher, 1st edition, 2019.
3. Manjunath Aradhya M and Srinivas Subramiam, "C Programming and Data Structures", Cengage India 1st edition, 2017.
4. Reema Thareja, "Data structures using C", Oxford University, 2nd Edition, 2014.
5. Gav.pai, "Data Structures and Algorithms", McGraw-Hill India, 1st edition, 2013.

Web References

1. https://www.tutorialspoint.com/data_structures_algorithms/
2. https://www.w3schools.in/data-structures-tutorial/intro/
3. https://nptel.ac.in/courses/106103069/
4. https://swayam.gov.in/nd1_noc20_cs70/preview
5. https://nptel.ac.in/courses/106103069/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
3	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
5	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech**						
Semester	**II**	Course Category: **PC**				End Semester Exam Type: **LE**		
Course Code	**U23ADP202**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Database Technologies Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to all Branches)								
Prerequisite	Basic Electrical Engineering, Laplace Transform							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Implement the DDL statements and DML commands.	**K2**
CO2	Experiment the built in functions in SQL	**K2**
CO3	Implement PL/SQL programs.	**K2**
CO4	Experiment Non-Relational Databases using NoSQL	**K3**
CO5	Explore Timeseries Databases using OpenTSDB	**K3**

List of Experiments:

1. Create Table using Data Definition Language (DDL). -
2. Modify Table using Data Manipulation Language (DML).
3. Store and Retrieve data through Data Control Language (DCL).
4. Implement Constraints and Built-in functions in various tables.
5. Perform Joins and Group-by functions.
6. Implement Simple Programs in PL/SQL.
7. Create PL/SQL programs using functions.
8. Create PL/SQL programs using procedures.
9. Create PL/SQL programs using triggers.
10. Create real time applications for gathering and listing of reviews using any of the NoSQL Databases
11. Create a real time application for monitoring oil well using IoT databases for capturing the metrics for predictive maintenance.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Ted Dunning and Ellen Friedman, “Time Series Databases New Ways to Store and Access Data”, Pearson Education, 3rd Edition, 2019.
2. Dan Sullivan,” NoSQL for Mere Mortals”, O’Rielly Media, 2nd Edition, 2019.
3. G.K.Gupta, "Database Management Systems”, Tata McGraw Hill, 2011.
4. Jeffrey D. Ullman, “Principles of database systems”, Computer Science Press, 1982.
5. Imran Bashir, “Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more”, PACKT Publisher, 2020.

Web References

1. https://nptel.ac.in/courses/106/106/106106095/
2. https://www.geeksforgeeks.org/sql-tutorial/
3. https://www.coursera.org/specializations/learn-sql-basics-data-science
4. https://docs.oracle.com/cd/E11882_01/server.112/e41084/toc.htm MySQL Online Documentation
5. http://dev.mysql.com/doc/

COs/POs/PSOs Mapping

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	3	3	3	1	2	-	-	-	-	-	-	-	3	3	3
2	3	2	2	1	2	-	-	-	-	-	-	-	3	3	3
3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**II**	Course Category Code: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23ADC2XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Ability Enhancement Courses**	**-**	**-**	**4**	**-**	**100**	**-**	**100**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**II**	Course Category : **MC**			End Semester Exam Type:			
Course Code	**U23ADM202**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Sports Yoga and NSS**	0	0	2	Non-Credit	100	-	100
Prerequisite	**-**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility and relaxation.	**K3**
	CO2 Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.	**K2**
	CO3 Develop understanding of psychological problems associated with age and lifestyle.	**K3**
	CO4 Recognize the importance of national service in community development.	**K3**
	CO5 Convert existing skills into socially relevant life skills.	**K3**

UNIT-I	**Introduction to Physical Education**	**Periods: 06**

Definition, Aims and Objectives of Physical Education - Changing trends in Physical Education
Physical Fitness, Wellness and Lifestyle: Importance of Physical Fitness and Wellness - Components of Physical fitness - Components of Health related fitness - Components of wellness - Preventing Health Threats through Lifestyle Change - Concept of Positive Lifestyle. **CO1**

UNIT-II	**Yoga and Lifestyle**	**Periods: 06**

Importance of Yoga - Elements of Yoga - Introduction - Asanas, Pranayama, Meditation and Yogic Kriyas - Yoga for concentration and related Asanas (Sukhasana, Tadasana, Padmasana and Shashankasana) - Relaxation Techniques for improving concentration - Yog-nidra. Asanas as preventive measures – Hypertension – Obesity - Back Pain-Diabetes - Asthema. **CO2**

UNIT-III	**Training and Planning in sports**	**Periods: 06**

Training - Warming up and limbering down-Skill, Technique and Style - Objectives of Planning – Tournament - Knock-Out, League/Round Robin and Combination.
Psychology and Sports - Important of Psychology in Physical Education and Sports - Differentiate Between Growth and Development - Adolescent problems and their Management - Emotion: Concept, Type and Controlling of emotions - Concepts and Types of Aggressions in Sports - Psychological benefits of exercise - Anxiety and Fear and its effects on Sports Performance - Motivation, its type and techniques - Understanding Stress and Coping strategies **CO3**

UNIT-IV	**Introduction to National Service Scheme**	**Periods: 06**

Orientation of NSS volunteers: History, motto, symbol, awards, structure and activities of NSS - Days of National and International Importance - Sensitizing about the thrust areas and awareness activities - Importance of tree plantation and voluntary blood donation - The role of SHGs and NGOs in community development – CSR - Life skills and youth development-extension activities in HEIs - various clubs and schemes like RRC, ELC, YRC, UBA, SBA, etc., **CO4**

UNIT-V	**Community Issues and the use of technology**	**Periods: 06**

Common Problems of rural India - Technology development and its suitability – Sustainability - Value addition to agricultural products - Service learning and youth volunteering – Shramdaan - Campus cleaning - Field visit to nearby communities - village survey - Initiatives to clean and green environment - preservation of water bodies in adopted villages. **CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Brar Ajmer Singh, Gill Jagtar Singh, Bains Jagdish, “Modern Textbook of Physical Education Health and Sports- I”, Kalyani
2. Publishers , 6th Edition, 2014
3. B.K.S. Iyengar, “Light on Yoga: The Definitive Guide to Yoga Practice”,Thorsons Publishers, Thorsons Classics edition, 2015
4. Joseph, Siby K, Mahodaya, “Bharat Essays on Conflict Resolution”, Institute of Gandhian Studies Publishers, 2007
5. Barman Prateeti , Goswami, “Document on Peace Education”, Triveni Akansha Publishing House, New Delhi, 2009
6. Prof R.B.S. Verma, “Field Work Practicum in Social Work-Emerging Concerns”, Rapid Publisher, Lucknow, 2020
7. Sibereisen, K , Richard M, “Lerner Approaches to Positive Youth Development”, Sage Publications, New Delhi, 2007
8. Hoshiar Singh, “Administration of Rural Development in India”,Sterling Publisher, the University of Michigan, 2009

Web References

1. http://www.thebetterindia.com/140/national-service-scheme-nss
2. http://en.wikipedia.org/wiki/national-service-scheme 19=http://nss.nic.in/adminstruct
3. http://nss.nic. in
4. http://socialworknss.org/about.html
5. Young Journal on Youth published by SAGE: http://you.sagepub.com

Evaluation methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	**MCQ Test**	**Presentation / Activity / Assignment**	
Marks	10	30	60	100

Department	**Mathematics**			Programme: **B.Tech.**				
Semester	**Third**			Course Category Code:**BS**		*End Semester Exam Type: **TE**		
Course Code	U23MATC03			Periods/Week			Credit	Maximum Marks
				L	T	P	C	CAM / ESE / TM
Course Name	**PROBABILITY AND STATISTICS**			**3**	**1**	**-**	**4**	**25 / 75 / 100**
(Common to All Branches Except CSBS)								
Prerequisite	Basic Probability							
Course Outcome	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)
	CO1	Understand the concept of probability.						**K3**
	CO2	Solve the problem on Random variables.						**K3**
	CO3	Understand the concepts of Analysis of variance.						**K3**
	CO4	Learn the applications of Large Samples.						**K3**
	CO5	Analyze the problems in small samples.						**K3**
UNIT – I	**THEORY OF PROBABILITY**						**Periods:12**	
Random Experiments - Sample Space - Exhaustive events- Axioms of probability – Conditional probability – Total probability – Bayes theorem.								**CO1**
UNIT – II	**RANDOM VARIABLES**						**Periods:12**	
Discrete Random Variable – Binomial distribution – Poisson distribution. Continuous Random Variable – Exponential distribution – Normal distribution (Excluding Derivation of Mean, Variance and MGF)								**CO2**
UNIT – III	**STATISTICS & ANALYSIS OF VARIANCES**						**Periods:12**	
Correlation – Rank correlation and Regression. Analysis of variance: One-way classifications. and two-way classifications.								**CO3**
UNIT – IV	**LARGE SAMPLES**						**Periods:12**	
Large Samples: Single Propositions – Difference of Proportions – Single Mean – Difference of Mean – Difference of Standard Deviations								**CO4**
UNIT – V	**SMALL SAMPLES**						**Periods:12**	
Test for Single and Difference Mean – Test for Ratio of Variances – Chi-Square test for Goodness of Fit and Independence of Attributes.								**CO5**
Lecture Periods:45	**Tutorial Periods:15**			**Practical Periods: -**			**Total Periods:60**	

Text Books

1. T. Veerarajan, “Probability, Statistics and Random Processes”, Tata McGraw-Hill, 3rd Edition, 2008.
2. A. Singaravelu, “Probability and Statistics”, Meenakshi Agency, 2019.
3. S.C. Gupta, V.K. Kapur “Fundamental of Mathematical Statistics” Sultan Chand & sons, 12th Edition, 2022.

Reference Books

1. B.S. Grewal, “Higher Engineering Mathematics”, Khanna publishers, 3rd Edition,2017
2. William Mendenhall, Robert J. Beaver and Barbara M. Beaver: “Introduction to Probability & Statistics”, Cengage Learning, 15thEdition, 2019.
3. Richard. A. Johnson, Irwin Miller and John E. Freund,” Probability and Statistics for Engineers”, Pearson Education, Asia, 9th Edition, 2018.
4. Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh, “An Introduction to Probability and Statistics”, Wiley, 3rd Edition 2008.

Web References

1. www.stat110.net
2. http://www.nptel.ac.in/courses/111105035 (R.V)
3. http:// www.probabilitycourse.com.
4. www.edx.org/Probability
5. http://www2.aueb.gr/users/demos/pro-stat.pdf

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	1	2	1	1
2	3	2	1	1	-	-	-	-	-	-	-	1	2	1	1
3	2	2	-	-	-	1	-	-	-	-	-	1	2	1	1
4	3	2	1	1	-	1	-	-	-	1	-	1	2	1	1
5	3	2	1	1	-	1	-	-	-	1	-	1	2	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code:**PC**				*End Semester Exam Type: **TE**		
Course Code	U23ADT304	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Software Engineering and AgileSoftware Development**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

Prerequisite	-		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Perform Software engineering processes.	**K2**
	CO2	Make use of software design.	**K2**
	CO3	Apply different software testing strategies.	**K2**
	CO4	Illustrate different Agile Methodology.	**K2**
	CO5	Make use of different process of Agile Methodology.	**K2**

UNIT-I	**SOFTWARE ENGINEERING PROCESSES**	**Periods: 9**	
Software engineering concepts – Development activities – Software development lifecycle models –Software project management – Project planning – Estimation – Scheduling – Risk management – Software configuration management - Project Planning – Empirical Estimation Techniques – Staffing Level Estimation – Scheduling – Organization and Team structures – Staffing – Software Requirements specification.			**CO1**
UNIT-II	**SOFTWARE DESIGN**	**Periods: 9**	
Characteristics of a Good Software Design – Coupling and Cohesion – Structured Analysis – Data Flow Diagrams – Structured and Detailed Design – Object oriented concepts – UML Diagrams – Use case model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Object Oriented Analysis and Design methodology – Characteristics of a good User Interface – Types – A User Interface Design methodology.			**CO2**
UNIT-III	**SOFTWARE TESTING**	**Periods: 9**	
Introduction to Software testing – Psychology of Testing – Principles of Software Testing – Defects – Defect Prevention Strategies – Role of a tester – Software Testing Life Cycle.			**CO3**
UNIT-IV	**AGILE METHODOLOGY**	**Periods: 9**	
Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model – Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams – Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values.			**CO4**
UNIT-V	**AGILE PROCESSES**	**Periods: 9**	
Lean Production – SCRUM, Crystal, Feature Driven Development – Adaptive Software Development – Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Ian Sommerville, “Software Engineering”, Pearson Education, Eighth edition, 2008.
2. Craig Larman, “Agile and Iterative Development–A Manager’s Guide”, Pearson Education, 2010.
3. Elisabeth Hendrickson, “Agile Testing” Quality Tree Software Inc, 2012.

Reference Books

1. Hazza and Dubinsky, “Agile Software Engineering, Series: Undergraduate Topics in Computer Science”, Springer, 2009.

2. Roger S. Pressman, “Software Engineering: A Practitioner's Approach”, McGraw-Hill International Edition, Seventh Edition, 2009.

3. David J. Anderson and Eli Schragenheim, “Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results”, Prentice Hall, 2003.

4. Object-Oriented Systems Analysis and Design, McGraw-Hill Higher Education; 4th Edition, 2010.

5. Robert C Martin, “Agile Software Development, Principles, Patents and Practices”, Prentice Hall, 2012.

6. James Shore and Shane Warden, “The art of Agile Development”, O’ Reiely, 2012.

7. Rajib Mall, “Fundamentals of Software Engineering”, PHI Learning, Third Edition, 2013.

6. H. B. Verbruggen, Spyros G. Tzafestas, “Artificial Intelligence in Industrial Decision Making, Control and Automation”, Springer, 2012.

Web References

1. https://www.coursera.org/courses?query=software%20engineering
2. https://www.edx.org/learn/software-engineering
3. https://www.udemy.com/courses/development/software-engineering/
4. https://www.coursera.org/learn/agile-software-development
5. https://www.tutorialspoint.com/sdlc/sdlc_agile_model.htm

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2
2	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2
3	2	2	2	2	-	-	-	-	-	-	-	-	2	2	2
4	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2
5	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code:**PC**			*End Semester Exam Type: **TE**			
Course Code	U23ADT305	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA M	ESE	TM
Course Name	**Artificial Intelligence & Expert System**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
Prerequisite	-							

Course Outcome		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Understand the concepts of AI.	**K2**
	CO2	Acquire various Problem-solving techniques.	**K2**
	CO3	Explore the concepts of knowledge representation and uncertain knowledge.	**K2**
	CO4	Understand the concepts of Expert system.	**K2**
	CO5	Explore about knowledge representation and inference method.	**K2**

UNIT-I	**INTRODUCTION TO AI**	**Periods: 9**	
Introduction: Introduction to Artificial Intelligence – Various definitions of AI – AI Applications and Techniques – Turing Test and Reasoning – forward and backward chaining. Intelligent Agents: Introduction to Intelligent Agents – Rational Agent – their structure – reflex – model-based – goal-based and utility-based agents – behavior and environment in which a particular agent operates.			**CO1**
UNIT-II	**PROBLEM SOLVING TECHNIQUES**	**Periods: 9**	
Problem Solving and Search Techniques: Problem Characteristics – Production Systems – Control Strategies – Breadth First Search – Depth First Search – iterative deepening – uniform cost search – Hill climbing and its Variations – simulated annealing – genetic algorithm search. Heuristics Search Techniques: Best First Search – A* algorithm – AO* algorithm – Min Max and game trees – refining Minmax– Alpha – Beta pruning – Constraint Satisfaction Problem – Means-End Analysis.			**CO2**
UNIT-III	**KNOWLEDGE REPRESENTATION AND UNCERTAIN KNOWLEDGE**	**Periods: 9**	
Knowledge Representation: Introduction to First Order Predicate Calculus – Resolution Principle – Semantic Nets – Conceptual Dependencies – Semantic networks – Frames system –Production Rules – Conceptual Graphs – Ontologies. Reasoning with Uncertain Knowledge: Different types of uncertainty — various probability constructs –Bayes' rule – Other approaches to modeling uncertainty such as Dempster-Shafer theory and Fuzzy sets/logic.			**CO3**
UNIT-IV	**INTRODUCTION TO EXPERT SYSTEM**	**Periods: 9**	
The meaning of an expert system - problem domain and knowledge domain - the advantages of an expert system - general stages in the development of an expert system - general characteristics of an expert system- history and uses of expert systems today - rule-based expert systems - procedural and nonprocedural paradigms - characteristics of artificial neural systems.			**CO4**
UNIT-V	**KNOWLEDGE REPRESENTATION AND INFERENCE**	**Periods: 9**	
Representation of Knowledge: The study of logic - difference between formal logic and informal logic - meaning of Knowledge – how knowledge can be represented. Methods of Inference: Trees – lattices - and graphs - state and problem spaces - AND-OR trees and goals - methods -Rule-limitation of inference -g - additional methods of Inference - Meta knowledge - the Markov decision process – Decision Making – Decision Making using ML, Decision Support System – Role of Artificial Intelligence in Intelligent Decision Support System.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. S. Russell and P. Norvig, “Artificial Intelligence: A Modern Approach”, Pearson Education, 3rd Edition, 2015.
2. Elaine Rich and Kelvin Knight, “Artificial Intelligence”, Tata McGraw Hill, 3rd Edition, 2017
3. DAN.W. Patterson, “Introduction to A.I. and Expert Systems”, PHI, 2007.
4. Durkin, J., “Expert systems Design and Development”, Macmillan, 1994.
5. Elias M. Awad, “Building Expert Systems”, West Publishing Company, 1996.

Reference Books

1. Michael Wooldridge, “An Introduction to MultiAgent Systems”, John Wiley & Sons, 2nd Edition, 2009.
2. Fabio Luigi Bellifemine, Giovanni Caire, Dominic Greenwood, “Developing Multi-Agent Systems with JADE”, Wiley Series in Agent Technology, John Wiley & Sons, 2007.
3. W.F. Clocksin and C.S. Mellish, “Programming in PROLOG”, Springer, 5th Edition, 2003.
4. Gonzalez and D. Dankel, "The Engineering of Knowledge-Based Systems", Prentice Hall, 1994.
5. Nikolopoulos, "Expert Systems", Marcel Dekker Inc. 1997.
6. H. B. Verbruggen, Spyros G. Tzafestas, “Artificial Intelligence in Industrial Decision Making, Control and Automation”, Springer, 2012.

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1. https://nptel.ac.in/courses/106/105/106105077/
2. https://www.tutorialspoint.com/artificial_intelligence/index.html
3. http://www.umsl.edu/~joshik/msis480/chapt11.html
4. https://www.coursera.org/courses?query=decision%20making
5. https://www.slideshare.net/akhilrocker143/572-11293384
6. https://www.sciencedirect.com/science/article/abs/pii/0378720693900696

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	3	-	-	-	-	-	-	-	-	2	2	3
2	3	2	3	2	-	-	-	-	-	-	-	-	3	3	2
3	2	2	3	2	-	-	-	-	-	-	-	-	2	2	3
4	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2
5	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT1	CAT2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code: **PC**			*End Semester Exam Type: **TE**			
Course Code	U23ADT306	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Basic Machine Learning Techniques**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

Prerequisite	-		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand the concepts of machine learning algorithms.	**K2**
	CO2	Acquire various Problem-solving techniques.	**K2**
	CO3	Explore the concepts of knowledge representation and uncertain knowledge.	**K2**
	CO4	Understand the concepts of Expert system.	**K2**
	CO5	Explore about knowledge representation and inference method.	**K2**

UNIT-I	**INTRODUCTION TO AI**	**Periods: 9**	
Introduction:Introduction to Artificial Intelligence, AI Applications and Techniques - Various definitions of AI, Turing Test and Reasoning - forward and backward chaining. Intelligent Agents: Introduction to Intelligent Agents, Rational Agent, their structure - reflex - model-based - goal-based and utility-based agents - behavior and environment			**CO1**
UNIT-II	**PROBLEM SOLVING TECHNIQUES**	**Periods: 9**	
Basic Problem Solving: Problem Characteristics, Production Systems, Control Strategies - Breadth First Search - Depth First Search - Iterative Deepening. Heuristic Search Techniques: Hill climbing, Simulated Annealing - Genetic Algorithm Search.			**CO2**
UNIT-III	**KNOWLEDGE REPRESENTATION AND UNCERTAIN KNOWLEDGE**	**Periods: 9**	
Knowledge Representation: Introduction to First Order Predicate Calculus - Semantic Nets - Conceptual Dependencies - Semantic networks - Frames system - Production Rules. Reasoning with Uncertain Knowledge: Various probability constructs - Bayes' rule - Dempster-Shafer theory - Fuzzy sets/logic.			**CO3**
UNIT-IV	**INTRODUCTION TO EXPERT SYSTEM**	**Periods: 9**	
Basics of Expert Systems: Problem domain and knowledge domain, Advantages of expert systems, History and uses of expert systems today, Rule-based expert systems, Procedural and non-procedural paradigms.			**CO4**
UNIT-V	**KNOWLEDGE REPRESENTATION AND INFERENCE**	**Periods: 9**	
Advanced Knowledge Representation: Conceptual Graphs - Ontologies. Inference Methods: Trees - lattices - graphs - AND-OR trees and goals - Rule-limitation of inference - Meta knowledge - Markov decision process - Decision Making - Decision Making using ML, Decision Support System - Role of Artificial Intelligence in Intelligent Decision Support System.			**CO5**

Lecture Periods: 30	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. S. Russell and P. Norvig, “Artificial Intelligence: A Modern Approach”, Pearson Education, 3rd Edition, 2015.
2. Elaine Rich and Kelvin Knight, “Artificial Intelligence”, Tata McGraw Hill, 3rd Edition, 2017
3. DAN.W. Patterson, “Introduction to A.I. and Expert Systems”, PHI, 2007.
4. Durkin, J., “Expert systems Design and Development”, Macmillan, 1994.
5. Elias M. Awad, “Building Expert Systems”, West Publishing Company, 1996.

Reference Books

1. Michael Wooldridge, “An Introduction to MultiAgent Systems”, John Wiley & Sons, 2nd Edition, 2009.
2. Fabio Luigi Bellifemine, Giovanni Caire, Dominic Greenwood, “Developing Multi-Agent Systems with JADE”, Wiley Series in Agent Technology, John Wiley & Sons, 2007.
3. W.F. Clocksin and C.S. Mellish, “Programming in PROLOG”, Springer, 5th Edition, 2003.
4. Gonzalez and D. Dankel, "The Engineering of Knowledge-Based Systems", Prentice Hall, 1994.
5. Nikolopoulos, "Expert Systems", Marcel Dekker Inc. 1997.
6. H. B. Verbruggen, Spyros G. Tzafestas, “Artificial Intelligence in Industrial Decision Making, Control and Automation”, Springer, 2012.

Web References

1. https://nptel.ac.in/courses/106/105/106105077/
2. https://www.tutorialspoint.com/artificial_intelligence/index.html
3. http://www.umsl.edu/~joshik/msis480/chapt11.html
4. https://www.coursera.org/courses?query=decision%20making
5. https://www.slideshare.net/akhilrocker143/572-11293384
6. https://www.sciencedirect.com/science/article/abs/pii/0378720693900696

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
2	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
3	-	-	-	-	-	3	3	2	2	-	-	3	-	-	-
4	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
5	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and BusinessSystems**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **HS**			End Semester Exam Type: **TE**			
Course Code	**U23HSTC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**UNIVERSAL HUMAN VALUES - II**	**2**	**0**	**0**	**2**	**25**	**75**	**100**
	(Common to all Branch)							
Prerequisite	UHV - I							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Evaluate the significance of value inputs in formal education and start applying them in their life and profession	**K2**
	CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	**K2**
	CO3	Analyze the value of harmonious relationship based on trust and respect in their life and profession	**K2**
	CO4	Examine the role of a human being in ensuring harmony in society and nature.	**K2**
	CO5	Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.	**K2**

UNIT - I	**Introduction To Value Education**	**Periods: 06**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) - Understanding Value Education- Self-exploration as the Process for Value Education - Basic Human Aspirations - Happiness and Prosperity - Current Scenario- Method to Fulfil the Basic Human Aspirations

UNIT - II	**Harmony In The Human Being**	**Periods: 06**

Understanding Human being as the Co-existence of the Self and the Body-Distinguishing between the Needs of the Self and the Body-The Body as an Instrument of the Self-Understanding Harmony in the Self-Harmony of the Self with the Body- Programme to ensure self-regulation and Health

UNIT - III	**Harmony In The Family And Society**	**Periods: 06**

Harmony in the Family - Basic Unit of Human Interaction- 'trust' - Foundational Value in Relationship - 'Respect' - as the Right Evaluation - Other Feelings, Justice in Human-to-Human Relationship - Understanding Harmony in the Society-Vision for the Universal Human Order.

UNIT - IV	**Harmony In The Nature / Existence**	**Periods: 06**

Understanding Harmony in the Nature-Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders ofNature - Realizing Existence as Co-existence at All Levels - Holistic Perception of Harmony in Existence

UNIT - V	**Implications Of The Holistic Understanding - A Look At Professional Ethics**	**Periods: 06**

Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct - Basis for Humanistic Education, HumanisticConstitution and Universal Human Order-Competence in Professional Ethics-Holistic Technologies, Production Systems and Management Models-Typical Case Studies-Strategies for Transition towards Value - based Life and Profession

Lecture- Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Text Book

1. R. R. Gaur, R. Asthana, G. P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books, 2nd Revised Edition, New Delhi, 2019.

Reference Books

1. A Nagraj, Jeevan Vidya Prakashan, Amarkantak, "Jeevan Vidya: EkParichaya", 2013.
2. A.N. Tripathi, "Human Values", New Age International Publishers, New Delhi, 3rd Edition, 2019.
3. Annie Leonard, "The Story of Stuff", Free Press, Reprint Edition, 2011.
4. Mohandas Karam chand Gandhi, "The Story of My Experiments with Truth – Mahatma Gandhi Autobiography", Finger printPublisher, 2009.
5. E. F Schumacher, "Small is Beautiful", Vintage Publisher, 1993.
6. Cecile Andrews, "Slow is Beautiful", New Society Publishers, 2006.
7. J C Kumarappa, "Economy of Permanence", Sarva Seva Sangh Prakashan, 2017.
8. Pandit Sunderlal, "Bharat Mein Angreji Raj", Prabhat Prakashan Publisher, 2021.
9. Dharampal, "Rediscovering India", Stosius Inc/Advent Books Division Publisher, 1983.
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule", Gyan Publishing House, 2023.
11. Maulana Abdul Kalam Azad, "India Wins Freedom", Orient BlackSwan Publisher, 1st Edition, 1988.
12. Life of Vivekananda, "Romain Rolland (English)", Advaita Ashrama Publisher, India, 4th Edition, 2010.

Mahatma Gandhi, "Romain Rolland (English)", Srishti Publishers & Distributors, 2020.

Web References

1. https://www.uhv.org.in/uhv-ii
2. http://www.storyofstuff.com
3. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
4. https://fdp-si.aicte-india.org/8dayUHV_download.php
5. https://www.youtube.com/watch?v=8ovkLRYXIjE

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
2	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
3	-	-	-	-	-	3	3	2	2	-	-	3	-	-	-
4	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
5	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**II/ III**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23CSBC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Design and Analysis of Algorithms**	**2**	**-**	**2**	**3**	**50**	**50**	**100**

(Common to All Branches)

Prerequisite	Programming (C or C++), Data Structures and Problem Solving Approaches.	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Analyze and improve the efficiency of algorithms and estimate the performance of algorithmand Divide and Conquer.	**K2**
	CO2 Determine the Greedy paradigms, Dynamic Programming and explain when an algorithmic design situation calls for it.	**K3**
	CO3 Interpret the Backtracking paradigms, Branch and Bound, NP-Hard paradigms and explain when an algorithmic design situation calls for it.	**K3**
	CO4 Demonstrate programs using Divide and Conquer, Greedy paradigms.	**K3**
	CO5 Build the programs using Dynamic Programming, Backtracking and Branch and Bound.	**K2**

UNIT - I	**Introduction To Algorithm and Divide and Conquer**	**Periods:10**	
Introduction – Algorithm – Pseudo code for expressing algorithms – Performance Analysis – Time complexity – Space complexity – Asymptotic Notation – Big oh notation – Omega notation – Theta notation and Little oh notation. **Divide and Conquer method**: Binary search – Merge sort – Quick sort			**CO1**
UNIT - II	**Greedy Method and Dynamic Programming**	**Periods:10**	
Greedy method: General method – applications– Knapsack problem – Minimum cost spanning trees –Single source shortest path problem. **Dynamic Programming**: Applications – Multistage graphs – 0/1 knapsack problem, All pairs shortest path problem – Traveling sales person problem			**CO2**
UNIT - III	**Backtracking and Branch and Bound**	**Periods:10**	
Backtracking: General method. Applications – N – queen problem – Sum of subsets problem – Graph coloring – Hamiltonian cycle – 0/1 Knapsack Problem. **Branch and Bound**: General method – Applications – Traveling sales person problem – 0/1 knapsack problem – LC Branch and Bound solution –FIFO Branch and Bound solution			**CO3**
UNIT - IV	**Laboratory Exercises**	**Periods:15**	
• Implementation of binary search using Divide-and-Conquer technique • Implementation of Finding Maximum and Minimum using Divide-and-Conquer technique. • Implementation of Knapsack using Greedy technique. • Implementation of Minimum Spanning Tree using Prim's and Kruskal's Algorithm using Greedy technique. • Implementation of Single-Source Shortest Paths algorithms using Greedy technique.			**CO4**
UNIT - V	**Laboratory Exercises**	**Periods:15**	
• Implementation of All Pairs Shortest Paths using Dynamic Programming technique. • Implementation of Traveling Salesman algorithms using Dynamic Programming technique. • Implementation of 8 Queens with the design of Backtracking. • Implementation of sum of subsets with the design of Backtracking. • Implementation of Traveling Salesman problems with Branch-and-Bound technique.			**CO5**

Lecture Periods:30	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods:60**

Text Books

1. Levitin Anany," Introduction to the Design and Analysis of Algorithms", Pearson Education India,1st Edition,2019.
2. E. Horowitz and S.Sahni, "Fundamentals of Algorithms", Galgotia Publications, 2nd Edition, 2010.
3. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, "Introduction to Algorithms",PHI/Pearson Education, 3rdEdition,2009.

Reference Books

1. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Pearson Education, Third Edition, 2012.
2. Aho Alfred V.,“Design & Analysis of Computer Algorithms”, Pearson Education India,2nd Edition,2018
3. Basu S. K.,” Design Methods and Analysis of Algorithms”, PHI Learning,3rd Edition, 2018.
4. E. Horowitz and S.Sahni, “Fundamentals of Algorithms”, 2nd Edition, Galgotia Publications, 2010.
5. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, “Introduction to Algorithms, 3rd Edition, PHI/Pearson Education, 2009.

Web References

1. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/
2. https://www.javatpoint.com/daa-tutorial
3. https://www.guru99.com/design-analysis-algorithms-tutorial.html
4. https://www.geeksforgeeks.org/fundamentals-of-algorithms/
5. https://swayam.gov.in/nd1_noc20_cs71/preview

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
2	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
3	-	-	-	-	-	3	3	2	2	-	-	3	-	-	-
4	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
5	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**English**	Programme: **B.Tech.**						
Semester	**Third**	Course Category Code:**HS**			*End Semester Exam Type:**LE**			
Course Code	**U23ENPC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**General Proficiency- I**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to ALL Branches except CSBS)

Prerequisite	Basics of English Language	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret meaning and apply reading strategies in technical and non-technical context	**K3**
	CO2 Develop interpersonal communication skills professionally	**K4**
	CO3 Demonstrate various forms of formal writing	**K3**
	CO4 Decode graphical data coherently	**K2**
	CO5 Apply the techniques of verbal aptitude in competitive exams	**K3**

UNIT- I	**COMPREHENSION ANALYSIS**	**Periods:6**	
Listening: Dialogue based on social contexts (IELTS based) - Speaking: Break the iceberg (IELTS based) Submitting Video Recording - Reading: Reading technical passage (IELTS based) - Writing: Writing Task: 2 (IELTS Academic) - Vocabulary: Synonyms (IELTS)			**CO1**
UNIT- II	**PERSONALITY DEVELOPMENT**	**Periods:6**	
Listening: Monologue about the everyday social issues (IELTS based) - Interview Videos - Speaking: Speak about the topic in the Flash Card (IELTS based) - Reading: British & American Vocabulary - Writing: SWOT Analysis - Vocabulary: Idioms and Phrases (IELTS)			**CO2**
UNIT- III	**INFERENTIAL LEARNING**	**Periods:6**	
Listening: Conversation between 4 people regarding education (IELTS based), Anecdotes - Speaking: Structure Discussion (IELTS based) - Reading: Distinguish between facts & opinions (IELTS based), - Writing: Writing Conversation to different context - Vocabulary: Phrasal Verbs (IELTS)			**CO3**
UNIT- IV	**INTERPRETATION AND FUNCTIONAL WRITING**	**Periods:6**	
Listening: Monologue on an academic subject (IELTS based), Group Discussion videos - Speaking: Group Discussion Practice - Reading: Read and review (Books, Magazines) - Writing: Writing Task 1: (IELTS Academic: Graph/ chart/tables description) - Vocabulary: Collocations (IELTS)			**CO4**
UNIT-V	**VERBAL APTITUDE - I**	**Periods:6**	
Language Enhancement: Articles, Preposition, Conjunction **Verbal Ability Enhancement:** Ordering of sentences, Blood Relation, Completing Statements- Cloze test, Spotting Errors - Sentence Improvement, Word Analogy, Word Groups **(GATE)**			**CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:30**

Reference Books

1. Lewis, Norman, "Word Power Made Easy".Goyal Publishers and Distributors Pvt.Ltd., Latest Edition, 2020.
2. Patterson,Kerry, Joseph Grenny,Ron McMillan, Al Switzler, "Crucial Conversation Tools for talking when Stakes are High", KindlePublication,2nd Edition, 2011.
3. Comfort, Jeremy,et.al. "Speaking Effectively: Developing Speaking Skills for Business English", Cambridge University Press,Cambridge: Reprint 2011.
4. Agarwal, R. S. "A Modern Approach to Verbal & Non Verbal Reasoning". S. Chand, 2010.
5. Wren, Percival Christopher, and Wren Martin. "High School English Grammar and Composition". S Chand, 2005.

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2. https://ieltsfocus.com/2017/08/02/collocations-ielts/
3. https://www.freshersliv e.com/online-test/blood-relations-questions-and-answers
4. https://www.toppr.com/guides/english-language/reading-comprehension/cloze-test/
5. https://www.examsbook.com/word-analogy-test-questions-with-answers

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
2	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
3	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
4	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
5	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1

Correlation Level: 1-Low, 2-Medium, 3-High

Evaluation Methods

Practical				
Continuous Assessment Internal Evaluation		**End Semester External Evaluation**		**Total Marks**
50 marks		**50 marks**		100
Conduction of Practical (Assignment 1&2 -10 Marks Performance in practical classes - 5 Marks)	15	Listening (L)	20	
Record	5	Speaking(S)	10	
Viva	5	Reading(R)	10	
Model Practical Examination (Model Exam is conducted for 50 Marks that will beconverted to 15 Marks)	15	Writing(W)	10	
Attendance	10			

Department	**Mathematics**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code: **CC**				*End Semester Exam Type: **LE**		
Course Code	U23MAPC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Engineering Mathematics Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to all Branches Except CSBS)								
Prerequisite	Matrices, Fourier Transforms, Laplace Transforms							

Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Perform and evaluate Matrix Operations	**K3**
	CO2 Solve Differential and Integral Equations	**K3**
	CO3 Construct Fourier series and Fourier Transforms of the given function	**K3**
	CO4 Find the Measures of Central tendency	**K3**
	CO5 Analyze Correlation and Regression lines	**K3**

List of Experiments:

1. Find the Inverse, Rank, Eigen values and Eigen Vectors of the matrix.
2. Solve the first order differential equation.
3. Find the integration of $\int_a^b f(x)dx$.
4. Find the Fourier series of f(x).
5. Find the Fourier Transform of f(x).
6. Find the Laplace Transform of f(x).
7. Find the Mean, Median and Mode.
8. Construct the Pie and Bar Diagram.
9. Find the Correlation coefficient.
10. Find the Regression lines.

Lecture Periods:- Nil	**Tutorial Periods:- Nil**	**Practical Periods: 30**	**Total Periods :30**

Reference Books

1. T. Veerarajan, “Engineering Mathematics, Tata McGraw Hill Education (India) Private Limited Chennai 2nd Edition Paperback – 1January 2018.

2. M.K. Venkataraman, “Engineering Mathematics, The National Publishing Company, Madras, 2016.

3. Dr. A. Singaravelu, “Probability and Statistics”, Meenakshi Agency, Paperback – 1, 2019.

Web References

1. https://www.mccormick.northwestern.edu/documents/students/undergraduate/introduction-to-matlab.pdf
2. https://www.nrigroupindia.com/niist/wp-content/uploads/sites/6/2022/02/lab-manual-it406matlab.pdf
3. https://www.studocu.com/row/document/comsats-university-islamabad/signals-and-systems/lab-lab-manual/38332410

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	1	1	-	1	-	-	-	-	-	1	1	1	1
2	3	2	1	1	-	1	-	-	-	-	-	1	1	1	1
3	2	1	-	-	-	1	-	-	-	-	-	1	1	1	1
4	2	1	-	-	-	1	-	-	-	-	-	1	1	1	1
5	3	2	1	1	-	1	-	-	-	-	-	1	1	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**I/II**	Course Category: **ES**					End Semester Exam Type: **LE**	
Course Code	**U23ADP303**	Periods / Week		Credit			Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Artificial Intelligence& Expert System Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to All Branches)								
Prerequisite	NIL							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Describe the basics of PROLOG programming.	**K2**
	CO2 Implement the concepts using BFS and A* algorithm.	**K2**
	CO3 Implement the concepts using Means End Analysis.	**K3**
	CO4 Ability to Describe the basics of Expert System.	**K3**
	CO5 Ability to develop specific expert system problems.	**K3**

List of Exercises

1. Study of PROLOG. Write the following programs using PROLOG. 2. Write simple fact for the statements using PROLOG. 3. Implementation of toy problems 4. Developing Best first search and A* Algorithm for real world problems 5. Implementation of knowledge representation schemes - use cases 6. Solve Robot (traversal) problem using means End Analysis. 7. Develop an Expert system for Categorize disease. 8. Develop an Expert System that asks you a couple of questions about a certain flower, and answers with its name as a result 9. Combine a machine learning model with an expert system for decision support. 10. Develop an intelligent system for personalized recommendations.	**CO1**

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Russell & Norvig, “Artificial Intelligence: A Modern Approach”, Prentice Hall, 1995.
2. Elain Rich and Kevin Knight, “Artificial Intelligence”, TMH, 1991.
3. Staurt Russel and peter norvig, “Artificial Intelligence-A modern approach”, PHI, 1998.
4. Durkin, J., “Expert systems Design and Development”, Macmillan, 1994.
5. Elias M. Awad, “Building Expert Systems”, West Publishing Company, 1996.

Web References

1. https://www.geeksforgeeks.org/prolog-an-introduction/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall- 2010/lecture-videos/lecture-3-reasoning-goal-trees-and-rule-based-expert-systems/
3. https://www.tutorialspoint.com/artificial_intelligence/index.html
4. https://www.youtube.com/watch?v=JMUxmLyrhSk
5. https://www.sciencedirect.com/science/article/abs/pii/0378720693900696

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	3	-	-	-	-	-	-	-	-	2	2	3
2	3	2	3	2	-	-	-	-	-	-	-	-	3	3	2
3	2	2	3	2	-	-	-	-	-	-	-	-	2	2	3
4	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2
5	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**III**	Course Category: **ES**					End Semester Exam Type: **LE**	
Course Code	**U23ADP304**	Periods / Week		Credit			Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Basic Machine Learning Techniques Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to All Branches)								
Prerequisite	NIL							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Describe the data preprocessing techniques	**K2**
	CO2	Implement the concepts using Supervised algorithms.	**K2**
	CO3	Implement the concepts using Unsupervised algorithms	**K3**
	CO4	Ability to implement Regression Techniques.	**K3**
	CO5	Experiment Dimensionality Reduction techniques.	**K3**

List of Exercises

1. Data preprocessing 2. Support Vector Machine 3. Naive Bayes 4. K-Nearest Neighbor 5. Linear Regression 6. Logistic Regression 7. K-Means 8. K-Medians 9. Principal Component Analysis 10. Linear Discriminant Analysis	**CO1**

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Andreas C. Mueller and Sarah Guido, “Introduction to Machine Learning with Python”, O’Reilly Media, Inc. First edition, 2016.
2. Henrik Brink, Joseph W. Richards, and Mark Fetherolf, “Real-World Machine Learning”, Manning Publications, 2017.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, The MIT Press, 2nd Edition, 2012.

Web References

1. https://pythonprogramming.net/machine-learning-tutorial-python-introduction/
2. https://algorithmia.com/blog/machine-learning-algorithms-in-python.
3. https://www.pyimagesearch.com/2019/01/14/machine-learning-in-python/.
4. https://machinelearningmastery.com/machine-learning-in-python-step-by-step/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	3	-	-	-	-	-	-	-	-	2	2	3
2	3	2	3	2	-	-	-	-	-	-	-	-	3	3	2
3	2	2	3	2	-	-	-	-	-	-	-	-	2	2	3
4	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2
5	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23ADC3XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE-III**	**-**	**-**	**4**	**-**	**100**	**-**	**100**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 50**	**Total Periods: 50**

Evaluation methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	10	90	100

Department	Artificial Intelligence and Data Science	Programme: **B.Tech.**						
Semester	**III**	Course Category: **AEC**			*End Semester Exam Type: **LE**			
Course Code	**U23ADS301**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Skill Enhancement Course-I**	**0**	**0**	**2**	**-**	**-**	**100**	**100**

1. **CLEAN CODE**

Course Content:

1. Introduction to Clean Code.
2. Bad Code - The Total Cost of Owning a Mess: The Grand Redesign in the Sky – Attitude.
3. The Primal Conundrum.
4. The Art of Clean Code - Schools of Thought - The Boy Scout Rule - Prequel and Principles.
5. Introduction to Naming Convention - Meaningful Names – Introduction - Use Intention-Revealing Names - Avoid Disinformation - Make Meaningful Distinctions - Use Pronounceable Names - Use Searchable Names - Avoid Encodings.
6. Hungarian Notation - Member Prefixes - Interfaces and Implementations.
7. Avoid Mental Mapping - Class Names - Method Names - Use Solution Domain Names - Use Problem Domain Names.
8. Functions - Blocks and Indenting - Sections within Functions - One Level of Abstraction per Function.
9. Reading Code from Top to Bottom: The Stepdown Rule - Switch Statements - Use Descriptive Names.
10. Function Arguments - Common Monadic Forms - Flag Arguments - Dyadic Functions – Triads - Argument Objects.
11. Comments - Comments Do Not Make Up for Bad Code - Explain Yourself in Code - Good Comments - Legal Comments.
12. Formatting - The Purpose of Formatting - Different Formatting Types.
13. Error Handling - Use Exceptions Rather Than Return Codes.

2. **EXPLORING OF GITHUB**

Course Content:

1. Introduction to Version Control - Keeping Historical Copies - Diffing Files - Applying Changes.
2. Practical Application of diff and patch.
3. Version control - Version Control and Automation.
4. Git - Installing Git - Installing Git on Windows (Optional) - First Steps with Git - Tracking Files - The Basic Git Workflow - Anatomy of a Commit Message.
5. Introduction to Git Locally - Using Git Locally.
6. Skipping the Staging Area - Getting More Information About Our Changes - Deleting and Renaming Files.
7. Undoing Changes Before Committing - Amending Commits – Rollbacks - Identifying a Commit
8. Introduction to branch - Creating New Branches - Working with Branches.
9. Merging - Merge Conflicts. Working with Remotes.
10. Introduction to GitHub - Basic Interaction with GitHub – Introduction to remote - Working with Remotes - Fetching New Changes - Updating the Local Repository.
11. The Pull-Merge-Push Workflow - Pushing Remote Branches - Rebasing the Changes - Rebasing Example.
12. Collaboration Introduction to Collaboration - Simple Pull Request on GitHub - The Typical Pull Request Workflow on GitHub - Updating an Existing Pull Request - Squashing Changes.
13. Code reviews - Code Review Workflow - Uses of Code Reviews in GitHub. Managing Collaboration.
14. Tracking Issues.
15. Continuous Integration.Collaboration.

3. **APTITUDE - I**

Course Content:

1. Number System - Basics, Properties & Type of Numbers - Divisibility Rules
2. LCM & HCF - Unit Digit Concept [Cyclicity Method]
3. Decimals, Simplification. Ratio & Proportion - Compounded & Duplicate Ratio - Inverse Ratio - Shortcut to Find Ratio - Continuous Proportion - Mean & Divisibility Proportion.
4. Ages - Both Data is in Ratio or Time Format - One Data in Ratio or Time Format & Other Data in Sum, Difference or Product
5. Logical [Puzzles] Method.
6. Average - Basics & Finding Average in Complex - Replacement & Alteration Method - Average Speed Finding Problems.
7. Allegation & Mixtures
8. Ratio of Mixture - Finding the Kilogram through Ratio
9. Mean Value Method
10. Ratio Mixture [Fraction Method] - Iteration Method.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Web references
1. https://www.indiabix.com/aptitude/questions-and-answers/ 2. https://www.ambitionbox.com/topics/aptitude/questions-and-answers 3. https://www.geeksforgeeks.org/aptitude-questions-and-answers/

Evaluation methods

Assessment	**Continuous Assessment Marks (CAM)**			**Total Marks**
	Attendance	**MCQ Test**	**Presentation / Activity / Assignment**	
Marks	10	30	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**					
Semester	**III**	Course Category: MC			*End Semester Exam Type: **TE**		
Course Code	**U23CBM303**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**INTRODUCTION TO CLIMATE CHANGE**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

UNIT-I	**ATMOSPHERE AND ITS COMPONENTS**	**(8Hrs)**
Importance of Atmosphere-Physical Chemical Characteristics of Atmosphere- Vertical structure of the atmosphere-Composition of the atmosphere-Atmospheric stability-Temperature profile of the atmosphere-Lapse rates-Temperature inversion-effects of inversion on pollution dispersion.		**CO1**
UNIT-II	**GLOBAL CLIMATE**	**(8Hrs)**
Account of past climate – Environmental indicators and instrumental records – Human Footprints on global warming- Predicting future climates- Temperature regime – Extreme climate events.		**CO2**
UNIT-III	**IMPACTS OF CLIMATE CHANGE**	**(8Hrs)**
Causes of Climate change: Change of Temperature in the environment-Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors — Agriculture, Forestry and Ecosystem — Water Resources — Human Health — Industry, Settlement and Society — Methods and Scenarios — Projected Impacts for Different Regions— Uncertainties in the Projected Impacts of Climate Change — Risk of Irreversible Changes.		**CO3**
UNIT- IV	**OBSERVED CHANGES AND ITS CAUSES**	**(8Hrs)**
Climate change and Carbon credits- Initiatives in India-Kyoto Protocol-Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks —The Montreal Protocol — UNFCCC — IPCC –Evidences of Changes in Climate and Environment — on a Global Scale and in India.		**CO4**
UNIT- V	**CLIMATE CHANGE AND MITIGATION MEASURES**	**(8Hrs)**
Clean Development Mechanism —Carbon Trading- examples of future Clean Technology — Biodiesel — Natural Compost — Eco-Friendly Plastic —I Alternate Energy — Hydrogen — Bio-fuels —Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices—Carbon sequestration — Carbon capture and storage (CCS) — International and Regional cooperation- Remedial measures.		**CO5**

Text Books

1. Joan Fitzgerald “Greenovation: Urban Leadership on Climate Change, Oxford University Press 2020.
2. J. David Neelin” Climate change and climate modelling” Cambridge University press (2011).
3. Robin Moilveen “Fundamentals of weather and climate” Oxford University Press (2nd Edition) (2010),
4. Andrew Dessler and Edward A. Parson “The Science and Politics of Global Climate Change” 2009
5. Dash Sushil Kumar, “Climate Change — An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007.

Reference Books

1. Bill McKibben(2012), The Global Warming Reader: A Century of Writing About Climate Change, Penguin.
2. JasonSmerdon(2009) Climate Change: The Science of Global Warming and Our Energy Future, Columbia University
3. Adaptation (2006) and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge.
4. J.M. Wallace and P.V. Hobbs (2006) Atmospheric Science, Elsevier / Academic Press.
5. Jan C. van Dam,(2003) Impacts of “Climate Change and Climate Variability on Hydrological Regimes”, Cambridge University Press,.

Web References

1. https://n tel.ac.in/courses/105102089/
2. https://www.warmheartworldwide
3. https://nptel.ac.in/content/storage.

Evaluation methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	**MCQ Test**	**Presentation / Activity / Assignment**	
Marks	10	30	60	100

IV Semester

Department	**Mathematics**			Programme: **B.Tech.**				
Semester	**IV**			Course Category Code:**BS**			*End Semester Exam Type: **TE**	
Course Code	**U23MATC05**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DISCRETE MATHEMATICS AND GRAPH THEORY**	**2**	**2**	**0**	**4**	**25**	**75**	**100**

Prerequisite	-	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Construct Mathematical arguments using logical connectives and truth tables.	**K3**
	CO2 Verify the correctness of an argument predicate logic and quantifiers.	**K3**
	CO3 Solve problems using counting techniques in Lattices.	**K3**
	CO4 Familiarize the different types of Graphs.	**K3**
	CO5 Understand the Applications of Shortest path algorithms.	**K3**

UNIT-I	**LOGICS AND PROOFS**	**Periods: 12**
Introduction – Connectives – Statement formulae – Truth table – Tautologies – Equivalence of Statement formulae – NAND and NOR Connectives – Implications – Principal conjunctive and disjunctive normal forms.		**CO1**
UNIT-II	**PREDICATE AND QUANTIFIERS**	**Periods: 12**
Predicate and Quantifiers – Rules of Inference theory – Conditional proof – Indirect method of proof.		**CO2**
UNIT-III	**LATTICES**	**Periods: 12**
Partially Ordering – Posets – Hasse Diagram – Lattices as Posets – Properties of Lattices – Sub lattices – Complemented and Distributive lattices.		**CO3**
UNIT-IV	**GRAPH THEORY**	**Periods: 12**
Graphs and types of Graphs – Matrix representation of graphs – Isomorphism – Connected graphs – Euler graphs – Hamilton paths and circuits.		**CO4**
UNIT-V	**TREES**	**Periods: 12**
Trees – Properties of Trees – Algorithm – Kruskal's algorithm.		**CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. P. Tremblay and R. Manohar, "Discrete Mathematical structures with Applications to computer Science", 13th reprint, Tata McGraw - Hill publishers, 2002.
2. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Dover Publications New York, First Edition, 2016.
3. Dr G. Balaji "Discrete Mathematics", G. Balaji Publishers – 14th Edition 2021.

Reference Books

1. C.L. Liu, "Elements of Discrete Mathematics", Tata McGraw - Hill Education Pvt. Ltd., 3rd Edition, 2008.
2. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Dover Publications New York, First Edition, 2016.
3. Dr G. Balaji "Discrete Mathematics", G. Balaji Publishers – 14th Edition 2021.

Web References

1. https://www.researchgate.net/publication/1922282_Discrete_Mathematics_for_Computer_Science_Some_Notes
2. https://nptel.ac.in/courses/111/107/111107058/
3. https://nptel.ac.in/courses/106/106/106106183/
4. https://www.pdfdrive.com/discrete-mathematics-for-computer-science-e17017833.html
5. https://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1	-	-	-	-	-	-	-	1	1	-	1
2	3	3	2	1	-	-	-	-	-	-	-	1	1	-	-
3	3	3	2	1	-	-	-	-	-	-	-	1	1	-	-
4	3	3	2	1	-	1	-	-	-	1	1	1	1	-	-
5	3	3	2	1	-	1	-	-	-	1	1	1	1	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**		Programme: **B.Tech.**					
Semester	**IV**		Course Category Code:**ES**			*End Semester Exam Type: **TE**		
Course Code	**U23ADDC01**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Computer Networks and Security**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	-								
Course Outcome	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)		
	CO1	Analyze and evaluate the cyber security needs of an organization					**K2**		
	CO2	Analyze the security issues in networks and computer systems to secure an infrastructure.					**K2**		
	CO3	Design operational cyber security strategies and policies.					**K3**		
	CO4	Apply critical thinking and problem-solving skills to detect current and future attacks on an organization's computer systems and networks.					**K3**		
	CO5	Examine the various network security threats and solutions					**K3**		

UNIT-I	**Introduction to Computer Networks**	**Periods: 9**
Introduction to computer networks-Basics of data communication-Types of networks: LAN, WAN, MAN-Network topologies: bus, star, ring, mesh-Network architectures: client-server, peer-to-peer-OSI model overview-TCP/IP protocol suite-Network addressing and subnetting		**CO1**
UNIT-II	**Network Security Fundamentals**	**Periods: 9**
Understanding the need for network security-Common security threats: malware, phishing, DoS attacks-Vulnerability assessment and risk management-Security policies and best practices-Principles of cryptography: encryption, decryption, hashing-Types of encryption algorithms: symmetric, asymmetric-Public Key Infrastructure (PKI)-Digital signatures and certificates		**CO2**
UNIT-III	**Authentication and Access Control**	**Periods: 9**
Authentication methods: passwords, tokens, biometrics-Single Sign-On (SSO) and multi-factor authentication-Role-based access control (RBAC) and discretionary access control (DAC)-Access control lists (ACLs)-Identity management systems-Secure authentication protocols: Kerberos, OAuth, SAML-Federation and identity federation		**CO3**
UNIT-IV	**Network Defense Techniques**	**Periods: 9**
Firewall technologies: stateful, stateless, next-generation-Intrusion Detection Systems (IDS) and Intrusion-Prevention Systems (IPS)-Network segmentation and DMZ (Demilitarized Zone)-Virtual Private Networks (VPNs): site-to-site, remote access-Secure communication protocols: SSL/TLS, SSH, IPsec-Endpoint security measures:antivirus, anti-malware, endpoint detection and response (EDR)-Security information and event management (SIEM) systems		**CO4**
UNIT-V	**Wireless Network Security**	**Periods: 9**
Wireless networking standards: Wi-Fi, Bluetooth, Zigbee-Wireless security protocols: WEP, WPA, WPA2, WPA3-Wireless encryption techniques: TKIP, AES-Security challenges in wireless networks: rogue access points, evil twin attacks-Wireless Intrusion Detection Systems (WIDS) and Wireless Intrusion Prevention Systems (WIPS)-Mobile device security considerations		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1.Tanenbaum, Computer Networks, Pearson Education, 5th Edition, 2013

2.William Stallings. Data and computer communications. Pearson Education India, 2013.

Reference Books

1.Perlman, R., Kaufman, C., and Speciner, M. (2016). Network security: private communication in a public world. Pearson Education India.

2.Stevens, W. R., Fenner, B., and Rudoff, A. M. (2018). UNIX Network Programming Volume 1. SMIT-SMU.

Web References
1. https://onlinecourses.nptel.ac.in/noc22_cs19/preview
2. https://www.geeksforgeeks.org/computer-network-tutorials/
3. https://www.geeksforgeeks.org/what-is-computer-networking/
4 https://www.javatpoint.com/computer-network-tutorial
5. https://www.tutorialspoint.com/computer_fundamentals/computer_networking.htm

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	2	-	-	-	-	-	-	-	3	2	2
2	3	2	2	1	2	-	-	-	-	-	-	-	3	2	2
3	3	3	3	2	3	-	-	-	-	-	-	-	3	2	3
4	3	2	2	1	3	-	-	-	-	-	-	-	3	2	3
5	3	3	3	2	3	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Information Technology**	Programme: **B.Tech.**						
Semester	**Four**	Course Category Code:**ES**			*End Semester Exam Type: **TE**			
Course Code	**U23ITTCO3**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming in Java**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	-	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Articulate the concept of Java fundamentals, OOPs and Strings	**K2**
	CO2 Demonstrate the principles of inheritance, packages and interfaces with real time applications	**K2**
	CO3 Create real time applications using exception handling and thread programming.	**K3**
	CO4 Build distributed applications using Collections and IO streams	**K3**
	CO5 Design and build simple GUI programs using AWT, Swings and build database applications	**K3**

UNIT-I	**Introduction**	**Periods: 9**	
Introduction: Java: History – Features – JVM - JRE - JDK – Data Types - Variables, Types, Expressions, Assignment Statements, Conditional and Iterative Control Structures - Arrays **OOPs with Java:** Class – Objects – Methods - Access Modifiers – Abstraction – Encapsulation - Constructors - this – static - Garbage Collection – Nested Classes. **String**: String Class– Built-in Methods – StringBuilder - StringBuffer			**CO1**
UNIT-II	**Inheritance, Interfaces and Packages**	**Periods: 9**	
Inheritance: Types of Inheritance – is-a Relationship, has-a Relationship – super keyword – final keyword – Polymorphism - Method overloading and Method overriding – Abstract Class **Interfaces:** Define – Extend – Implement – Access - Interfaces vs Abstract classes **Packages:** Define – Create – Access – Import – Autoboxing and Auto unboxing			**CO2**
UNIT-III	**Exception Handling and Multithreading**	**Periods: 9**	
Exception Handling: Exception Hierarchy – Checked and Unchecked Exceptions – try, catch, throws, throw and finally – User Defined Exceptions. **Multithreading:** Thread – Life cycle – Defining and Running – Implementation Types – Thread Priorities – Thread Synchronization - Inter-Thread Communication			**CO3**
UNIT-IV	**Collections and I/O Streams METHODOLOGY**	**Periods: 9**	
Collections: List: ArrayList and LinkedList. Set: HashSet and TreeSet. Map: HashMap – Stack – Queue. Lambda Expressions. **I/O Streams:** Streams – Byte Streams and Character Streams – FileInputStream and FileOutputStream – FileReader and FileWriter.			**CO4**
UNIT-V	**GUI and JDBC**	**Periods: 9**	
AWT: Components – Controls – Event Handling **SWING**: Swing Components – Layout Management. **JDBC:** JDBC Architecture – JDBC Driver Types – Implementation of JDBC.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Allen B. Downey and Chris Mayeld, "Think Java - How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2020
2. Herbert Schildt, "Java: The Complete Reference", TMH Publishing Company Ltd, 11tri Edition, 2018.
3. H.M.Dietel and P.J.Dietel, "Java How to Program", 11th Edition, Pearson Education/PHI, 2017
4. Cay S. Horstmann, Gary Cornell, "Core Java Volume - I Fundamentals", 9th Edition, Prentice Hall, 2013.

Reference Books

1. Sagayaraj, Denis, Karthik, Gajalakshmi, "JAVA Programming for core and advanced learners", Universities Press Private Limited, 2018.
2. Poaul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
3. P.J. Dietel and H.M Dietel, "Java for Programmers", Pearson Education, 9tri Edition, 2011.

4. Steven Holzner, “Java 2 Black book”, Dreamtech Press, 2011

Web References

1. https://www.javatpoint.com/java-tutorial
2. https://docs.oracle.com/en/java/
3. https://www.studytonight.com/java/
4. https://onlinecourses.nptel.ac.in/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	-	2	3	2	1
2	3	3	3	-	3	-	-	-	-	-	-	2	3	2	1
3	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1
4	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1
5	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code:**PC**			*End Semester Exam Type: **TE**			
Course Code	**U23ADT408**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Machine Learning Techniques**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	-	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the concepts of Decision learning algorithm.	**K2**
	CO2 Explore the rule-based learning.	**K2**
	CO3 Acquire knowledge on ensemble learning.	**K2**
	CO4 Explore and Analyze the Neural Network.	**K2**
	CO5 Demonstrate the backpropagation Neural Network.	**K3**

UNIT- I	**DECISION TREES**	**Periods: 9**
Decision tree representation – Basic decision tree algorithm – Hypothesis space search – Inductive bias – Issues in decision tree – Case studies with C4.5 and CART – Incremental decision tree induction – ID3 – Hidden Morkov Model.		**CO1**
UNIT- II	**RULE BASED LEARNING**	**Periods: 9**
Rule Induction – One Rule in Rule Learning – Association rule mining – Association rules – Case studies with Apriori and Equivalence Class Transformation Algorithm.		**CO2**
UNIT- III	**ENSEMBLE LEARNING**	**Periods: 9**
Introduction – Bayesian methods – Bagging: Random Forest – Boosting: Adaboost and XGBoost Algorithms Light GBM – Stacking		**CO3**
UNIT- IV	**ARTIFICIAL NEURAL NETWORK**	**Periods: 9**
Neural Network Representation – Types of activation functions - Network Topology – Perceptrons – Learning rule: Hebbian – Perceptron and Delta – Single Layer Neural Network.		**CO4**
UNIT- V	**FEED FORWARD NEURAL NETWORK**	**Periods: 9**
Multi-Layer Feedforward Network – MLP Architecture – Error Metrics: Mean Square Error (MSE) – Cross-Entropy (CE) – Minimum Classification Error (MCE) – Learning by Backpropagation – Enhancing backpropagation –Generalization Issues.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Tom M. Mitchell, “Machine Learning”, McGraw Hill, 1997.
2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, The MIT Press, Second Edition, 2012.
3. Henrik Brink, Joseph W. Richards and Mark Fetherolf, “Real-World Machine Learning”, Manning Publications Co, 2017.

Reference Books

1. Charu C. Aggarwal “Data Classification Algorithms and Applications” Chapman & Hall/CRC Data Mining and Knowledge Discovery Series.
2. Andreas C. Mueller and Sarah Guido, “Introduction to Machine Learning with Python”, O’Reilly Media, Inc. First Edition, 2016.
3. Eremy Watt, Reza Borhani, and Aggelos K. Katsaggelos, “Machine Learning Refined Foundations, Algorithms, and Applications” Cambridge University Press, 2016.
4. Shai Shalev-Shwartz and Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms”, Cambridge University Press, 2014.
5. John Hearty “Advanced Machine Learning with Python“, Packt Publishing Ltd., 2016.

Web References

1. https://nptel.ac.in/courses/106/106/106106139/
2. https://www.coursera.org/learn/machine-learning.
3. https://www.youtube.com/watch?v=GwIo3gDZCVQ

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2
2	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2
3	2	2	2	2	-	-	-	-	-	-	-	-	2	2	2
4	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2
5	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **PC**				End Semester Exam Type: **TE**		
Course Code	**U23ADB402**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Linux Internals**	**3**	**0**	**0**	**3**	**50**	**50**	**100**

(Common to all Branches)

Prerequisite	Any Programming Knowledge	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand concepts of OS basics	**K2**
	CO2 Learn various Linux basics and shell programming	**K2**
	CO3 Learn about inter process communication and socket programming	**K2**
	CO4 Apply various Linux commands and shell programming concepts	**K3**
	CO5 Apply IPC concepts, message queue and socket programming concepts	**K3**

UNIT-I	**Overview of Operating Systems and Process Management**	**Periods: 10**
Introduction to System Software – Objectives and functions of OS – Evolution of OS – Operating system components – Interrupts – System calls, Management: Processes – Operations on Processes – CPU Scheduling. Threads – Overview – Multithreading models – Threading issues - Paging – Segmentation – Segmentation with paging, Virtual Memory: Background – Demand Paging – Page Replacement – Thrashing.		**CO1**
UNIT-II	**Linux Basics and Shell Programming**	**Periods: 10**
Linux Basics: Introduction to Linux: History, GNU Movement, System Organization (Kernel and Shell), Difference between CLI OS & GUI OS, Windows v/s Linux, Importance of Linux Kernel, Files and Directories. Concept of Open-Source Software, Linux, Linux Architecture, Linux File System. Shell programming with Bourne Again Shell (bash): Introduction, Shell responsibilities, Pipes and redirection, here documents, Running a shell script, Shell as a programming language, Shell meta characters, File-name substitution, Shell variables, Command. substitution, Shell commands.		**CO2**
UNIT-III	**Inter Process Communication, and Socket Programming**	**Periods: 10**
Introduction to IPC-The Critical-section problem – Synchronization hardware – Mutex locks – Semaphores – Classic problems of synchronization – Critical regions – Monitors, IPC between processes on a single computer system, IPC between processes on different systems, Pipes-creation between related processes using FIFOs (Named pipes), Introduction to Berkley Sockets, IPC over a network, client – server model, Socket address structures (Unix domain and internet domain), Socket system calls for connection-oriented protocol and connectionless protocol		**CO3**
UNIT-IV	**Laboratory Exercises**	**Periods: 15**
• Study and Practice on various commands like man, passwd, tty, script, clear, date, cal, cp, mv, ln, rm, unlink, mkdir, rmdir, du, df, mount, umount, find, unmask, ulimit, ps, who, • Study and Practice on various commands like cat, tail, head , sort, nl, uniq, grep, egrep,fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, tar, cpio. • Write a Shell Program to print all .txt files and .c files • Write a Shell program to move a set of files to a specified directory. • Write a Shell program to display all the users who are currently logged in after a specified time. • Write a Shell Program to wish the user based on the login time. • Simulate cat command. b) Simulate cp command. • Simulate head command. b) Simulate tail command.		**CO4**
UNIT-V	**Laboratory Exercises**	**Periods: 15**
• Write a program to handle the signals like SIGINT, SIGQUIT, SIGFPE. • Implement the following IPC forms a) FIFO b) PIPE • Implement message queue form of IPC. • Implement shared memory form of IPC. • Write a C program, using sockets create client and server socket programs. Write a TCP iterative server program, in server program take user input for port number and bind the port address. Server waits for • clients to connect. When client connects, communication can happen using recv and sent functions.		**CO5**

Lecture Periods: 30	Tutorial Periods:	Practical Periods: 30	Total Periods: 60

Textbooks

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne. “Operating System Concepts”, Wiley India, 9th Edition,2018
2. Sumitabha Das, “Unix Concepts and Applications”, Tata McGraw Hill Publication, 4th Edition, 2017
3. Richard Petersen,”Linux-The complete Reference”, Tata McGraw Hill Publication, 6th edition, 2008
4. Richard Blum, Christine Breshnahan, ” Linux Command Line and Shell Scripting Biblell”, Wiley Publications, 3rd Edition, 2015.
5. Robert Love ,”Linux System Programming”, O’Reilly, 2nd Edition, 2013

Reference Books

1 N. Matthew, R.Stones, Wrox, “Begining Linux Programming”, Wiley India Edition, 4th Edition, 2010
2. Shell Scripting: Expert Recipes for Linux, Bash and morell, Steve Parker, Wrox Publication, 2011
3. Christopher Negus, “Linux Bible”, Wiley Publications, 10th Edition,2020
4. Stephen Kochan, Patrick Wood, “Shell Programming in Unix, Linux and OS X: The Fourth Edition of Unix Shell Programming (Developer's Library)”, 4th Edition, 2016
5. Michael RK, “Mastering UNIX Shell Scripting - Bash, Bourne, and Korn Shell Scripting for Programmers, System Administrators, and UNIX Gurus”, Wiley Publications, 2nd Edition, 2008

Web References

1.https://www.tutorialspoint.com/linux_admin/index.htm
2.https://linode.com/docs/tools-reference/linux-system-administrationbasics/
3.https://www.opensourceforu.com/2016/07/introduction-linux-system-administration/
4.https://www.linuxfoundation.orghttps://www.cs.cmu.edu/~avrim/451f11/lectures/lect1025.pdf
5.https://cseweb.ucsd.edu//classes/sp05/cse101/Day19NP.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
3	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
5	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Theory						
Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Attendance		
Marks	5	5	5	5	75	60
	20(to be weighted for 10 marks)				(to be weighted for 50 marks)	

Practical				
Continuous Assessment Internal Evaluation		**End Semester Internal Evaluation**		**Total Marks**
30(to be weighted for 10 marks)		**30 marks**		40
Procedure / Algorithms	5	Procedure / Algorithms	5	
Experiment / Program Execution	10	Experiment / Program Execution	10	
Result / Output	10	Result / Output	10	
Viva-Voce	5	Viva-Voce	5	

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**English**			Programme: **B.Tech.**				
Semester	**IV**			Course Category Code:**HS**			*End Semester Exam Type: **TE**	
Course Code	**U23ENPC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**General Proficiency - II**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Prerequisite	-	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Infer ideas to attend international standardized test by broadening receptive and productive skills	**K2**
	CO2 Interpret the types of writing in different state of affairs	**K3**
	CO3 Acquire meticulous exposure in speaking and get rid of performance anxiety	**K2**
	CO4 Articulate the ideas and opinions effectively and coherently	**K2**
	CO5 Progress the skills to compete in various competitive exams like GATE, GRE, UPSC, etc.	**K4**

UNIT-I	**CAREER SKILLS**	**Periods: 9**	
Listening: Listening at specific contexts - Speaking: Demonstrative speaking practice using visual aids (charts, graphs, maps) - Reading: Read and Review -Newspaper, Advertisement, Company Handbooks, and Guidelines (IELTS based) - Writing: Integrated Writing Task (TOEFL) - Vocabulary: Synonyms and Antonyms (IELTS)			**CO1**
UNIT-II	**CORPORATE SKILLS**	**Periods: 9**	
Listening: Listening English news and reproducing in own words - Speaking: Team Presentation - Reading: Short texts and Longer Passages (cloze reading) - Writing: Analytical Writing: Analyzing an issue and Argument task (GRE based) - Vocabulary: Prefix and Suffix			**CO2**
UNIT-III	**FUNCTIONAL SKILLS**	**Periods: 9**	
Listening: Listening TED Talks - Speaking: Brainstorming & Individual Presentation - Reading: Text Completion (GRE Based) - Writing: Picture Inference - Vocabulary: Word Formation			**CO3**
UNIT-IV	**TRANSFERRABLE SKILLS**	**Periods: 9**	
Listening: Listening Documentaries and making notes - Speaking: Mock Interview - Reading: Read texts on emerging trends - Writing: Agreeing & Disagreeing Essay (IELTS) - Vocabulary: Euphemism, Redundancy, Clichés and Intensifiers			**CO4**
UNIT-V	**VERBAL APTITUDE - II**	**Periods: 9**	
Transformational Grammar: Tenses, Change of Voice, Concord **Verbal Ability Enhancement:** Letter Series, Coding &Decoding, Sentence Equivalence (GRE)Analytical Reasoning and Logical Reasoning (GATE), Syllogism, One-word Substitution, Jumbled Sentences			**CO5**

Lecture Periods: 30	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. https://www.englishclub.com/grammar/nouns-compound.htm
2. https://lofoya.com/Verbal-Test-Questions-and-Answers/Sentence-Completion/l3p1
3. https://www.grammarwiz.com/phrases-and-clauses-quiz.html
4. https://www.clarkandmiller.com/25-english-euphemisms-for-delicate-situations/
5. http://www.englishvocabularyexercises.com/general-vocabulary/

Web References

1. https://www.englishclub.com/grammar/nouns-compound.htm
2. https://lofoya.com/Verbal-Test-Questions-and-Answers/Sentence-Completion/l3p1
3. https://www.grammarwiz.com/phrases-and-clauses-quiz.html
4. https://www.clarkandmiller.com/25-english-euphemisms-for-delicate-situations/
5. http://www.englishvocabularyexercises.com/general-vocabulary/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
2	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
3	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
4	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
5	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Practical				
Continuous Assessment Internal Evaluation		**End Semester External Evaluation**		**Total Marks**
50 marks		**50 marks**		100
Conduction of Practical (Assignment 1&2 -10 Marks Performance in practical classes - 5 Marks)	15	Listening (L)	20	
Record	5	Speaking(S)	10	
Viva	5	Reading(R)	10	
Model Practical Examination (Model Exam is conducted for 50 Marks that will be converted to 15 Marks)	15	Writing(W)	10	
Attendance	10			

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code:**ES**			*End Semester Exam Type: **TE**			
Course Code	**U23ADP405**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Computer Networks and Security Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Prerequisite	-	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand and interpret network traffic patterns effectively using tools like Wireshark.	**K3**
	CO2 Configure firewalls, IDS, and VPNs to protect networks from various cyber threats.	**K3**
	CO3 Detect and respond to security incidents promptly by analyzing network logs and implementing appropriate measures.	**K2**
	CO4 Conduct comprehensive security assessments of networks, including wireless networks and web applications, to identify vulnerabilities.	**K3**
	CO5 Apply practical network security skills learned through experimentation to bolster the security of systems and organizations.	**K3**

List of Experiments

1. Analyze network traffic using Wireshark. 2. Set up and test firewall rules using software like iptables. 3. Deploy and test open-source IDS like Snort. 4. Assess Wi-Fi network security using tools like Aircrack-ng. 5. Simulate DoS attacks and evaluate their impact. 6. Set up and test VPN connections for security and performance. 7. Analyze network protocols using packet capture tools. 8. Demonstrate DNS spoofing attacks using tools like Ettercap. 9. Test web applications for common vulnerabilities. 10. Analyze network logs and packet captures to investigate security incidents.	**CO1**

Lecture Periods: -	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1.Tanenbaum, Computer Networks, Pearson Education, 5th Edition, 2013

2.William Stallings. Data and computer communications. Pearson Education India, 2013.

3.Perlman, R., Kaufman, C., and Speciner, M. (2016). Network security: private communication in a public world. Pearso Education India.

4.Stevens, W. R., Fenner, B., and Rudoff, A. M. (2018). UNIX Network Programming Volume 1. SMIT-SMU.

1.

Web References

1. https://www.wireshark.org/
2. https://www.snort.org/
3. https://www.kali.org/
4. https://owasp.org/
5. https://www.sans.org/reading-room

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
2	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
3	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
4	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
5	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Information Technology**		Programme: **B.Tech.**					
Semester	**Four**		Course Category Code:**ES**			*End Semester Exam Type: **LE**		
Course Code	**U23ITPCO3**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Programming in Java Laboratory**		**0**	**0**	**2**	**1**	**50**	**50**	**100**
Prerequisite	-								
Course Outcome	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)		
	CO1	Apply and practice logical formulations to solve simple problems leading to specific applications.					**K3**		
	CO2	Demonstrate the use of inheritance, interface and package in relevant applications					**K3**		
	CO3	Implement robust application programs in Java using exception handling and multithreading					**K3**		
	CO4	Build java distributed applications using Collections and IO streams.					**K3**		
	CO5	Implement Graphical User Interface based application programs by utilizing event handling features and Swing in Java.					**K3**		

List of Exercises

1. Develop simple programs using java	**CO1**
2. Develop a java program that implements class and object.	
3. Write a java program to find the frequency of a given character in a string	
4. Write a java program to demonstrate inheritance and interfaces.	
5. Develop a java program that implements the Packages.	
6. Create java applications using Exception Handling for error handling.	
7. Develop a simple real life application program to illustrate the use of Multi-Threads.	
8. Implement simple applications using Collections.	
9. Develop application using the concept of I/O Streams	
10. Write a Java Program to demonstrate AWT and Swing Components	
11. Develop a simple application and use JDBC to connect to a back-end database.	

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Allen B. Downey and Chris Mayeld, “Think Java - How to Think Like a Computer Scientist”, 2nd Edition, Green Tea Press, 2020
2. Sagayaraj, Denis, Karthik, Gajalakshmi, “JAVA Programming for core and advanced learners”, Universities Press Private Limited, 2018
3. Cay.S.Horstmann and Gary Cornell, “Core Java 2”, Vol 2, Advanced Features, Pearson Education, 7th Edition, 2010

Web References

1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM’s tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog.
5. https://www.geeksforgeeks.org.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
2	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
3	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
4	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
5	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code:**PC**			*End Semester Exam Type: **LE**			
Course Code	**U23ADP406**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Machine Learning Techniques Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Prerequisite	-	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the basics of machine learning algorithms.	**K2**
	CO2 Implement decision and rule based learning models.	**K2**
	CO3 Experiment the Equivalence class transformation algorithm.	**K3**
	CO4 Implement ensemble models.	**K2**
	CO5 Implement the neural network.	**K3**

List of Experiments

Implementation the following algorithms with suitable applications using Python. **CO1**

1. ID.3 algorithm
2. C4.5 algorithm
3. CART Decision Tree Algorithm
4. Apriori
5. Equivalence Class Transformation Algorithm
6. Naïve Bayes ensemble
7. Random forests
8. Adaboost
9. XGBoost
10. Simple Neural Network

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Andreas C. Mueller and Sarah Guido, "Introduction to Machine Learning with Python", O'Reilly Media, Inc. First edition, 2016.
2. Charu C. Aggarwal "Data Classification Algorithms and Applications" Chapman & Hall/CRC Data Mining and Knowledge Discovery Series.
3. John Hearty "Advanced Machine Learning with Python", Packt Publishing Ltd., 2016.

Web References

1. https://www.deeplearning.ai/
2. https://www.youtube.com/c/MachineLearningwithPhil/playlists
3. https://www.youtube.com/user/howardjeremyp/playlists
4. https://www.youtube.com/user/dataschool/videos
5. https://www.youtube.com/channel/UC5zx8Owijmv-bbhAK6Z9apg/playlists

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2
2	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2
3	2	2	2	2	-	-	-	-	-	-	-	-	2	2	2
4	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2
5	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code:**PE**			*End Semester Exam Type: **TE**			
Course Code	**U23CSDC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Automata and Compiler Design**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

Prerequisite	-	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the concept of Finite Automata, NFA and DFA.	**K2**
	CO2 Understand about Context Free Language and Normal Forms	**K2**
	CO3 Construct Push Down Automata and Turing Machine	**K3**
	CO4 Explain the concept of Lexical Analysis and Syntax Analysis	**K3**
	CO5 Describe the Intermediate code generation, Code Optimization and Code Generation	**K3**

UNIT-I	**FINITE AUTOMATA AND REGULAR EXPRESSIONS**	**Periods: 9**
Introduction: Finite Automata – Deterministic Finite Automata – Non-Deterministic Finite Automata – Conversion from NFA to DFA – NFA with epsilon transition - Eliminating epsilon transition -Regular Expression- Conversion from Regular Expression to NFA- Conversion from Regular Expression to DFA (Direct / Indirect method) – Minimized DFA.		**CO1**
UNIT-II	**CONTEXT-FREE GRAMMAR AND NORMAL FORMS**	**Periods: 9**
Types of Grammar - Chomsky_s hierarchy of languages -Context-Free Grammar (CFG) – Derivations and Parse trees – Ambiguity in grammars – Normal Forms – Chomsky Normal Form – Greibach Normal Form.		**CO2**
UNIT-III	**PUSHDOWN AUTOMATA AND TURING MACHINES**	**Periods: 9**
Push Down Automata (PDA): Definition of the Pushdown Automata - Languages of pushdown automata – CFG to PDA - Turing Machine - Turing machines for regular languages- Turing machine construction for Palindrome, Addition, Subtraction.		**CO3**
UNIT-IV	**LEXICAL ANALYSIS AND SYNTAX ANALYSIS**	**Periods: 9**
Compilers: The Phases of compiler – Lexical analysis – The role of the lexical analyser – Input buffering – Parser: Top Down Parser – Predictive Parser, Bottom up Parser – Shift Reduce Parser - Operator Precedence Parser-SLR Parser.		**CO4**
UNIT-V	**INTERMEDIATE CODE GENERATION, CODE OPTIMIZATION AND CODE GENERATION**	**Periods: 9**
Intermediate Code Generation: Intermediate Languages. Code Optimization: Principle sources of optimization – Loop Optimization. Code Generation: Issues in the design of code generator – Simple code generator – Basic blocks and flow graphs – The DAG representation of Basic Block - Generating code form DAGs - Peephole optimization.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Hopcroft, 'Introduction to Automata Theory, Languages, and Computation", Pearson, 3rd Edition, 2008.
2. Alfred Aho, V. Ravi Sethi, and D. Jeffery Ullman, "Compilers Principles, Techniques and Tools", Addison-Wesley, 2nd Edition, 2007.
3. John C. Martin, "Introduction to Languages and the Theory of Computations", McGraw Hill, 3rd Edition, 2007.

Reference Books

1. Kamala Krithivasan, Rama R, "Introduction to Formal languages Automata Theory and Computation", Pearson, 2019.
2. Peter Linz, "An Introduction to Formal Languages and Automata", Jones & Bartlett, 6th Edition, 2016.
3. Anil Malviya, Malabika Datta, "Theory of Computation & Applications - Automata Theory Formal Languages", BPB publications, 2015.
4. Charles N. Fischer and Richard J. Leblanc, "Crafting a Compiler with C", Benjamin Cummings, 2009.
5. Mishra K.L.P, "Theory of Computer Science: Automata, Languages and Computation", Prentice Hall India Learning, 1st Edition, 2006.

Web References

1. https://www.cse.iitb.ac.in/~akg/courses/2019-cs310/index.html
2. https://www.cse.iitm.ac.in/~krishna/cs3300/
3. https://www.geeksforgeeks.org/theory-of-computation-automata-tutorials/
4. https://www.javatpoint.com/automata-tutorial
5. https://www.tutorialspoint.com/automata_theory/index.htm

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
2	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
3	2	2	-	-	-	1	-	-	-	-	-	1	3	-	-
4	3	2	1	1	-	1	-	-	-	1	-	1	3	-	1
5	3	2	1	1	-	1	-	-	-	1	-	1	3	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code:**PE**			*End Semester Exam Type: **TE**			
Course Code	**U23ADE401**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**AI in Smart Cities**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	-	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the basics of IoT in smart cities	**K2**
	CO2 Understand the smart technologies using AI	**K2**
	CO3 Understand AI based energy forecasting	**K3**
	CO4 Analyse the safety concern about public	**K3**
	CO5 Understand the chatbots and virtual assistants	**K3**

UNIT-I	**INTRODUCTION TO AI IN SMART CITIES**	**Periods: 9**	
Overview of AI in smart cities - Role of AI in transforming urban infrastructure - Benefits and challenges of implementing AI in smart cities - AI-powered sensors and Internet of Things (IoT) - Data analytics and predictive modelling			**CO1**
UNIT-II	**AI APPLICATIONS IN URBAN MOBILITY**	**Periods: 9**	
AI-driven traffic management - congestion prediction - Intelligent transportation systems - smart traffic lights - AI-powered public transportation optimization - Autonomous vehicles and self-driving technology - Smart parking solutions using AI			**CO2**
UNIT-III	**AI FOR ENERGY EFFICIENCY AND SUSTAINABILITY**	**Periods: 9**	
AI-based energy demand forecasting and optimization - Smart grid management - AI-enabled energy distribution - Energy consumption analytics and smart metering - AI in renewable energy integration and optimization - Sustainable waste management and recycling with AI			**CO3**
UNIT-IV	**AI FOR PUBLIC SAFETY AND SECURITY**	**Periods: 9**	
AI-powered video surveillance and facial recognition - Predictive policing and crime pattern analysis - Emergency response systems using AI and IoT - AI in disaster management - early warning systems - Cybersecurity and AI-enabled threat detection in smart cities			**CO4**
UNIT-V	**AI FOR CITIZEN ENGAGEMENT AND SERVICES**	**Periods: 9**	
AI-powered smart city platforms and citizen portals - AI-enabled personalized citizen services and recommendations - Chatbots and virtual assistants for citizen support - Social media analytics and sentiment analysis - AI in smart governance			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Gaurav Kumar, Pradeep Tomar, Siddhartha Bhattacharyya, "Artificial Intelligence for Smart Cities: Technologies and Applications" 2020
2. H. V. Jagadish, Shyam R. Chidamber, "Smart Cities: Foundations, Principles, and Applications" 2017
3. Saifullah Muhammad, Chaker Abdelaziz Kerrachel, "The Future of Smart Cities: Applying Artificial Intelligence and Blockchain Technologies" 2020

Reference Books

1. Amir H. Gandomi and Amir Alavi , "Artificial Intelligence for Smart Cities",2020
2. Ravi S.Sandhu , "Artificial Intelligence in Smart Cities: Technologies, Applications, and Challenges", 2021
3. Anthony M. Townsend, "Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia", 2013
4. Houbing Song, Danda B. Rawat, and Sabina Jeschke , "AI for Sustainable Cities: Integrating AI, IoT, and Smart Cities", 2020
5. Yassine Maleh and Mohamed Anouar Essayouti , "AI and IoT in Smart City Security", 2019

Web References

1. https://www.smartcitiesworld.net/
2. https://www.idc.com/
3. https://smartcities.ieee.org/
4. https://www.unglobalpulse.org/
5. https://smartcitylab.com/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	1	1	1	2	1	-
2	3	2	1	1	-	-	-	-	-	1	1	1	2	1	-
3	3	2	1	1	-	-	-	-	-	1	1	1	2	1	-
4	3	2	1	1	-	-	-	-	-	1	1	1	2	1	-
5	3	2	1	1	-	-	-	-	-	1	1	1	2	1	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**		Programme: **B.Tech.**				
Semester	**IV**		Course Category Code: **PE**			*End Semester Exam Type: **TE**	
Course Code	**U23ADE402**		Periods/ Week		Credit	Maximum Marks	
			T	P	C	CAM	ESE	TM
Course Name	**Ethics In Data Science**		**3**	**-**	**3**	**25**	**75**	**100**
	(Common to All Branches Except CSBS)							
Prerequisite	Basic Probability							
Course Outcome	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)	
	CO1	Understand the fundamental principles of ethics in data science, recognizing the importance of ethical decision-making in the field.					**K2**	
	CO2	Analyze privacy concerns and data protection laws, applying techniques to protect data privacy in various contexts.					**K3**	
	CO3	Identify biases in data and algorithms, developing strategies to ensure fairness and mitigate bias in data science projects.					**K3**	
	CO4	Evaluate the roles of transparency and accountability in algorithmic decision-making, advocating for explainable AI and interpretability of models.					**K3**	
	CO5	Implement ethical guidelines in data science projects, demonstrating an ability to navigate ethical challenges in innovation and technology development.					**K3**	

UNIT – I	**INTRODUCTION TO ETHICS IN DATA SCIENCE**	**Periods:12**	
Fundamental principles of ethics - Importance of ethics in data science - Ethical decision-making frameworks - Case studies on ethical dilemmas in data science.			**CO1**
UNIT – II	**PRIVACY AND DATA PROTECTION**	**Periods:12**	
Concepts of privacy in the digital age - Data protection laws and regulations - Techniques for protecting privacy in data collection and analysis - Challenges of anonymization and data masking.			**CO2**
UNIT – III	**BIAS AND FAIRNESS**	**Periods:12**	
Understanding bias in data and algorithms - Measures to ensure fairness in machine learning models - Impact of bias on societal and individual levels - Strategies for mitigating bias in data science projects.			**CO3**
UNIT – IV	**TRANSPARENCY AND ACCOUNTABILITY**	**Periods:12**	
The role of transparency in data science - Explainable AI and interpretability of models - Accountability in algorithmic decision making - Ethical considerations in AI deployments.			**CO4**
UNIT – V	**ETHICS IN PRACTICE**	**Periods:12**	
Ethical guidelines for data scientists - Developing ethical data science projects - Role of ethics in innovation and technology development - Future challenges in ethics and data science.			**CO5**
Lecture Periods:45	**Tutorial Periods:15**	**Practical Periods: -**	**Total Periods:60**

Text Books

1. "Ethics and Data Science" - Mike Loukides, Hilary Mason, DJ Patil.
2. "Data Ethics: The New Competitive Advantage" - Gry Hasselbalch, Pernille Tranberg.
3. "The Ethical Algorithm" - Michael Kearns, Aaron Roth.

Reference Books

1. "Algorithms of Oppression" - Safiya Umoja Noble.
2. "Data Justice and COVID-19: Global Perspectives" - Edited by Linnet Taylor, Gargi Sharma, Aaron Martin, Shazade Jameson.
3 "Privacy, Big Data, and the Public Good: Frameworks for Engagement" - Edited by Julia Lane, Victoria Stodden, Stefan Bender, Helen Nissenbaum.

Web References

1. www.datasociety.net
2. www.futureofprivacy.org
3. http:// www. fairnessandaccuracy.org
4. www. aiethicslab.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	1	2	1	1
2	3	2	1	1	-	-	-	-	-	-	-	1	2	1	1
3	2	2	-	-	-	1	-	-	-	-	-	1	2	1	1
4	3	2	1	1	-	1	-	-	-	1	-	1	2	1	1
5	3	2	1	1	-	1	-	-	-	1	-	1	2	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	Artificial Intelligence and Data Science	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code:**PC**			*End Semester Exam Type: **TE**			
Course Code	**U23ADE403**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Genetic Algorithm**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

Prerequisite	-	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the concepts of AI.	**K2**
	CO2 Acquire various Problem-solving techniques.	**K2**
	CO3 Explore the concepts of knowledge representation and uncertain knowledge.	**K2**
	CO4 Understand the concepts of Expert system.	**K2**
	CO5 Explore about knowledge representation and inference method.	**K2**

UNIT-I	**INTRODUCTION TO GA**	**Periods: 9**	
Introduction: Introduction to Genetic Algorithm – Definitions and Terminology – A Simple Class of Gas: Genetic Operations on Binary Strings – Selection – Crossover – Mutation – Summary – Example – A Very Simple One –– An Oscillating One-Dimensional Function – A Two-Dimensional Function – Global Smoothness versus Local Perturbations.			**CO1**
UNIT-II	**ANALYSIS AND VARIENTS**	**Periods: 9**	
Analysis: The Schema Theorem – The Optimal Allocation of Trials – Implicit Parallelism – Building Blocks and the Coding Problem – Example: The Traveling Salesman Problem – Concluding Remarks – Variants: Messy Genetic Algorithms – Alternative Selection Schemes – Adaptive Genetic Algorithms – Hybrid Genetic –Algorithms.			**CO2**
UNIT-III	**GA VARIANTS FOR REAL-VALUED OPTIMIZATION PROBLEMS**	**Periods: 9**	
GA Variants for Real-Valued Optimization Problems: Real-Coded GAs – Crossover Operators for Reloaded GAs – Mutation Operators for Real-Coded GAS – Evolutionary Strategies – Recombination in Ess – Mutation in Ess – Selection and Sampling in Ess – Evolutionary Programming – Original EP – D. B. Fogel's Modified EP – Selection and Sampling in EP. Tuning of Fuzzy Systems Using Genetic Algorithms : Tuning of Fuzzy Sets – Coding Fuzzy Subsets of an Interval – Coding Whole Fuzzy Partitions – Standard Fitness Functions – Genetic Operators – A Practical Example – The Fuzzy System – The Optimization of the Classification System – Concluding Remarks – Finding Rule Bases with GAs.			**CO3**
UNIT-IV	**GENETIC PROGRAMMING**	**Periods: 9**	
Data Representation: The Choice of the Programming Language – Manipulating Programs – Random Initialization – Crossing Programs – Mutating Programs – The Fitness Function – Fuzzy Genetic Programming (FGP) – A Checklist for Applying Genetic Programming.			**CO4**
UNIT-V	**CLASSIFIER SYSTEMS**	**Periods: 9**	
Introduction: Holland Classifier Systems – The Production System – The Bucket Brigade Algorithm – Rule Generation – Fuzzy Classifier Systems of the Michigan Type – Directly Fuzzifying Holland Classifier Systems – Bonarini's ELF Method – An Improved FCS – Online Modification of the Whole Knowledge Base.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Ulrich Bodenhofer, "Genetic Algorithms: Theory and Applications", 3rd Edition, 2004.
2. Melanie Mitchell, "An Introduction to Genetic Algorithms," 1st Edition, 1996.
3. David B. Fogel, "Evolutionary Computation: Toward a New Philosophy of Machine Intelligence," 3rd Edition, 2006.

Reference Books

1. David E. Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning," 1st Edition, 1989.
2. Melanie Mitchell, "An Introduction to Genetic Algorithms," 1st Edition, 1996.
3. Zbigniew Michalewicz, David B. Fogel, "How to Solve It: Modern Heuristics," 2nd Edition, 2004.
4. Kenneth A. De Jong, "Evolutionary Computation: A Unified Approach," 1st Edition, 2006.
5. David E. Goldberg, "Genetic Algorithms: The Design of Innovation," 1st Edition, 2002.
6. Darrell Whitley, "Genetic Algorithms + Data Structures = Evolution Programs," 1st Edition, 1989.

Web References
1. http://www.obitko.com/tutorials/genetic-algorithms/index.php
2. http://www.cleveralgorithms.com/nature-inspired/evolution/genetic_algorithm.html
3. https://towardsdatascience.com/a-gentle-introduction-to-genetic-algorithms-9fe1d821567 4. https://www.tutorialspoint.com/genetic_algorithms/index.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	3	-	-	-	-	-	-	-	-	2	2	3
2	3	2	3	2	-	-	-	-	-	-	-	-	3	3	2
3	2	2	3	2	-	-	-	-	-	-	-	-	2	2	3
4	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2
5	3	2	3	3	-	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**		Programme: **B.Tech.**					
Semester	**IV**		Course Category Code:**PE**			*End Semester Exam Type: **TE**		
Course Code	**U23ADE404**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**User Experience Design**		**3**	**-**	**-**	**3**	**25**	**75**	**100**
(Common to All Branches Except CSBS)									
Prerequisite	Basic Probability								
Course Outcome	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)	
	CO1	Understand and apply the fundamental principles of user experience design to create user- centric digital products.					**K2**	
	CO2	Conduct effective user research, develop user personas, and utilize usability testing to inform design decisions.					**K3**	
	CO3	Employ design thinking and strategy to align user needs with business goals, demonstrating the ability to develop a comprehensive UX strategy.					**K3**	
	CO4	Implement interaction design principles across various devices and platforms, ensuring accessible and inclusive design practices.					**K3**	
	CO5	Evaluate user experience through appropriate metrics and KPIs, employing an iterative design process for continuous improvement and user feedback integration					**K3**	
UNIT – I	**INTRODUCTION TO USER EXPERIENCE DESIGN**					**Periods:12**		
Principles of UX design - Importance of user-centric design - Overview of UX design process - Role of UX in product development.								**CO1**
UNIT – II	**RESEARCH IN UX DESIGN**					**Periods:12**		
Research in Design - Techniques for user research - Developing user personas - Conducting usability testing - Analyzing research data for design insights.								**CO2**
UNIT – III	**DESIGN THINKING AND STRATERGY**					**Periods:12**		
Fundamentals of design thinking - Frameworks for UX strategy - Aligning business goals with user needs - Case studies on successful UX strategies.								**CO3**
UNIT – IV	**INTERACTION DESIGN**					**Periods:12**		
Principles of interaction design - Designing for different devices and platforms - Prototyping methods - Accessibility and inclusive design.								**CO4**
UNIT – V	**UX EVALUATION**					**Periods:12**		
Methods for evaluating user experience - Metrics and KPIs for UX - Iterative design process - Implementing feedback and continuous improvement.								**CO5**
Lecture Periods:45	**Tutorial Periods:15**		**Practical Periods: -**			**Total Periods:60**		

Text Books

1. "The Design of Everyday Things" - Don Norman.
2. "Don't Make Me Think" - Steve Krug.
3. "Lean UX: Designing Great Products with Agile Teams" - Jeff Gothelf, Josh Seiden.

Reference Books

1. "100 Things Every Designer Needs to Know About People" - Susan Weinschenk.
2. "Measuring the User Experience: Collecting, Analyzing, and Presenting UX Metrics" - Tom Tullis, Bill Albert.
3. "Observing the User Experience: A Practitioner's Guide to User Research" - Elizabeth Goodman, Mike Kuniavsky, Andrea Moed.

Web References

1. nngroup.com
2. usability.gov
3. interaction-design.org
4. uxdesign.cc

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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	1	2	1	1
2	3	2	1	1	-	-	-	-	-	-	-	1	2	1	1
3	2	2	-	-	-	1	-	-	-	-	-	1	2	1	1
4	3	2	1	1	-	1	-	-	-	1	-	1	2	1	1
5	3	2	1	1	-	1	-	-	-	1	-	1	2	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **AEC**			*End Semester Exam Type: **-**			
Course Code	**U23ADC4XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Certification Course-IV**	**0**	**0**	**4**	**-**	**100**	**-**	**100**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 50**	**Total Periods: 50**

Evaluation methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	10	90	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **AEC**			*End Semester Exam Type: **LE**			
Course Code	**U23ADS402**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Skill Enhancement Course-II**	**0**	**0**	**2**	**-**	**-**	**100**	**100**

1. **API DESIGN – I**

Course Content:

1. REST – What You Didn't Know
2. A brief history of REST
3. Principle 1 – everything is a resource
4. Principle 2 – each resource is identifiable by a unique identifier
5. Principle 3 – use the standard HTTP methods
6. Principle 4 – resources can have multiple representations
7. Principle 5 – communicate statelessly
8. The REST goals
9. Separation of the representation and the resource
10. Visibility and Reliability
11. Scalability and performance
12. Working with WADL
13. Taking advantage of the existing infrastructure
14. Getting Started with Node.js
15. Installing Node.js
16. Node Package Manager
17. Installing the Express framework and other modules
18. Setting up a development environment
19. Handling HTTP requests
20. Modularizing code
21. Testing Node.js
22. Working with mock objects
23. Deploying an application

2. EXPLORING OF RESEARCH TOOLS

Course Content:

1. Bit.ai
2. elink.io
3. GanttPRO
4. Grammarly
5. Typeset.io
6. Scrivener
7. Endnote
8. Evernote
9. Mendeley
10. ContentMine
11. ResearchGate
12. Google Scholar

3. APTITUDE – II

1. Number System – II [Advanced Level].
2. Factors [Sum, Product, odd, Even].
3. Remainder Theorem - No of Zeros at End -Highest Power - Finding the Last two Digits.
4. Time & Work, Chain Rule - Working Together.
5. Combination Method - Before, After & Alternative Method.
6. Men & Days - Men, Days & Work - Efficiency & Wages.
7. Equation Method.
8. Profit & Loss - Basics & Short Cuts - Passing Through Successive Hands.
9. Purchase & Selling - Dishonest Shopkeeper.

10. Successive Discount into Single Equivalent Discount - Dealing with two or more Parts.
11. Percentage - Conversion & Shortcuts - Population, Depreciation Methods.
12. Percentage Savings & Expenditure - Reduction in Consumption - Percentage Relationship.
13. Time, Speed & Distance, Trains, Boats - Relationship between T/S/D.
14. Train in same Direction - Opposite Direction.
15. Boats along with Streams - Against the Stream

Lecture Periods:	Tutorial Periods:	Practical Periods: 30	Total Periods: 30

Web references

1. https://www.indiabix.com/aptitude/questions-and-answers/
2. https://www.ambitionbox.com/topics/aptitude/questions-and-answers
3. https://www.geeksforgeeks.org/aptitude-questions-and-answers/

Evaluation methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **MC**			*End Semester Exam Type: **TE**			
Course Code	**U23ADM404**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Right to Information Law and Good Governance**	**2**	**0**	**0**	**-**	**-**	**100**	**100**

UNIT-I	**Introduction**	**(9Hrs)**	
Conceptual background — Right to know — Open Government — Transparency in governance and accountability — Right to information under the Indian Constitution - Article 19 (l)(a) and Article 21 of the Constitution — Role of NGOs and movement for right to information — Right to Information Act, 2005 — Scope and objectives.			**CO1**
UNIT-II	**Obligation of Public Authorities**	**(9Hrs)**	
Obligations of public authorities: Section 4,Designation of Public Information Officers: Section 5, Disposal of request: Section 7, Exemption from disclosure of information: Section 8 Grounds for rejection to access in certain cases: Section 9, Severability: Section 10, Third party information: Section 11			**CO2**
UNIT-III	**Central and State Information Commission**	**(9Hrs)**	
Constitution of Central and State Information Commissions Terms of office and conditions of service, Removal of Chief Information Commissioner or Information Commissioner. Powers and functions of Information Commissions.			**CO3**
UNIT- IV	**Judiciary and Right to Information Act**	**(9Hrs)**	
Protection of right to access the information — Role of the Supreme Court and High Courts — Recent attempts of dilution of the right to information Law			**CO4**
UNIT- V	**Right to Information Act, 2005 and its relevance to other laws**	**(9Hrs)**	
Public Records Act, 1993, Whistle Blowers Protection Act, 2014, Official Secrets Act, 1923			**CO5**

Text Books

1. Virender Negi, Monika Negi," Right to Information: Key to Good Governance", Indu Book Services Pvt. Limited, 2019
2. R. M. Pal, Somen Chakraborty "Human Rights Education in India" Indian Social Institute, 2000
3. Sairam Bhat," Right to Information and Good Governance - Volume 3 of NLSIU book series" National Law School of India University, 2016

Reference Books

1. Sairam Bhat [ed], Right to Information and Good Governance, NLSIU Book Series-3, 2016. [ISBN-9789383363452]
2. Sairam Bhat, Right to Information, Eastern Book House, 2012. [ISBN-978838021553]
3. Praveen Dala; Consumer Protection and Right to Information; Central Information Commission, 2007.

Web References

1. https://archive.nptel.ac.in/courses/129/106/129106001/
2. https://onlinecourses.nptel.ac.in/noc20_lw01/preview
3. https://www.classcentral.com/course/swayam-right-to-information-and-good-governance-19988

Evaluation methods

Assessment	**Continuous Assessment Marks (CAM)**			**Total Marks**
	Attendance	**MCQ Test**	**Presentation / Activity / Assignment**	
Marks	10	30	60	100

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)

Puducherry

(As per UGC - 2018 Regulations and Affiliated to Pondicherry University)

PUDUCHERRY – 605107

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

M.TECH.

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

(REGULATIONS - 2023)

CURRICULUM AND SYLLABI

COLLEGE VISION AND MISSION

VISION

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society.

MISSION

M1: Quality Education : To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices.

M2: Research and Innovation : To foster value-based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues.

M3: Employability and Entrepreneurship : To inculcate the employability and entrepreneurial skills through value and skill based training.

M4: Ethical Values : To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society.

DEPARTMENT VISION AND MISSION

VISION

Vision

Incorporating the Data Science skills and applying the acquired analytical knowledge in the heterogeneous domains through Artificial Intelligence

Mission

M1: Understand Data Science:

Amalgamation of Programming Knowledge, Mathematical Skill Set and Knowledge of Business Domains to face the challenges of the real-world requirement

M2: Applying the Acquired Knowledge:

Inculcating the spirit of applying the acquired knowledge, innovation and creativity among students to work in heterogeneous domains

M3: Capstone Project:

Providing forum to carry out a capstone project through collaborations with the industries

M4: Be socially beneficial and other moral concerns:

Inspiring the educational experience in the field of application development and ensure the design, principle and ethic to be followed in the society.

M5: Continuous Learning for keen Initiative:

Affording continuous learning in the field of current trends in Artificial Intelligence and Data Science for keen initiative and enterprise focused.

PROGRAMME OUTCOMES (POs)

PO1: Exploration of Research: An ability to independently carry out research/investigation and development work to solve practical problems.
PO2: Technical Skill: An ability to write and present a substantial technical report/document.
PO3: Expertise in Academics: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO4: Scholarship of Knowledge: Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.
PO5: Usage of Modern Tools: Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations.
PO6: Ethical Practices and Social Responsibility: Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Competitive Platform: To create a competitive platform for solving critical problems in a wide variety of fields.
PEO2: Exploration: Enthusiastic participation in learning, understanding, designing and applying new innovative research ideas as the field evolves.
PEO3: Career: Applying cutting-edge technology that improves knowledge and to commit students for life-long learning to reach the leading positions in the career.
PEO4: Professional Values: Simulate the graduates to hold the responsibilities in the context of technology, ethics, society and humanity.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Computational Skills: Graduates with the ability to apply basic knowledge of Computer Science in solving the critical problems.
PSO2: Studious Research: Ability to convert innovative ideas into research or society oriented projects through current trending technologies.
PSO3: Employability: Acquire placement in highly reputed industries or accomplish new technical

business skills with the contemporary trends in the industry.

STRUCTURE FOR POSTGRADUATE ENGINEERING PROGRAM

Sl.No	Course Category	Breakdown of Credits
1	Humanities and Social Sciences (HS)	6
2	Basic Sciences (BS)	3
3	Engineering Sciences (ES)	-
4	Professional Core (PC)	25
5	Professional Electives (PE)	18
6	Open Electives (OE)	-
7	Professional Activities (PA)	20
8	Ability Enhancement Courses (AEC)	-
9	Mandatory courses (MC)	-
Total		**72**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl.No	Course Category	Credits per Semester				Total Credits
		I	II	III	IV	
1	Humanities and Social Sciences (HS)	4	2	-	-	6
2	Basic Sciences (BS)	3	-	-	-	3
3	Engineering Sciences (ES)	-	-	-	-	-
4	Professional Core (PC)	11	14	-	-	25
5	Professional Electives (PE)	3	6	9	-	18
6	Open Electives (OE)	-	-	-	-	-
7	Professional Activities (PA)			8	12	20

8	Ability Enhancement Courses (AEC)*	-	-	-	-	-
9	Mandatory Courses (MC)*	-	-	-	-	-
Total		**21**	**22**	**17**	**12**	**72**

**** AEC, MC Credits are not included for CGPA calculation***

CURRICULUM

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23MAT105	Probability and Statistics	BS	2	1	0	3	40	60	100
2	P23ADT101	Machine Learning Algorithms	PC	3	0	0	3	40	60	100
3	P23ADT102	Computing Systems for Data Science	PC	3	0	0	3	40	60	100
4	P23ADT103	Artificial Intelligence and Intelligent Systems	PC	3	0	0	3	40	60	100
5	P23HSTC01	Research Methodology and IPR	HS	2	0	0	2	40	60	100
6	P23ADE1XX	Professional Elective – I *	PE	3	0	0	3	40	60	100
Practical										
7	P23ADP101	Machine Learning Algorithms Laboratory	PC	0	0	4	2	50	50	100
8	P23HSPC01	Technical Report Writing and Seminar	HS	0	0	4	2	100	-	100
Ability Enhancement Course										
9	P23ADC1XX	Ability Enhancement Course-I #	AEC	0	0	4	-	100	-	100
10	P23ACT10X	Audit Course-I**	AEC	0	0	2	-	100	-	100
							21	590	410	1000

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23ADT204	Parallel Programming Paradigms	PC	3	0	0	3	40	60	100
2	P23ADT205	Natural Language Processing	PC	3	0	0	3	40	60	100
3	P23ADT206	Advanced Deep Learning	PC	3	0	0	3	40	60	100
4	P23ADT207	AI and Robotic Process Automation	PC	3	0	0	3	40	60	100
5	P23ADE2XX	Professional Elective - II	PE	3	0	0	3	40	60	100
6	P23ADE2XX	Professional Elective - III	PE	3	0	0	3	40	60	100
Practical										
7	P23ADP202	Advanced Deep Learning Laboratory	PC	0	0	4	2	50	50	100
8	P23HSPC02	Seminar on ICT: A Hands-on Approach	HS	0	0	4	2	100	-	100
Ability Enhancement Course										
9	P23ADC2XX	Ability Enhancement Course-II #	AEC	0	0	4	-	100	-	100
10	P23ACT20X	Audit Course-II**	AEC	0	0	2	-	100	-	100
							22	590	410	1000

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23ADE3XX	Professional Elective – IV *	PE	3	0	0	3	40	60	100
2	P23ADE3XX	Professional Elective – V *	PE	3	0	0	3	40	60	100
3	P23ADE3XX	Professional Elective – VI *	PE	3	0	0	3	40	60	100
Practical										
7	P23ADW301	Project Phase - I	PA	0	0	12	6	50	50	100
8	P23ADW302	Internship	PA	0	0	0	2	100	-	100
Ability Enhancement Course										
10	P23ADC301	NPTEL/GIAN/MOOC	AEC	0	0	0	-	100	-	100
							17	370	230	600

SEMESTER – IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Practical										
7	P23ADW403	Project Phase - II	PA	0	0	24	12	50	50	100
							12	50	50	100

*** Professional Elective Courses are to be selected from the list given in Annexure I**
 # Ability Enhancement Courses are to be selected from the list given in Annexure II
**** Audit Courses are to be selected from the list given in Annexure III**

BS- Basic Sciences

PC – Professional Core

PE – Professional Elective

HS - Humanities and Social Sciences

PA - Professional Activity

CC- Common Course

AC- Audit Course

AEC - Ability Enhancement Course

CREDIT DISTRIBUTION

Semester	I	II	III	IV	Total
Credits	21	22	17	12	72

Total number of credits required to complete
M.Tech in Computer Science and Engineering : 72 credits

ANNEXURE- I
PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course Code	Course Title
Professional Elective-I		
1	**P23ADEC01**	Agile and Software Project Management
2	**P23ADE101**	Python for Data Science
3	**P23ADE102**	Data Science Essentials
4	**P23ADE103**	Big Data Mining and Analytics
5	**P23ADE104**	Artificial Intelligence for Decision Making
Professional Elective-II		
1	**P23BDEC02**	Web Analytics and Development
2	**P23ADE205**	Data Visualization using Tableau and Power BI
3	**P23ADE206**	Predictive Modelling
4	**P23ADE207**	Next Generation Database Systems
5	**P23ADE208**	Advanced Algorithms
Professional Elective-III		
1	P23ADE209	AI and Robotics
2	P23ADE210	Explainable Artificial Intelligence
3	P23ADE211	Introduction to Real-time Data Analytics
4	P23ADE212	Data Engineering in the Cloud
5	P23ADE213	Machine learning on Cloud platform
Professional Elective-IV		
1	P23ADE314	Generative Adversarial Networks
2	P23ADE315	Introduction to Large Language Models (LLMs)
3	P23ADE316	Transfer Learning
4	P23ADE317	Information Retrieval and Text Mining
5	P23ADE318	Statistical Natural Language Processing (NLP)
Professional Elective-V		
1	P23ADE319	Predictive Analytics
2	P23ADE320	Prescriptive Analytics
3	P23ADE321	Descriptive analytics
4	P23ADE322	Internet of Things (IoT) Data Analytics
5	P23ADE323	Social Media Analytics
Professional Elective-VI		
1	P23ADE324	Machine Learning Model Deployment and Management
2	P23ADE325	AI for Sustainability
3	P23ADE326	AI in Natural Language Processing
4	P23ADE327	AI Applications in Cloud Computing

5	P23ADE328	Ethics in AI and Data Science

ANNEXURE- II

ABILITY ENHANCEMENT COURSES

Sl. No.	Course Code	Course Title
1	P23XXCX01	Adobe Photoshop
2	P23XXCX02	Adobe Animate
3	P23XXCX03	Adobe Dreamweaver
4	P23XXCX04	Adobe After Effects
5	P23XXCX05	Adobe Illustrator
6	P23XXCX06	Adobe InDesign
7	P23XXCX07	Autodesk AutoCAD -ACU
8	P23XXCX08	Autodesk Inventor - ACU
9	P23XXCX09	Autodesk Revit - ACU
10	P23XXCX10	Autodesk Fusion 360 - ACU
11	P23XXCX11	Autodesk 3ds Max - ACU
12	P23XXCX12	Autodesk Maya - ACU
13	P23XXCX13	Cloud Security Foundations
14	P23XXCX14	Cloud Computing Architecture
15	P23XXCX15	Cloud Foundation
16	P23XXCX16	Cloud Practitioner
17	P23XXCX17	Cloud Solution Architect
18	P23XXCX18	Data Engineering
19	P23XXCX19	Machine Learning Foundation
20	P23XXCX20	Robotic Process Automation / Medical Robotics
21	P23XXCX21	Advance Programming Using C
22	P23XXCX22	Advance Programming Using C ++
23	P23XXCX23	C Programming
24	P23XXCX24	C++ Programming
25	P23XXCX25	CCNP Enterprise: Advanced Routing
26	P23XXCX26	CCNP Enterprise: Core Networking
27	P23XXCX27	Cisco Certified Network Associate - Level 2
28	P23XXCX28	Cisco Certified Network Associate- Level 1
29	P23XXCX29	Cisco Certified Network Associate- Level 3
30	P23XXCX30	Fundamentals Of Internet of Things
31	P23XXCX31	Internet Of Things / Solar and Smart Energy System with IoT

32	P23XXCX32	Java Script Programming
33	P23XXCX33	NGD Linux Essentials
34	P23XXCX34	NGD Linux I
35	P23XXCX35	NGD Linux II
36	P23XXCX36	Advance Java Programming
37	P23XXCX37	Android Programming / Android Medical App Development
38	P23XXCX38	Angular JS
39	P23XXCX39	Catia
40	P23XXCX40	Communication Skills for Business
41	P23XXCX41	Coral Draw
42	P23XXCX42	Data Science Using R
43	P23XXCX43	Digital Marketing
44	P23XXCX44	Embedded System Using C
45	P23XXCX45	Embedded System with IOT / Arduino
46	P23XXCX46	English For IT
47	P23XXCX47	Plaxis
48	P23XXCX48	Sketch Up
49	P23XXCX49	Financial Planning, Banking and Investment Management
50	P23XXCX50	Foundation Of Stock Market Investing
51	P23XXCX51	Machine Learning / Machine Learning for Medical Diagnosis
52	P23XXCX52	IOT Using Python
53	P23XXCX53	Creo (Modelling & Simulation)
54	P23XXCX54	Soft Skills, Verbal, Aptitude
55	P23XXCX55	Software Testing
56	P23XXCX56	MX-Road
57	P23XXCX57	CLO 3D
58	P23XXCX58	Solid works
59	P23XXCX59	Staad Pro
60	P23XXCX60	Total Station
61	P23XXCX61	Hydraulic Automation
62	P23XXCX62	Industrial Automation
63	P23XXCX63	Pneumatics Automation
64	P23XXCX64	Agile Methodologies
65	P23XXCX65	Block Chain
66	P23XXCX66	Devops
67	P23XXCX67	Artificial Intelligence

68	P23XXCX68	Cloud Computing
69	P23XXCX69	Computational Thinking
70	P23XXCX70	Cyber Security
71	P23XXCX71	Data Analytics
72	P23XXCX72	Databases
73	P23XXCX73	Java Programming
74	P23XXCX74	Networking
75	P23XXCX75	Python Programming
76	P23XXCX76	Web Application Development (HTML, CSS, JS)
77	P23XXCX77	Network Security
78	P23XXCX78	MATLAB
79	P23XXCX79	Azure Fundamentals
80	P23XXCX80	Azure AI (AI-900)
81	P23XXCX81	Azure Data (DP -900)
82	P23XXCX82	Microsoft 365 Fundamentals (SS-900)
83	P23XXCX83	Microsoft Security, Compliance and Identity (SC-900)
84	P23XXCX84	Microsoft Power Platform (Pl-900)
85	P23XXCX85	Microsoft Dynamics Fundamentals 365 – CRM
86	P23XXCX86	Microsoft Excel
87	P23XXCX87	Microsoft Excel Expert
88	P23XXCX88	Securities Market Foundation
89	P23XXCX89	Derivatives Equinity
90	P23XXCX90	Research Analyst
91	P23XXCX91	Portfolio Management Services
92	P23XXCX92	Cyber Security
93	P23XXCX93	Cloud Security
94	P23XXCX94	PMI – Ready
95	P23XXCX95	Tally – GST & TDS
96	P23XXCX96	Advance Tally
97	P23XXCX97	Associate Artist
98	P23XXCX98	Certified Unity Programming
99	P23XXCX99	VR Development

ANNEXURE-III

AUDIT COURSES
(Common to all M.Tech Programme)

Sl. No.	Course Code	Course Title
1	P23ACTX01	English for Research Paper Writing
2	P23ACTX02	Disaster Management
3	P23ACTX03	Sanskrit for Technical Knowledge
4	P23ACTX04	Value Education
5	P23ACTX05	Constitution of India
6	P23ACTX06	Pedagogy Studies
7	P23ACTX07	Stress Management by Yoga
8	P23ACTX08	Personality Development Through Life Enlightenment Skills
9	P23ACTX09	Unnat Bharat Abhiyan

Annexure III

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**II**	Course Category: **PC**				*End Semester Exam Type:**TE**		
Course Code	**P23ADT204**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Parallel Programming Paradigms**	**3**	**-**	**-**	**3**	**40**	**60**	**100**
	(AI&DS)							
Prerequisite	Operating System Concepts, Computer Architecture and Organization							

Course Outcome		On of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Develop message passing parallel programs using MPI framework	**K3**
	CO2	Implement shared memory parallel programs using Pthreads	**K3**
	CO3	Work with shared memory parallel programs using OpenMP	**K3**
	CO4	Analyse the complexity of parallel algorithms	**K3**
	CO5	Build applications using GPU based CUDA programming	**K3**

UNIT – I	**Message Passing Paradigm**	**Periods:9**	
Basic MPI programming – MPI_Init and MPI_Finalize – MPI communicators – SPMD programs – Message passing – MPI_Send and MPI_Recv – Message matching – MPI I/O – Parallel I/O – Collective communication – MPI_Reduce - MPI_Allreduce, broadcast, scatter, gather, allgather – Derived types – Remote Memory Access – Performance evaluation of MPI programs			**CO1**
UNIT – II	**Shared Memory Paradigm: pthreads**	**Periods:9**	
Basics of Pthreads – Thread synchronization – Critical sections – Busy waiting – Mutex – Semaphores – Barriers and condition variables – Read write locks with examples - Caches, cache coherence and false sharing – Pthreads case study			**CO2**
UNIT – III	**Shared Memory Paradigm: openMP**	**Periods:9**	
Basic OpenMP constructs – scope of variables – Reduction clause – Parallel For directive – loops in OpenMP – Scheduling loops – Synchronization in OpenMP – Case Study: Producer-Consumer problem – Cache issues – Threads safety in OpenMP – OpenMP best practices			**CO3**
UNIT – IV	**Parallel Algorithms**	**Periods:9**	
Elementary parallel algorithms: Reduction – Broadcast - Prefix sum. Matrix multiplication: Algorithm for processor array - Algorithm for multiprocessors and multicomputer. Sorting: Odd even transposition sort - Bitonic merge - Quick sort algorithms			**CO4**
UNIT – V	**GPU Programming with CUDA**	**Periods:9**	
GPUs and GPGPU - GPU architectures - Heterogeneous computing – Simple CUDA program - Threads, blocks, and grids - Vector addition – CUDA trapezoidal rule – improvements - Implementation of trapezoidal rule with warpSize thread blocks – block with more than one warp			**CO5**

LecturePeriods:45	**TutorialPeriods:0**	**Practical Periods: -0**	**TotalPeriods:45**

Text Books

1. Peter S. Pacheco, Matthew Malensek, “An introduction to parallel programming”, Second edition, Morgan Kaufmann, 2021
2. Niranjan N. Chiplunkar, Raju K, “Introduction to Parallel Computing”, Wiley, 2021.
3. Michael J. Quinn, “Parallel Computing: Theory & Practice”, Tata McGraw Hill, Second edition, Reprint 2017.

Reference Books

1. A. Munshi, B. Gaster, T. G. Mattson, J. Fung, and D. Ginsburg, “OpenCL programming guide”, Addison Wesley, 2011
2. M. J. Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2011.
3. Rob Farber, “CUDA application design and development”, Morgan Haufmann, 2011

Web References

1. http://condor.cc.ku.edu/~grobe/docs/intro-MPI-C.shtml
2. http://www.hpcc.unn.ru/mskurs/ENG/DOC/pp09.pdf
3. https://www.cs.cmu.edu/afs/cs/academic/class/15492-f07/www/pthreads.html
4. https://www.openmp.org/
5. https://developer.nvidia.com/blog/even-easier-introduction-cuda/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	2	1	2	2	3	2	2
2	1	2	2	2	2	2	3	2	2
3	2	3	3	1	3	3	3	3	3
4	2	3	3	1	3	3	3	3	3
5	2	3	3	1	3	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**			Programme: **M.Tech.**				
Semester	**II**			Course Category Code: **PE**		*End Semester Exam Type: **TE**		
Course Code	**P23ADE209**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM / ESE / TM
Course Name	**AI and Robotics**			**3**	**-**	**-**	**3**	**40 / 60 / 100**

Prerequisite	Artificial Intelligence		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand video storage formats and pre-processing.	**K2**
	CO2	Apply learning methods to identify and classify objects.	**K3**
	CO3	Apply modelling techniques to objects and scenes from videos.	**K3**
	CO4	Analyze visual context from real-time videos	**K3**
	CO5	Apply non-deep learning methods to real-time videos.	**K3**

UNIT-I	**Introduction to AI and Robotics**	**Periods: 9**	
Overview of Robotics and Its Evolution - Introduction to Artificial Intelligence in Robotics - Role of Machine Learning in Robotics - Challenges and Opportunities in AI-powered Robotics			**CO1**
UNIT-II	**Robot Perception and Sensing**	**Periods: 9**	
Sensor Technologies for Robotics - Computer Vision Techniques for Robot Perception - Lidar and Radar Systems in Robotics - Fusion of Sensor Data for Enhanced Perception in Robots			**CO2**
UNIT-III	**Robot Learning and Adaptation**	**Periods: 9**	
Reinforcement Learning for Robot Control - Deep Learning for Robot Perception and Decision Making - Transfer Learning and Generalization in Robotics - Self-learning and Autonomous Adaptation in Robots			**CO3**
UNIT-IV	**Robot Motion Planning and Control**	**Periods: 9**	
Path Planning Algorithms for Robots - Trajectory Generation and Optimization Techniques - Control Theory in Robotics - Human-Robot Interaction and Collaboration			**CO4**
UNIT-V	**Advanced Topics in AI and Robotics**	**Periods: 9**	
Swarm Robotics and Multi-Agent Systems - Bio-inspired Robotics and Soft Robotics - Ethical and Societal Implications of AI in Robotics - Cutting-edge Research and Future Directions in AI-powered Robotics			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Roland Siegwart, "Introduction to Autonomous Mobile Robots," MIT Press, 2nd edition, 2021.
2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach," Pearson, 4th edition, 2020.

Reference Books

1. Peter Corke, "Robotics, Vision & Control: Fundamental Algorithms In MATLAB/Simulink," Springer, 1st edition, 2011.
2. Matteo Pivato, "Deep Learning for Robotics," Packt Publishing, 1st edition, 2019.

Web References

1. https://www.ieee-ras.org/
2. https://openai.com/research/ingredients-for-robotics-research

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**II**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE210**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Explainable Artificial Intelligence**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Deep Learning and Artificial Intelligence	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand video storage formats and pre-processing.	**K2**
	CO2 Apply learning methods to identify and classify objects.	**K3**
	CO3 Apply modelling techniques to objects and scenes from videos.	**K3**
	CO4 Analyze visual context from real-time videos	**K3**
	CO5 Apply non-deep learning methods to real-time videos.	**K3**

UNIT-I	**Introduction to Explainable AI**	**Periods: 9**	
Understanding the Need for Explainable AI - Importance of Transparency in AI Systems - Historical Context and Evolution of XAI Challenges and Opportunities in XAI Research			**CO1**
UNIT-II	**Bias and Fairness in AI and Data Science**	**Periods: 9**	
Model-specific XAI Techniques: Decision Trees, Rule-based Systems - Post-hoc XAI Techniques: LIME, SHAP, CAM - Interpretable Models: Linear Models, Decision Trees, Rule-based Models - Model-Agnostic XAI Techniques: Feature Importance, Partial Dependence Plots			**CO2**
UNIT-III	**Privacy and Security in AI and Data Science**	**Periods: 9**	
Metrics for XAI Evaluation: Faithfulness, Transparency, Simplicity, Utility - User-Centric Evaluation Methods - Challenges in Evaluating XAI Systems: Subjectivity, Context-dependency			**CO3**
UNIT-IV	**Transparency and Accountability**	**Periods: 9**	
Healthcare: Interpretable Models for Diagnosis and Prognosis - Finance: Fraud Detection, Credit Scoring - Autonomous - Systems: Interpretable Decision-making in Robotics and Autonomous Vehicles - Legal and Ethical Considerations in XAI Applications			**CO4**
UNIT-V	**Social and Ethical Impact of AI and Data Science**	**Periods: 9**	
Advancements in XAI Research: Deep Learning Interpretability, Reinforcement Learning - Incorporating XAI into AI Systems Development Lifecycle - Addressing the Trade-offs between Performance and Interpretability - Societal Implications and Adoption of XAI Technologies			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Mukund Sundararajan, "Explainable AI: Techniques for Transparency and Understanding in Artificial Intelligence Systems," O'Reilly Media, 1st edition, 2020.
2. Wojciech Samek, "A Primer on Explainable Artificial Intelligence (XAI)," Springer, 1st edition, 2019.

Reference Books

1. Christoph Molnar, "Interpretable Machine Learning," Lulu Publishing Services, 1st edition, 2019.
2. Solon Barocas, "Fairness, Accountability, and Transparency in Machine Learning," O'Reilly Media, 1st edition, 2019.

Web References

1. https://www.microsoft.com/en-us/research/theme/fate/
2. https://github.com/shap/shap

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**II**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE211**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Introduction to Real-time Data Analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**
Prerequisite	Data Analytics							

Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand video storage formats and pre-processing.	**K2**
	CO2 Apply learning methods to identify and classify objects.	**K3**
	CO3 Apply modelling techniques to objects and scenes from videos.	**K3**
	CO4 Analyze visual context from real-time videos	**K3**
	CO5 Apply non-deep learning methods to real-time videos.	**K3**

UNIT-I	**Real-time Data Analytics**	**Periods: 9**
Challenges and Benefits of Real-time Analytics - Comparison of Batch vs. Real-time Processing - Introduction to Cloud Computing for Analytics - Cloud Architecture for Real-time Data Pipelines.		**CO1**
UNIT-II	**Fundamentals of Streaming Data**	**Periods: 9**
Characteristics of Streaming Data - Data Stream Processing Models (Lambda Architecture, Kappa Architecture) - Apache Spark Streaming Framework - Micro-batching vs. Continuous Processing.		**CO2**
UNIT-III	**Cloud-based Tools for Real-time Analytics**	**Periods: 9**
Exploring a Cloud Platform for Real-time Analytics (AWS Kinesis, Azure Stream Analytics, GCP Pub/Sub) - Data Ingestion and Preprocessing on Cloud - Stream Processing with Apache Spark on Cloud - Real-time Analytics Dashboards and Visualization		**CO3**
UNIT-IV	**Advanced Real-time Analytics Applications**	**Periods: 9**
Real-time Machine Learning for Predictions (Anomaly Detection, Fraud Detection) - Real-time Sentiment Analysis using - Streaming Social Media Data - Real-time Recommendation Systems for E-commerce - Case Studies of Real-time Analytics in Different Industries		**CO4**
UNIT-V	**Building a Real-time Analytics Project**	**Periods: 9**
Defining a Real-time Analytics Use Case - Designing and Implementing a Real-time Data Pipeline on Cloud - Evaluating Performance and Scalability of the System - Best Practices for Real-time Analytics Deployment		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Yuanyuan (YY) Feng, "Real-Time Analytics: Techniques and Applications," Wiley, 1st edition, 2014.
2. Michael Minelli, Jamie Andrews, and Murelle Murtagh, "Big Data: Principles and Practices," John Wiley & Sons, 1st edition, 2012.

Reference Books

1. Holden Karau, Eugene Yang, and Bobby Rao, "Learning Apache Spark," O'Reilly Media, 1st edition, 2015.
2. Jun Rao and Prakash Nanda, "Kafka: The Definitive Guide," O'Reilly Media, 1st edition, 2016.

Web References

1. https://spark.apache.org/
2. https://kafka.apache.org/
3. https://www.techtarget.com/searchbusinessanalytics/post/How-predictive-and-prescriptive-analytics-impact-the-bottom-line

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**II**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE212**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Data Engineering in the Cloud**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Data Science and Cloud Computing	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand video storage formats and pre-processing.	**K2**
	CO2 Apply learning methods to identify and classify objects.	**K3**
	CO3 Apply modelling techniques to objects and scenes from videos.	**K3**
	CO4 Analyze visual context from real-time videos	**K3**
	CO5 Apply non-deep learning methods to real-time videos.	**K3**

UNIT-I	**Cloud Infrastructure for Data Engineering**	**Periods: 9**	
Introduction to Cloud Computing for Data Engineering - Cloud Storage Options for Big Data (Object Storage, Data Lakes) - Virtual machines vs. Serverless computing for Data Processing - Managing and Scaling Data Engineering Workloads on Cloud			**CO1**
UNIT-II	**Cloud Data Storage Services**	**Periods: 9**	
Exploring a Cloud Platform for Data Storage (AWS S3, Azure Blob Storage, GCP Cloud Storage) - Data Partitioning and Optimization for Efficient Storage - Security and Access Controls for Cloud Data Storage - Data Lifecycle Management in the Cloud			**CO2**
UNIT-III	**Cloud Data Processing Technologies**	**Periods: 9**	
Batch Data Processing with Cloud Services (AWS Glue, Azure Data Factory, GCP Cloud Dataflow) - Introduction to Stream - Processing on Cloud Platforms - Data Transformation and Cleaning with Cloud-based Tools - Scheduling and Monitoring Data Processing Pipelines			**CO3**
UNIT-IV	**Data Pipelines and Orchestration**	**Periods: 9**	
Designing and Implementing Data Pipelines on Cloud - Introduction to Workflow Management Tools (Apache Airflow, Luigi) Version Control for Data Pipelines and Data Quality Management - Best Practices for Building Reliable and Scalable Data Pipelines			**CO4**
UNIT-V	**Building a Data Engineering Project on Cloud**	**Periods: 9**	
Defining a Data Engineering Use Case - Designing and Implementing a Data Pipeline on Cloud - Automating Data Processing Tasks - Testing, Debugging, and Monitoring the Data Pipeline - Case Studies of Data Engineering Workflows in the Cloud			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Nick Caldwell and Matt Juras, "Data Engineering on Google Cloud Platform," O'Reilly Media, 1st edition, 2019.
2. Corey Quinn, "Data Engineering with AWS," O'Reilly Media, 1st edition, 2021.

Reference Books

1. Holden Karau, Eugene Yang, and Bobby Rao, "Learning Apache Spark," O'Reilly Media, 2nd edition, 2020.
2. DJ Patil, "Building Data Science Teams," O'Reilly Media, 1st edition, 2011.

Web References

1. https://learn.microsoft.com/en-us/credentials/certifications/azure-data-engineer/
2. https://www.cloudera.com/products/data-engineering.html

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**II**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE213**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Machine learning on Cloud platform**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Machine Learning	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand video storage formats and pre-processing.	**K2**
	CO2 Apply learning methods to identify and classify objects.	**K3**
	CO3 Apply modelling techniques to objects and scenes from videos.	**K3**
	CO4 Analyze visual context from real-time videos	**K3**
	CO5 Apply non-deep learning methods to real-time videos.	**K3**

UNIT-I	**Cloud Computing for Machine Learning**	**Periods: 9**
Introduction to Cloud Computing for Machine Learning - Benefits and Challenges of Training ML models on Cloud - Cloud Services for Machine Learning (Virtual Machines, Containers, Serverless Functions) - Managing and Scaling Machine Learning Workloads on Cloud		**CO1**
UNIT-II	**Building and Training ML Models on Cloud**	**Periods: 9**
Distributed Training of Machine Learning Models on Cloud Platforms - Model Hyperparameter Tuning with Cloud Resources Managing Data Pipelines for Training and Validation - Monitoring and Debugging Training Jobs on Cloud		**CO2**
UNIT-III	**Cloud-based Machine Learning Platforms**	**Periods: 9**
Exploring a Cloud Platform for Machine Learning (AWS SageMaker, Azure Machine Learning, GCP AI Platform) - Building and Training Machine Learning Pipelines on Cloud - Version Control and Model Management for Cloud-based ML - Integration with Cloud Storage and Data Processing Services		**CO3**
UNIT-IV	**Deployment and Serving Machine Learning Models**	**Periods: 9**
Model Deployment Strategies on Cloud Platforms (APIs, Batch Scoring) - Real-time Inference with Cloud-based ML Services Model Optimization and Compression for Efficient Deployment - Monitoring and A/B Testing of Deployed ML Models		**CO4**
UNIT-V	**Machine Learning Project on Cloud**	**Periods: 9**
Choosing a Machine Learning Problem for Cloud Deployment - Designing and Implementing an ML Pipeline on Cloud Operationalizing and Monitoring the Deployed Model - Case Studies of Successful Machine Learning Applications in the Cloud		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow”,Shroff/O'Reilly,3rd Edition,2022
2. Luis Pedro Coelho ,”Building Machine Learning Systems with Python”, Packt Pub Ltd, 2nd Edition, 2013

Reference Books

1. Jake VanderPlas, “Machine Learning with Google Cloud Platform”, O'Reilly Media, 2nd Edition, 2022.
2. Paul Crickard, “Machine Learning with Amazon Web Services”, Packt Pub Ltd, 1st Edition, 2015

Web References

1. https://aws.amazon.com/training/?trk=548ed19c-6022-4acf-90f3ffa8ef8e2461&sc_channel=ps&ef_id=CjwKCAjw7-SvBhB6EiwAwYdCAZqopNjDlqV_SJny0FDu4gQbauok_v9vGqnU1be54tzsNLgBhpaOhoCrVUQAvD_BwE:G:s&s_kwcid=AL!4422!3!543075513284!p!!g!!amazon%20web%20services%20ai%20training!14492222808!124577467817&gclid=CjwKCAjw7SvBhB6EiwAwYdCAZqopNjDlqV_SJny0FDu4gQbauok_v9vGqnU1be54tzsNLgBhpaOhoCrVUQAvD_BwE
2. https://cloud.google.com/products/ai

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE314**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Generative Adversarial Networks**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Deep Learning	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Remembering the concept of AI and Human computer interaction	**K2**
	CO2 Understand the advanced interaction techniques.	**K2**
	CO3 Evaluate chatbot development platforms	**K3**
	CO4 Designing Human Robot interaction.	**K3**
	CO5 Evaluate ubiquitous computing and ambient intelligence.	**K3**

UNIT-I	**Introduction to Generative Modeling and GANs**	**Periods: 9**	
What is generative modeling - Applications of generative models - Introduction to Generative Adversarial Networks (GANs) - The adversarial training process - Mathematical formulation of GANs			**CO1**

UNIT-II	**GAN Architectures**	**Periods: 9**	
Deep Convolutional Generative Adversarial Networks (DCGANs) - Understanding the Generator and Discriminator networks Loss functions for GAN training - Evaluating GAN performance			**CO2**

UNIT-III	**Training and Implementing GANs**	**Periods: 9**	
Challenges in GAN training: mode collapse and vanishing gradients - Techniques for stable GAN training - Implementing a DCGAN from scratch using PyTorch- Training GANs on various datasets			**CO3**

UNIT-IV	**Advanced GAN Applications**	**Periods: 9**	
Applications of GANs in image generation, editing, and translation - Style Transfer with GANs - Generative AI for music and text creation - Exploring the creative potential of GANs			**CO4**

UNIT-V	**GAN Research and Future Directions**	**Periods: 9**	
Recent advancements in GAN architectures- The ethical considerations of GAN-generated content Exploring the limitations and potential future directions of GAN research			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Yoav Goldberg. "Language Models for Natural Language Processing". O'Reilly Media. First Edition. 2019
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, “Deep Learning”, MIT Press, 1st Edition, 2016

Reference Books

1. Aurélien Géron. "Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow". O'Reilly Media. 2nd Edition. 2019
2. Lee Elder IV. "Generative Adversarial Networks with PyTorch". Packt Publishing. First Edition. 2019

Web References

1. https://en.m.wikipedia.org/wiki/Generative_adversarial_network
2. https://machinelearningmastery.com/generative_adversarial_networks/#:~:text=Generative%20Adversarial%20Networks%2C%20or%20GANs,networks%20or%20CNNs%20for%20short.
3. https://towardsdatascience.com/intuitive-introduction-to-generative-adversarial-networks-gans-230e76f973a9

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**					
Semester	**III**	Course Category Code: **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23ADE315**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Introduction to Large Language Models (LLMs)**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Deep Learning and NLP		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand the concept of saptio temporal statistics.	**K2**
	CO2	Evaluate event analysis and weather forecasting.	**K3**
	CO3	Analyze earth system modelling challenges.	**K3**
	CO4	Evalate the spatial temporal modelling environment.	**K3**
	CO5	Analyze climate changing and disaster prediction.	**K3**

UNIT-I	**Demystifying Large Language Models**	**Periods: 9**	
What are Large Language Models - Understanding the "Large" in Large Language Models: Data and Training Paradigms - Transformer Architecture: The Backbone of LLMs - Unveiling the Power of Attention Mechanisms.			**CO1**
UNIT-II	**LLM Training and Techniques**	**Periods: 9**	
Pre-training, Fine-tuning, and Transfer Learning for LLMs - Exploring different LLM training objectives - Addressing Challenges in LLM Training: Bias, Safety, and Explainability			**CO2**
UNIT-III	**Unveiling the Capabilities of LLMs**	**Periods: 9**	
Text Generation: From creative writing to code generation - Machine Translation: Breaking down language barriers with LLMs - Text Summarization: Extracting key information with LLMs - Question Answering: Unveiling the power of factual language understanding			**CO3**
UNIT-IV	**Applications of Large Language Models**	**Periods: 9**	
LLMs for Chatbots and Conversational AI - Leveraging LLMs for Content Creation and Summarization - Exploring the potential of LLMs in Education and Research - Future Applications of LLMs: From personalized learning to human-computer collaboration			**CO4**
UNIT-V	**The Societal Impact of LLMs**	**Periods: 9**	
Ethical considerations of LLM use: Bias, Fairness, and Transparency - The evolving landscape of human-machine interaction with LLMs - Exploring the potential societal benefits and challenges of LLMs			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Yoav Goldberg. "Language Models for Natural Language Processing". O'Reilly Media. First Edition. 2019
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, “Deep Learning”, MIT Press, 1st Edition, 2016
3. Dan Jurafsky and James H. Martin. "Speech and Language Processing". Pearson. Third Edition. 2024

Reference Books

1. Sumit Raj. "Building Chatbots with Python". Packt Publishing. First Edition. 2020.
2. Lester Mackey and Jason Veit. "Hugging Face Transformers". O'Reilly Media. First Edition. 2022.
3. Eric Matias. "Implementing Machine Learning and Deep Learning with Python". Packt Publishing. First Edition. 2019.

Web References

1. https://blog.google/technology/ai/
2. https://openai.com/blog
3. http://jalammar.github.io/illustrated-transformer/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category Code: **PE** *End Semester Exam Type: **TE**						
Course Code	**P23ADE316**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Transfer Learning**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Deep Learning	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand various optimization problems and basic techniques such as gradient descent and Newton's method.	**K2**
	CO2 Master linear programming, simplex method, duality, and basics of integer programming.	**K3**
	CO3 Gain proficiency in convex sets/functions, convex optimization problems, and relevant algorithms for machine learning applications.	**K3**
	CO4 Acquire skills in stochastic optimization, including stochastic gradient descent, mini-batch learning, and convergence analysis.	**K3**
	CO5 Explore evolutionary algorithms, swarm intelligence, metaheuristic methods, and optimization strategies for large-scale and distributed systems.	**K2**

UNIT-I	**Foundations of Transfer Learning**	**Periods: 9**	
Introduction to Machine Learning and its limitations - Understanding data scarcity and the rise of transfer learning - Core principles of transfer learning: Positive and Negative Transfer - Applications of transfer learning across various domains			**CO1**
UNIT-II	**Pre-trained Models and Feature Extraction**	**Periods: 9**	
Exploring popular pre-trained models and their architectures - Feature extraction: Leveraging pre-trained models for learning transferable representations - Fine-tuning pre-trained models for new tasks			**CO2**
UNIT-III	**Transfer Learning Techniques and Applications**	**Periods: 9**	
Domain Adaptation: Transferring knowledge across different data distributions - Freezing vs. Fine-tuning: Optimizing the learning process for transfer learning - Case studies: Applying transfer learning to image classification, text sentiment analysis, and more			**CO3**
UNIT-IV	**Implementation and Practical Considerations**	**Periods: 9**	
Implementing transfer learning with popular deep learning frameworks - Choosing the right pre-trained model for your task - Addressing challenges in transfer learning: Overfitting and catastrophic forgetting			**CO4**
UNIT-V	**The Future of Transfer Learning**	**Periods: 9**	
Emerging trends in transfer learning research- The impact of transfer learning on democratizing AI development - Exploring the ethical considerations of using pre-trained models			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow", O'Reilly Media, First Edition,2019
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", MIT Press, 2016
3. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012

Reference Books

1. Francois Chollet, "Deep Learning with Python", Publisher: Manning,2017
2. John Schnabel, "Machine Learning Crash Course", Publisher: Addison-Wesley Professional, 2019
3. Luis Pedro Coelho, "Building Machine Learning Systems with Python", Publisher: Packt Publishing, 2015

Web References

1. https://machinelearningmastery.com/transfer-learning-for-deep-learning/
2. https://machinelearningmastery.com/transfer-learning-for-deep-learning/
3. https://en.m.wikipedia.org/wiki/Transfer_learning

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category Code:**PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE317**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Information Retrieval and Text Mining**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	NLP	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand fundamental Computer Vision, Computer Graphics and human computer Interaction Techniques related to VR/AR	**K2**
	CO2 Understand Geometric Modeling Techniques	**K2**
	CO3 Understand the Virtual Environment	**K2**
	CO4 Analyze and evaluate VR/AR Technologies	**K3**
	CO5 Apply various types of Hardware and Software in Virtual Reality systems	**K3**
	CO6 Design and formulate Virtual/Augmented Reality Applications	**K3**

UNIT-I	**Introduction to Information Retrieval and Text Mining**	**Periods: 9**	
The Information Retrieval (IR) landscape: Search engines and beyond - Text Mining: Unveiling hidden patterns and trends in text data - Applications of Information Retrieval and Text Mining (e.g., web search, document recommendation, topic modeling) - Data Preprocessing for Text Analysis: Cleaning, Tokenization, and Normalization			**CO1**
UNIT-II	**Text Representation and Indexing**	**Periods: 9**	
Bag-of-Words Model: Representing documents as collections of terms - TF-IDF (Term Frequency-Inverse Document Frequency): Weighting terms for relevance - Text encoding techniques: Word Embeddings and Vector Space Models - Indexing Techniques: Efficiently storing and retrieving textual information			**CO2**
UNIT-III	**Retrieval Models and Evaluation**	**Periods: 9**	
Boolean Retrieval: Combining keywords for precise search - The Vector Space Model: A geometric approach to document retrieval - Probabilistic Retrieval Models: Ranking documents based on relevance probabilities - Evaluating the effectiveness of information retrieval systems using precision, recall and F1-score			**CO3**
UNIT-IV	**Text Classification and Clustering**	**Periods: 9**	
ISupervised Learning for Text Classification: Categorizing documents based on content - Popular Text Classification Algorithms: Naïve Bayes, Support Vector Machines (SVM) - Unsupervised Learning for Text Clustering: Grouping documents by topic similarity - K-Means Clustering and Hierarchical Clustering Techniques for Text Data			**CO4**
UNIT-V	**Advanced Information Retrieval and Text Mining Applications**	**Periods: 9**	
Supervised Learning for Text Classification: Categorizing documents based on content - Popular Text Classification Algorithms: Naïve Bayes, Support Vector Machines (SVM) - Unsupervised Learning for Text Clustering: Grouping documents by topic similarity - K-Means Clustering and Hierarchical Clustering Techniques for Text Data			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Manning, Raghavan, and Schütze. "Introduction to Information Retrieval". Cambridge University Press. Third Edition. 2008.
2. Michael Berry and Gordon Linoff. "Text Mining: Applications and Techniques". Wiley. 1999.
3. Dan Jurafsky and James H. Martin. "Speech and Language Processing". Pearson. 2019.

Reference Books

1. Jason Brownlee. "Python for Text Analysis". Publisher: Machine Learning Mastery. 2019
2. Delip Rao and Brian McMahan. "Natural Language Processing with Deep Learning". Publisher: O'Reilly Media. 2018.
3. "Machine Learning for Text Analytics". 2020.

Web References

1. The Text Mining Guide (https://medium.com/budding-data-scientist/text-mining-a-basic-beginners-guide-5d2ecc04e4e6)
2. The Association for Computational Linguistics (ACL) (https://www.aclweb.org/)
3. The National Institute of Standards and Technology (NIST) Text Retrieval Conference (TREC) (https://trec.nist.gov/)

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Semester	III	Course Category Code: PE			*End Semester Exam Type: TE		
Course Code	P23ADE318	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Statistical Natural Language Processing (NLP)**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	NLP	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the fundamentals and importance of IoT data analytics.	**K2**
	CO2 Analyze and process large-scale IoT data.	**K3**
	CO3 Implement data flow management for IoT data streams.	**K3**
	CO4 Apply machine learning models to IoT data for predictive analytics.	**K3**
	CO5 Evaluate the performance and scalability of IoT analytics solutions.	**K3**

UNIT-I	**Introduction to Statistical NLP**	**Periods: 9**	
Review of core NLP concepts: Morphology, Syntax, Semantics -The role of statistics in NLP: Probabilistic language modeling- Language Models: n-grams, smoothing techniques-Evaluation metrics for Language Models: Perplexity, BLEU score			**CO1**
UNIT-II	**Probabilistic Methods for NLP**	**Periods: 9**	
Hidden Markov Models (HMMs) for language processing - Part-of-Speech (POS) tagging with HMMs- Conditional Random Fields (CRFs) for sequence labeling tasks-N-gram Language Models with Backoff			**CO2**
UNIT-III	**Statistical Machine Translation**	**Periods: 9**	
Statistical Machine Translation (SMT) : Machine translation as a statistical inference problem - Phrase-based Machine - Translation models - Alignment models for SMT - Evaluation metrics for Machine Translation			**CO3**
UNIT-IV	**Advanced Statistical Techniques for NLP**	**Periods: 9**	
Topic Modeling: Latent Dirichlet Allocation (LDA) for unsupervised learning of topics-Sentiment Analysis: Statistical methods for sentiment classification-Text Summarization: Extractive and Abstractive summarization with statistical models-Deep Learning vs. Statistical NLP: Understanding their strengths and limitations			**CO4**
UNIT-V	**Emerging Trends in Statistical NLP**	**Periods: 9**	
Neural Statistical Machine Translation (NMT)-Variational Inference for Text Analysis-Bayesian Deep Learning for NLP Tasks-The Future of Statistical NLP: Explainable AI and interpretability			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Christopher D. Manning and Hinrich Schütze, "Foundations of Statistical Natural Language Processing", MIT Press, 1st edition, 1999.
2. Dan Jurafsky and James H. Martin, "Speech and Language Processing", Pearson, 3rd edition, 2019.
3. Graeme Hirst, "Statistical Language Learning", MIT Press, 1st edition, 1989.

Reference Books

1. Xuhui Huang, Alexis Michaelides, and Richard Yarrington, "Statistical Methods for Speech Processing", Springer, 1st edition, 2019.
2. Ruslan Mitkov, "Probabilistic Natural Language Processing", MIT Press, 1st edition, 2023.
3. Steven Bird, Ewan Klein, and Edward Loper, "Natural Language Processing with Python", O'Reilly Media, 1st edition,2019.

Web References

1. https://nlp.stanford.edu/
2. https://en.m.wikipedia.org/wiki/Category:Statistical_natural_language_processing
3. https://pages.ucsd.edu/~bakovic/compphon/Jurafsky,%20Martin.-Speech%20and%20Language%20Processing_%20An%20Introduction%20to%20Natural%20Language%20Processing%20(2007).pdf

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category Code: **PE** *End Semester Exam Type: **TE**						
Course Code	**P23ADE319**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Predictive Analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Data Analytics		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand the basic concepts of Nature Inspired Optimization Techniques	**K2**
	CO2	Understand the various Bio-Inspired algorithms	**K2**
	CO3	Understand the various Physics and Chemistry Inspired Algorithms	**K2**
	CO4	Understand the various application arears in artificial intelligence	**K2**
	CO5	Ability to apply the various techniques of Nature Inspired Optimization in real time applications	**K3**

UNIT-I	**Introduction to Predictive Analytics**	**Periods: 9**	
The power of data: Transforming data into predictive insights - Applications of Predictive Analytics in business, finance, healthcare, and more - Understanding the Predictive Analytics workflow: Data exploration, model building, and evaluation Ethical considerations in using predictive models			**CO1**
UNIT-II	**Statistical Foundations for Prediction**	**Periods: 9**	
Review of core statistical concepts: Descriptive statistics, hypothesis testing, correlation analysis - Introduction to Probability and Distributions: Understanding data variability for prediction - Linear Regression: Building the foundation for predictive modeling Evaluating Model Performance: Metrics like R-squared and Mean Squared Error			**CO2**
UNIT-III	**Classification for Predictive Modeling**	**Periods: 9**	
Logistic Regression: Predicting binary outcomes (yes/no) - Classification Algorithms: Decision Trees, Support Vector Machines (SVM) for complex relationships - Model Selection and Regularization Techniques: Preventing overfitting for better predictions Ensemble Methods: Combining multiple models for improved accuracy			**CO3**
UNIT-IV	**Advanced Predictive Techniques**	**Periods: 9**	
Time Series Analysis: Forecasting future trends based on historical data - Association Rule Learning: Identifying relationships between variables - Clustering for Segmentation: Grouping data points based on similarities for targeted predictions - Introduction to Feature Engineering: Transforming data for better model performance			
UNIT-V	**Deployment and Impact of Predictive Models**	**Periods: 9**	
Model Interpretability: Understanding how models make predictions - Model Monitoring and Evaluation: Ensuring model performance over time - Integrating Predictive Models into Decision Making Processes: Using insights for informed actions - The Future of Predictive Analytics: Exploring trends like Deep Learning and Explainable AI			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Rob J. Hyndman and George Athanasopoulos, "Forecasting: Principles and Practice", Publisher: OTexts, Edition: Second, 2018

Reference Books

1. Wes McKinney, "Python for Data Analysis", Publisher: O'Reilly Media, 2012
2. Sebastian Raschka and Vahid Rostamzadeh, "Machine Learning with Python", Publisher: Packt Publishing, Edition: 2nd, 2019

Web References

1. https://machinelearningmastery.com/tutorial-first-neural-network-python-keras/
2. https://www.sas.com/en_in/insights/analytics/predictive-analytics.html

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category Code: **PE** *End Semester Exam Type: **TE**						
Course Code	**P23ADE320**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Prescriptive Analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Data Analytics	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the basic concepts of Information Retrieval	**K2**
	CO2 Understand the Types of Information Retrieval System Models.	**K2**
	CO3 Ability to provide insights into data processing	**K3**
	CO4 Ability to analyze performance of retrieval	**K3**
	CO5 Ability to apply machine-learning techniques to text clustering and classification	**K3**

UNIT-I	**Introduction to Prescriptive Analytics**	**Periods: 9**
Distinguishing Prediction from Prescription: Moving beyond forecasting to optimal decision-making - Applications of Prescriptive Analytics in business, finance, supply chain management, and more - The Prescriptive Analytics Workflow: Problem definition, model building, solution evaluation, and implementation		**CO1**
UNIT-II	**Foundations of Optimization**	**Periods: 9**
Linear Programming (LP): The cornerstone of prescriptive modeling for maximizing or minimizing a linear objective function - Formulating Optimization Problems for Prescriptive Analytics - Solving Linear Programs: Understanding the simplex algorithm and its applications - Sensitivity Analysis: Exploring how changes in constraints impact optimal solutions		**CO2**
UNIT-III	**Advanced Optimization Techniques**	**Periods: 9**
Integer Programming (IP): Optimization problems with integer-valued variables - Non-Linear - Programming: Dealing with non-linear relationships between variables - Heuristics and Metaheuristics: Efficient solution methods for complex optimization problems - Multi-Criteria Decision Making: Optimizing with multiple objectives		**CO3**
UNIT-IV	**Implementing Prescriptive Analytics**	**Periods: 9**
Modeling Languages and Software for Optimization: Tools for translating problems into mathematical models - Integration with Data Analysis Tools: Connecting prescriptive models with real-world data streams - Scenario Analysis: Evaluating the impact of different future conditions on optimal decisions - Challenges and Considerations in Prescriptive Analytics: Model validation and real-world implementation		**CO4**
UNIT-V	**The Future of Prescriptive Analytics**	**Periods: 9**
Emerging Trends: Machine Learning and Deep Learning for Prescriptive Modeling - Big Data and Prescriptive Analytics: - Optimizing decisions with massive datasets - The Ethical Considerations of Prescriptive Analytics: Bias, Fairness, and Explainability - Prescriptive Analytics and Artificial Intelligence: The evolving landscape of data-driven decision-making		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. James Evans and Kenneth Lindsay, "Business Analytics: Decision Making Using Data", Publisher: Pearson, Edition: Second Edition, 2014

Reference Books

1. Eugene Santos, "Python for Optimization", Publisher: MIT Press, Edition: First, 2020
2. Dimitris Bertsimas and Garrett van Ryzin, "Prescriptive Analytics", Publisher: Springer, Edition: 1st, 1999

Web References

1. https://www.qlik.com/us/augmented-analytics/prescriptive-analytics
2. https://www.forbes.com/sites/danielnewman/2020/01/02/why-the-future-of-data-analytics-is-prescriptive-analytics/?sh=4e0325b65981

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**P23ADE321**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Descriptive analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Data Analytics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Perform Geospatial Data Analysis Processes	**K3**
	CO2 Plan and Execute Geo-Spatial Projects	**K3**
	CO3 Understanding spatial data manipulation and analysis techniques	**K2**
	CO4 Comprehension of Different Spatial Analysis Methodologies	**K2**
	CO5 Acquisition of Advanced Spatial Analytics Techniques	**K3**

UNIT-I	**Introduction to Descriptive Analytics**	**Periods: 9**	
The Role of Descriptive Analytics in the Data Analysis Process - Applications of Descriptive Analytics in business, finance, marketing, and more-Understanding Data Types: Categorical, Numerical, and Dates-Data Cleaning and Preprocessing: Preparing data for analysis.			**CO1**
UNIT-II	**Measures of Central Tendency**	**Periods: 9**	
Understanding how data is distributed: Frequency Distributions and Histograms-Measures of Central Tendency: Mean, Median, Mode-Choosing the right measure of central tendency based on data characteristics.			**CO2**
UNIT-III	**Measures of Dispersion and Variability**	**Periods: 9**	
Understanding data spread: Range, Variance, Standard Deviation-Quantile -based Measures of Dispersion: Interquartile Range (IQR) and Box Plots -Exploring the relationship between central tendency and dispersion			**CO3**
UNIT-IV	**Measures of Association and Relationships**	**Periods: 9**	
Exploring relationships between variables: Covariance and Correlation-Understanding the limitations of correlation: Causation vs. Correlation-Cross-tabulation and Chi-Square Test: Analyzing relationships between categorical variables			**CO4**
UNIT-V	**Data Visualization for Descriptive Analytics**	**Periods: 9**	
The Power of Visualization: Communicating insights effectively-Charts and Graphs for Descriptive Analytics: Bar Charts, Pie Charts, Scatter Plots, Line Charts-Best Practices for Data Visualization: Choosing the right chart type and effective design principles.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Mark Albright and Wayne Winston, "Business Intelligence and Applied Statistics: A Practical Approach", Wiley,2019.
2. James Evans, "Data Analysis for Business Decisions", South-Western College Pub,2021.

References Books

1. Mark Albright and Wayne Winston, "Business Intelligence and Applied Statistics: A Practical Approach", Wiley,2019.
2. James Evans, "Data Analysis for Business Decisions", South-Western College Pub,2022.
3. PACKT Publishing, "Hands-On Exploratory Data Analysis with Python",1st Edition,2021.

Web References

1. Seaborn: Statistical Data Visualization (https://seaborn.pydata.org/)
2. Matplotlib: Plotting with Python (https://matplotlib.org/)
3. DataCamp: Descriptive Statistics in Python(https://campus.datacamp.com/courses/analyzing-survey-data-in-python/descriptive-inferential-statistics?ex=1#:~:text=Descriptive%20statistics%20allow%20data%20to,anomalous%20observations%20in%20the%20data.)

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category Code: **PE** *End Semester Exam Type: **TE**						
Course Code	**P23ADE322**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Internet of Things (IoT) Data Analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Data Analytics		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand behavioral game theory for artificial intelligence domain.	**K2**
	CO2	Understand the concepts of game theory for learning techniques in artificial intelligence.	**K2**
	CO3	Apply game theoretic principles for dealing data for data science.	**K3**
	CO4	Ability to apply the human behaviors like decision making in game theory	**K3**
	CO5	Ability to apply the modern problems in AI and DS using game theory concepts	**K3**

UNIT-I	**Introduction to IoT and Data Analytics**	**Periods: 9**	
What is the Internet of Things - Exploring the landscape of connected devices - Understanding the nature of IoT data: Sensor data, heterogeneity, and real-time aspects - The role of data analytics in IoT: Transforming data into actionable insights Applications of IoT data analytics across various industries			**CO1**
UNIT-II	**Data Acquisition and Management for IoT**	**Periods: 9**	
IoT data collection methods: Sensors, network protocols, and data ingestion pipelines - Data storage and management for IoT: Cloud-based solutions, edge computing, and time-series databases - Data quality and pre-processing techniques for IoT data: Cleaning, filtering, and handling missing values			**CO2**
UNIT-III	**Analytics Techniques for IoT Data**	**Periods: 9**	
Descriptive Analytics: Summarizing and visualizing IoT data for initial insights - Diagnostic Analytics: Identifying root causes of issues using techniques like anomaly detection and correlation analysis - Predictive Analytics: Forecasting future trends and potential problems with IoT data			**CO3**
UNIT-IV	**Advanced Analytics for IoT**	**Periods: 9**	
Machine Learning for IoT Data Analytics: Supervised and unsupervised learning applications - Stream Processing and Real-time Analytics: Analyzing data as it's generated for faster decision-making - Big Data Analytics for IoT: Managing and analyzing massive datasets from large-scale IoT deployments			**CO4**
UNIT-V	**Security and Privacy Considerations in IoT Data Analytics**	**Periods: 9**	
Security threats and vulnerabilities in IoT data collection and storage - Data privacy concerns in the context of IoT: Anonymization, access control, and ethical considerations - Privacy-preserving data analytics techniques for IoT			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Luis Muñoz, "The Internet of Things: Applications from the Consumer to the Enterprise",1st,2015
2. Viktor Mayer-Schönberger and Kenneth Cukier, "Big Data: A Revolution That Will Transform How We Live, Work, and Think",Reprint,2nd,2014

Reference Books

1. Hrushikesh Mehta, "Data Analytics for the Internet of Things",1st,2016
2. Reza Zafarani, "Machine Learning for the Internet of Things",1st,2017

Web References

1. The Role of Data Analytics in the Internet of Things (InApp) (https://www.linkedin.com/pulse/role-big-data-analytics-iot-apps-sheetal-tiwari-ocvjf)
2. A Beginner's Guide to IoT Analytics (SAS) (https://www.sas.com/en_us/software/analytics-iot.html)

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	1	-	2	2	3	-	1	2	1
2	1	-	2	2	3	-	2	2	1
3	1	2	2	2	-	-	2	2	1
4	3	-	2	2	2	-	2	2	1
5	3	-	2	2	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**					
Semester	**III**	Course Category Code: **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23ADE323**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Social Media Analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Data Analytics	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the basics of data science	**K2**
	CO2 To understand the mathematical knowledge for data science	**K2**
	CO3 To gain knowledge about data warehousing	**K3**
	CO4 Explore about PowerBi	**K3**
	CO5 Deliver the quick overview of SAS	**K3**

UNIT-I	**Introduction to Social Media Analytics**	**Periods: 9**
The Rise of Social Media and its Data Landscape - Understanding different social media platforms and their functionalities Applications of Social Media Analytics: Brand monitoring, customer sentiment analysis, market research -Introduction to the Social Media Analytics Process: Data collection, analysis, and visualization		**CO1**
UNIT-II	**Data Acquisition and Social Listening**	**Periods: 9**
Social Media APIs and Data Scraping Techniques - Leveraging social listening tools for data collection - Data Cleaning and Preprocessing Techniques for Social Media Data - Ethical Considerations in Social Media Data Collection		**CO2**
UNIT-III	**Social Network Analysis & Network Metrics**	**Periods: 9**
Social Network Fundamentals: Nodes, Edges, Communities - Network Metrics for Analyzing Social Media Interactions - Degree Centrality, Betweenness Centrality - Identifying Influencers and Key Opinion Leaders on Social Media - Community Detection and Topic Modeling Techniques for Social Media Analysis		**CO3**
UNIT-IV	**Text Analytics and Sentiment Analysis**	**Periods: 9**
Text Preprocessing for Social Media Data: Tokenization, Stop Word Removal, Stemming/Lemmatization - Sentiment Analysis Techniques: Identifying positive, negative, and neutral sentiment in social media text - Opinion Mining and Aspect-Based Sentiment Analysis: Extracting specific opinions on products, brands, or topics - Exploring Advanced Text Analysis Techniques - Topic Modeling - Named Entity Recognition		**CO4**
UNIT-V	**Social Media Analytics for Business Applications**	**Periods: 9**
Social Media Marketing and Advertising: Optimizing campaigns based on social media insights - Building Social Media Listening Dashboards for Real-Time Monitoring - Social CRM: Leveraging Social Media Data for Customer Relationship Management - Measuring Social Media ROI (Return on Investment) and the Impact of Social Media Strategies		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Guy Kawasaki and Peg Fitzpatrick, "The Art of Social Media Marketing: Power Tactics for Building Brand and Driving Results",1st,2014
2. Lisa Jenkins, "Social Media Marketing Strategy",2nd,2020

Reference Books

1. Reza Zafarani and Huan Liu, "Social Media Mining: Text Mining and Social Network Analysis",:Cambridge University Press,2nd,2014
2. Wayne W. Zachary, "Social Network Analysis: A Network Approach to Social Science",Cambridge University Press,1st,2000

Web References

1. Social Media Analytics: The Complete Guide (Sprout Social) ([https://sproutsocial.com/insights/social-media-analytics/])
2. What is Social Media Analytics? (Hootsuite) ([https://blog.hootsuite.com/what-is-social-media-analytics/])

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**		Programme: **M.Tech.**					
Semester	**III**		Course Category Code: **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23ADE324**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Machine Learning Model Deployment and Management**		**3**	**-**	**-**	**3**	**40**	**60**	**100**
Prerequisite	Basic understanding of Artificial Intelligence, Machine Learning, and Agricultural Sciences								
Course Outcome	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)	
	CO1	Understand the role of AI and ML in modern agriculture.						**K2**	
	CO2	Develop AI models to predict crop yields and detect plant diseases.						**K3**	
	CO3	Implement machine learning algorithms for precision agriculture.						**K3**	
	CO4	Analyze agricultural data for sustainable farming practices.						**K3**	
	CO5	Evaluate AI-based solutions for challenges in the agricultural sector.						**K3**	
UNIT-I	**Introduction to Model Deployment and Management**					**Periods: 9**			
Overview of Model Deployment Process - Importance of Model Management in AI Systems - Challenges in Model Deployment and Management - Best Practices in Model Deployment and Management									**CO1**
UNIT-II	**Infrastructure for Model Deployment**					**Periods: 9**			
Cloud Computing for Model Deployment - Containerization Technologies - Docker - Kubernetes - Microservices Architecture for Model Deployment - Serverless Computing for Scalable Deployments									**CO2**
UNIT-III	**Model Monitoring and Performance Optimization**					**Periods: 9**			
Real-Time Model Monitoring Techniques - Performance Metrics for Deployed Models - Automated Model Retraining Strategies Continuous Integration and Continuous Deployment (CI/CD) Pipelines for Models									**CO3**
UNIT-IV	**Governance and Security in Model Deployment**					**Periods: 9**			
Ethical Considerations in Model Deployment - Regulatory Compliance for AI Systems - Data Privacy and Security in Model Deployment - Techniques for Model Explainability and Interpretability									**CO4**
UNIT-V	**Model Versioning and Collaboration**					**Periods: 9**			
Version Control Systems for Machine Learning Models - Collaborative Model Development Platforms - Model Deployment in DevOps Culture - Case Studies and Industry Applications of Model Deployment and Management									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 45**			

Text Books

1. Kevin Murphy, "Machine Learning: A Probabilistic Perspective," MIT Press, 1st edition, 2012.
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow," O'Reilly Media, 2nd edition, 2019.

Reference Books

1. Kenji Watanabe, "Production-Ready Machine Learning: Building Scalable, Maintainable, and Trustworthy Systems", O'Reilly Media, 1st Edition, 2022.
2. Zoe Curinga, Holden Karnofsky, and Diego Placona, "MLOps: Machine Learning Operations", O'Reilly Media,1st Edition, 2022.

Web References

1. Machine Learning Model Deployment: A Gentle Introduction (Google Cloud AI) (https://medium.com/publicis-sapient-france/how-to-deploy-your-own-ml-model-to-gcp-in-5-simple-steps-bf2b5898c1ab)
2. A Field Guide to Model Deployment (Netflix Tech Blog) (http://techblog.netflix.com/2013/08/deploying-netflix-api.html)

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE325**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**AI for Sustainability**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Artificial Intelligence		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Develop very good skills in spreadsheet for exploring and analyzing data	**K3**
	CO2	Ability to use various add-ins of excel to solve advanced analytical problems	**K3**
	CO3	Ability to create Worksheet, Dashboard and Story Board creation in excel	**K3**
	CO4	Ability to develop different Predictive algorithms in excel for different applications	**K3**
	CO5	Ability to apply the different prescriptive analytics.	**K3**

UNIT-I	**Introduction to AI for Sustainability**	**Periods: 9**	
Overview of Sustainability Challenges - Role of Artificial Intelligence in Addressing Sustainability Issues - Sustainable Development Goals (SDGs) and AI Applications - Ethical Considerations in AI for Sustainability			**CO1**
UNIT-II	**Sustainable Energy Management with AI**	**Periods: 9**	
Renewable Energy Forecasting Using Machine Learning - Smart Grid Optimization and Energy Demand Management - AI Applications in Energy Efficiency and Conservation - Case Studies of AI-driven Solutions in Energy Sector Sustainability			**CO2**
UNIT-III	**Environmental Monitoring and Conservation**	**Periods: 9**	
Remote Sensing and Satellite Data Analysis for Environmental Monitoring - Biodiversity Conservation and Habitat Monitoring with AI - AI for Climate Change Modeling and Mitigation - Wildlife Protection and Anti-Poaching Efforts Supported by AI			**CO3**
UNIT-IV	**Sustainable Agriculture and Food Security**	**Periods: 9**	
Precision Agriculture and Crop Monitoring with AI - Predictive Analytics for Crop Yield Optimization - AI Solutions for Water Management in Agriculture - Food Supply Chain Optimization using Artificial Intelligence			**CO4**
UNIT-V	**AI for Sustainable Urban Development**	**Periods: 9**	
Smart City Initiatives and AI Applications - Traffic Management and Pollution Reduction with AI - Waste Management and Recycling using AI Techniques - Urban Planning and Design Supported by Artificial Intelligence			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Zoe Curinga, Holden Karnofsky, and Diego Placona,"Ai for Green IT: Practices for Sustainable IT Development" by . Apress, 2nd edition, 2020

Reference Books

1. "AI for Sustainability Specialization" by University of Alberta on Coursera.
2. "DeepLearning.AI Sustainability specialization" by DeepLearning.AI

Web References

1. https://planetarycomputer.microsoft.com/
2. https://aiforgood.itu.int/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE326**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**AI in Natural Language Processing**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Artificial Intelligence		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand the basic need for Natural Language Processing with python	**K2**
	CO2	Understand the basics of Text Processing Fundamentals for NLP.	**K2**
	CO3	Comprehend the architecture of NLP models and algorithms	**K2**
	CO4	Process and analyze textual data using NLP techniques.	**K3**
	CO5	Apply NLP to tasks such as sentiment analysis, question answering, and machine translation.	**K3**

UNIT-I	**Introduction to Language Processing with Python**	**Periods: 9**	
Exploring Texts and Words with Python - Basic Text statistics – Control Structure in Python - Automatic Natural Language Understanding - Accessing Text Corpora - Lexical Resources - including WordNet			**CO1**
UNIT-II	**Text Processing Fundamentals**	**Periods: 9**	
Handling Raw Text: Retrieving from Web/Disk - Working with Strings and Unicode - Normalizing Text - Regular Expressions for Pattern Detection and Tokenization - Categorizing and Tagging Words using Taggers and Dictionaries - Tagged Corpora			**CO2**
UNIT-III	**Text Classification and Deep Learning**	**Periods: 9**	
Supervised Classification – Evaluation - Naive Bayes Classifiers - Introduction to Deep Learning - Convolutional Neural Networks - Recurrent Neural Networks - Classifying Text with Deep Learning			**CO3**
UNIT-IV	**Information Extraction and Sentence Analysis**	**Periods: 9**	
Information Extraction - Chunking, Developing and Evaluating Chunkers - Recursion in Linguistic Structure - Named Entity Recognition - Relation Extraction - Some Grammatical Dilemmas - Context-Free Grammar, Parsing with Context-Free Grammar			**CO4**
UNIT-V	**Applications of NLP**	**Periods: 9**	
Topic modeling - Text classification - Sentiment analysis - Word sense disambiguation - Speech recognition and speech to text - Text to speech - Language detection and translation.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Dan Jurafsky and James H. Martin, "Speech and Language Processing," Pearson, 3rd edition, 2020.
2. Steven Bird, Ewan Klein, and Edward Loper, "Natural Language Processing with Python," O'Reilly Media, 1st edition, 2009.

Reference Books

1. Yoav Goldberg, "Deep Learning for Natural Language Processing," O'Reilly Media, 1st edition, 2017.
2. Delip Rao and Brian McMahan, "Hands-On Natural Language Processing with PyTorch," O'Reilly Media, 1st edition, 2019.

Web References

1. https://huggingface.co/transformers
2. https://www.aclweb.org/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	2	-	-	-	1	2	1
2	3	3	3	-	1	-	2	2	1
3	2	3	2	1	2	-	2	2	1
4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE327**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**AI Applications in Cloud Computing**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Artificial Intelligence		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand the fundamental concepts of shape perception and representation.	**K2**
	CO2	Ability to apply the concepts of different object recognition techniques in advanced computer vision.	**K3**
	CO3	Ability to apply the various types of advanced object recognition models.	**K3**
	CO4	Proficiency in using different filters and motion analysis in computer vision.	**K3**
	CO5	Ability to analyze the applications of video analysis.	**K3**

UNIT-I	**Introduction to AI Applications in Cloud**	**Periods: 9**	
Overview of Cloud Computing and Its Evolution - Introduction to Artificial Intelligence and Its Applications - Intersection of AI and Cloud Computing - Benefits and Challenges of Deploying AI in the Cloud			**CO1**
UNIT-II	**Cloud-based Machine Learning Services**	**Periods: 9**	
Introduction to Cloud-based ML Services - Building and Deploying ML Models in the Cloud - Scalability and Performance Optimization in Cloud-based ML - Case Studies of Successful ML Deployments in the Cloud			**CO2**
UNIT-III	**AI-powered Big Data Analytics in the Cloud**	**Periods: 9**	
Introduction to Big Data Analytics in the Cloud - Integrating AI Techniques for Big Data Processing - Real-time Data Analytics with AI in Cloud Environments - Data Security and Privacy Concerns in Cloud-based Big Data Analytics			**CO3**
UNIT-IV	**Cloud-based AI Applications in Industry Verticals**	**Periods: 9**	
AI Applications in Healthcare on Cloud Platforms - AI-driven Smart Manufacturing Solutions in the Cloud - Cloud-based AI in Finance and Banking - AI-enabled E-commerce and Retail Solutions on Cloud Infrastructure			**CO4**
UNIT-V	**Future Trends and Challenges in AI Applications on Cloud**	**Periods: 9**	
Emerging Technologies Shaping the Future of AI in the Cloud - Ethical and Regulatory Considerations in Cloud-based AI - Challenges in Data Governance and Management in Cloud-based AI - Research Directions and Opportunities for Innovation			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Martin Happe, "The Cloud Market and the Economics of Cloud Computing," Cambridge University Press, 1st edition, 2020.
2. Luis Pedro Coelho, "Building Machine Learning Systems with Python," Packt Publishing, 1st edition, 2013.

Reference Books

1. Hrushikesh Mehta, "Data Analytics for the Internet of Things," Apress, 1st edition, 2016.
2. Martin Licker, "Machine Learning for Cloud Management," CRC Press, 1st edition, 2020.

Web References

1. https://www.leewayhertz.com/ai-in-cloud-computing/
2. https://tinyurl.com/msdyu9vn

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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	1	-	2	2	3	-	1	2	1
2	1	-	2	2	3	-	2	2	1
3	1	2	2	2	-	-	2	2	1
4	3	-	2	2	2	-	2	2	1
5	3	-	2	2	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE328**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Ethics in AI and Data Science**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Data Science and Artificial Intelligence	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand video storage formats and pre-processing.	**K2**
	CO2 Apply learning methods to identify and classify objects.	**K3**
	CO3 Apply modelling techniques to objects and scenes from videos.	**K3**
	CO4 Analyze visual context from real-time videos	**K3**
	CO5 Apply non-deep learning methods to real-time videos.	**K3**

UNIT-I	**Introduction to Ethics in AI and Data Science**	**Periods: 9**
Overview of Ethical Considerations in AI and Data Science - Historical Perspectives on Ethical Issues in Technology - Importance of Ethical Frameworks in AI and Data Science - Ethical Challenges in Data Collection, Storage, and Usage		**CO1**
UNIT-II	**Bias and Fairness in AI and Data Science**	**Periods: 9**
Understanding Bias in Data and Algorithms - Fairness Metrics and Evaluation Techniques - Mitigating Bias in AI and Data Science Systems - Case Studies on Bias and Fairness in Real-world Applications		**CO2**
UNIT-III	**Privacy and Security in AI and Data Science**	**Periods: 9**
Privacy Principles and Regulations - Privacy-preserving Techniques in Data Science - Security Risks in AI and Data Systems - Ethical Implications of Data Breaches and Unauthorized Access		**CO3**
UNIT-IV	**Transparency and Accountability**	**Periods: 9**
Explainable AI Techniques - Interpretable Machine Learning Models - Ensuring Accountability in AI Decision Making - Legal and Ethical Responsibilities of AI Developers and Users		**CO4**
UNIT-V	**Social and Ethical Impact of AI and Data Science**	**Periods: 9**
Ethical AI Design for Social Good - AI and Data Science in Healthcare Ethics - Ethical Implications of AI in Criminal Justice and Law Enforcement - Debates on the Future of Work and AI's Impact on Employment		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. John Danaher, "Ethics of Artificial Intelligence," MIT Press, 1st edition, 2020.
2. Foster Provost and Tom Fawcett, "Data Science for Business," O'Reilly Media, 1st edition, 2013.

Reference Books

1. Cathy O'Neil, "Weapons of Math Destruction," Crown Publishing Group, 1st edition, 2016.
2. Mukund Sundararajan, "Explainable AI: Techniques for Transparency and Understanding in Artificial Intelligence Systems," O'Reilly Media, 1st edition, 2019.

Web References

1. https://ajlunited.org/
2. https://partnershiponai.org/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
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4	3	3	3	1	3	-	2	2	1
5	3	3	3	1	3	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100