SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

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

PUDUCHERRY – 605107

B.TECH.

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Regulation-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

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: Engineering knowledge:

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis:

Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions:

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage:**

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society:

Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability:

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

PO8: Ethics:

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work:

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication:

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance:

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning:

Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Acquiring the data:

To create an essential knowledge for extracting data from heterogeneous domains.

PEO2: Information Inferring and Knowledge representation:

To equip the student with knowledge, through different programming skills and creating a knowledge representation for the inferred data, so that it can be applied in the real time scenario.

PEO3: Design method:

To enable the student as a Data Analyst by designing a right Machine Learning algorithm and seamless programming skill to solve any sort of application.

PEO4: Systematic Enhancement:

To provide them with a keen knowledge on current trends and to enhance its impact periodically on the existing applications to meet the future scenario.

PROGRAM SPECIFIC OBJECTIVES (PSOs)

PSO 1: Mathematical Foundation and Data Procuring:

To utilize the knowledge of Mathematical concept in procured Data from various Data sources.

PSO 2: Intellect Applications and Research Technologies:

To utilize the technical concepts, ideas, methodologies and the new emerging technologies in Artificial Intelligence and use this knowledge in their analytic skill to solving the current and future Data Analytics real time applications.

PSO 3: Developments of Real Time Applications:

To utilize the knowledge acquired and create a forum to carry out a capstone project through collaborations with the industries

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM

Sl. No	Course Category	Breakdown of Credits
1	Humanities and Social Sciences including Management courses (HS)	16
2	Basic Science Courses (BS)	17
3	Engineering Science Courses (ES)	41
4	Professional Core Courses (PC)	58
5	Professional Elective Courses (PE)	18
6	Open Elective Courses (OE)	09
7	Project Work and Internship (PA)	13
8	Ability Enhancement Courses (AEC*)	-
9	Mandatory Courses (MC*)	-
Total		**172**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl.No	Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Science Courses (HS)	4	3	3	1	2	-	-	3	16
2	Basic Science Courses (BS)	4	4	5	4		-	-	-	17
3	Engineering Science Courses (ES)	12	12	6	11	-	-	-	-	41
4	Professional Core Courses (PC)	4	4	8	4	12	15	11	-	58
5	Professional Elective Courses (PE)	-	-	-	3	3	3	3	6	18
6	Open Elective Courses (OE)	-	-	-		3	3	3	-	09
7	Project Work (PA)	-	-	-	-	1	1	2	8	12
8	Internship (PA)	-	-	-	-	-	-	1	-	01
9	Ability Enhancement courses (AEC*) Courses (AEC*)	-	-	-	-	-	-	-	-	-
10	Mandatory Courses (MC*)	-	-	-	-	-	-	-	-	-
Total		**22**	**23**	**22**	**23**	**21**	**22**	**20**	**17**	**172**

*** AEC and MC course Credits are not included for CGPA calculation**

HONOURS DEGREE PROGRAMME:

The student is permitted to opt for earning an honours degree in the same discipline of engineering in addition to the degree in his/her own discipline. To earn an honours degree the student is required to earn an additional 18 - 20 credits (over and above the total 170 credits prescribed in the curriculum) starting from fourth semester onwards by completing 5 additional courses offered in respective semesters. A student is eligible to exercise this option if he/she has passed all the courses offered upto third semester in the first attempt itself and has earned a CGPA / GPA* (*for lateral entry) of not less than 8.0. The prescribed courses offered for Honours degree are given in **Annexure V**.

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	3	1	0	4	25	75	100
2	U23ESTC03	Basics of Electrical and Electronics Engineering	ES	3	0	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	3	1	0	4	25	75	100
2	U23BSTC01	Physical Science for Engineers	ES	3	0	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	3	1	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 and 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	2	0	0	2	25	75	100
Theory cum Practical										
6	U23CSBC01	Design and Analysis of Algorithms	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC01	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 and 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	2	0	0	-	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 and Graph Theory	BS	3	1	0	4	25	75	100
2	U23ADDC01	Computer Networks and Security	ES	3	0	0	3	25	75	100
3	U23ITTCO2	Programming in JAVA	ES	3	0	0	3	25	75	100
4	U23ADT407	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	U23ADB401	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	U23ITPCO2	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	2	0	0	-	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	U23ADT508	Cloud Computing and Data Management Architectures	PC	3	0	0	3	25	75	100
3	U23ADT509	Deep Learning	PC	3	0	0	3	25	75	100
4	U23ADT510	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 and Data Management Architectures 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	2	0	0	-	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	U23ADTC02	NLP and Chatbot	PC	3	0	0	3	25	75	100
2	U23ADT611	Robotic Process Automation – UI Path	PC	3	0	0	3	25	75	100
3	U23CSTC07	Web Designing	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	U23ADB602	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	U23CSPC06	Web Designing Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23ADW602	Mini project	PA	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	2	0	0	-	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	U23ADT712	Intelligent Systems and Control	PC	3	0	0	3	25	75	100
2	U23ADT713	IoT Systems and Analytics	PC	3	0	0	3	25	75	100
3	U23ADT714	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	U23ADP712	Intelligent Systems and Control Laboratory	PC	0	0	2	1	50	50	100
7	U23ADP713	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	Introduction to Computer Vision
3	U23ADE402	R Programming
4	U23ADE403	Tools and Techniques of Data Science
5	U23ADE404	Data Handling and Preprocessing
Professional Elective – II (Offered in Semester V) *		
1	U23ADE505	Text Mining and Sentiment Analysis
2	U23ADE506	User Experience Design
3	U23ADE507	Java Programming: Essential Concepts to Advanced Mastery
4	U23ADE508	Exploratory Data Analysis
5	U23ADE509	Designing Machine Learning Systems
Professional Elective – III (Offered in Semester VI) *		
1	U23ADE610	Speech Processing and Analytics
2	U23ITEC05	Augmented Reality and Virtual Reality
3	U23ADE611	Advanced Java Programming
4	U23ADE612	Predictive Data Analytics
5	U23ADE613	Advanced Natural Language Processing
Professional Elective – IV (Offered in Semester VII) *		
1	U23ADE714	AI Ethics
2	U23ADE715	Prompt Engineering
3	U23ADE716	Ethics in Data Science
4	U23ADE717	Cloud based Machine Learning Platforms
5	U23ADE718	Quantum AI
Professional Elective – V (Offered in Semester VIII) *		
1	U23ADE819	AI in Agriculture
2	U23ADE820	AI in Healthcare
3	U23ADE821	Stream Processing
4	U23ADE822	Sustainable AI
5	U23ADE823	AI in Finance
Professional Elective – VI (Offered in Semester VIII) *		
1	U23ADE824	Augmented Analytics
2	U23ADE825	Modern Cryptography
3	U23ADE826	AI in Automobile Industry
4	U23ADE827	AI in E-Commerce
5	U23ADE828	AI in Smart Cities

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**)				
1	U23ADDC02	Principle of Artificial Intelligence and Machine Learning	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics
2	U23ADOC01	Introduction to Data Science	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics
Open Elective – III (Offered in Semester VII)				
3	U23ADOC02	Data science Application of Vision	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE
4	U23ADOC03	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 - I**
		a) Clean code
		b) Exploring of GITHUB
		c) Aptitude - I
2.	U23ADS402	**SKILL ENHANCEMENT COURSE - II**
		a) API design - I
		b) Exploring of Research Tools
		c) Aptitude - II

**** Choose any one SKILL ENHANCEMENT COURSE in the list for SEC - I, SEC - II***

Annexure – V

HONOURS PROGRAMME – Artificial Intelligence and Machine Learning

COURSE DETAILS											
Sl. No.	**Semester**	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
					L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory											
1	IV	U23MXT401	Parallel Programming and High Performance Computing	PC	3	0	0	3	25	75	100
2	V	U23MXB501	Advanced Deep Learning	PC	3	0	2	4	50	50	100
3	VI	U23MXB602	Reinforcement Learning	PC	3	0	2	4	50	50	100
4	VII	U23MXT702	Image and Video Analytics	PC	3	0	0	3	25	75	100
5	VIII	U23MXT803	Prompt Engineering	PC	3	0	0	3	25	75	100
6	VIII	U23MXW801	Project	PA	0	0	4	2	50	50	100
	Total							**19**	**225**	**375**	**600**
Equivalent NPTEL courses[##]											
1	IV	U23MXTN01	Parallel Programming	**3**	**NPTEL** ***Students can opt for any of these courses instead of theory papers in IV, VII and VIII semesters**				**12 Weeks Course**		
2	VII	U23MXTN02	Deep Learning for Computer Vision	**3**							
3	VIII	U23MXTN03	Introduction to Large Language Models (LLMs)	**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.

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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, Opportunities 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.

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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	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	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.

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	**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**
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

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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.

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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.

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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 Speaking: Just a Minute, Impromptu Speech, Contemporary Issues Reading: Variety of examples for Modes of Writing Writing: Different types of letters			**CO4**
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.

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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 **AI & DS Syllabi**		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	**Database Technology**		
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.

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	**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	**-**							

			BT Mapping (Highest Level)
Course Outcomes	**On completion of the course, the students will be able to**		
	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	**III**	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			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	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

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	Programming Logc		
Course Outcomes	**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	CAM	ESE	TM
Course Name	**Artificial Intelligence & Expert System**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

Prerequisite	-		
Course Outcomes	**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.

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	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	Python Programming		
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	Explore the classification models	**K2**
	CO3	Acquire knowledge on regression models.	**K2**
	CO4	Analyze the clustering algorithms.	**K3**
	CO5	Demonstrate the dimensionality reduction techniques.	**K3**

UNIT I	**INTRODUCTION TO MACHINE LEARNING**	**Periods: 9**	
Basics of Machine Learning – Using data to make decisions – Types of Machine Learning Algorithms – Workflow: from data to deployment – Data Preprocessing and Feature Engineering – Outlier Detection – Performance Evaluation			**CO1**
UNIT-II	**REGRESSION MODELS**	**Periods: 9**	
Introduction of Regression Algorithms – Linear Regression – Multivariate Linear Regression – Logistic Regression – sigmoid function – Applications - Performance Evaluation.			**CO2**
UNIT-III	**CLASSIFICATION MODELS**	**Periods: 9**	
Basics of Classification Algorithms – Building a Classifier and making Predictions – Support Vector Machine – separating data with maximum margin – Bayes theorem – Naive Bayes – classifying with conditional probabilities – K-Nearest Neighbor – Classifying with distance measurements – Applications - Performance Evaluation			**CO3**
UNIT-IV	**CLUSTERING MODELS**	**Periods: 9**	
Basics of Clustering Algorithms – K-Means improving cluster performance with postprocessing – K-Medians – Expectation Maximization – Hierarchical Clustering – Applications			**CO4**
UNIT-V	**DIMENSIONALITY REDUCTION TECHNIQUES**	**Periods: 9**	
Introduction– Subset Selection - Principal Component Analysis (PCA) – Factor analysis – Multidimensional Scaling - Linear Discriminant Analysis (LDA) – Generalized Discriminant Analysis(GDA) – Case Study.			**CO5**

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

Text Books

1. Henrik Brink, Joseph W. Richards, and Mark Fetherolf, “Real-World Machine Learning”, Manning Publications, 2017.
2. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Science, 1997.
3. Peter Harrington, “Machine Learning in action”, Manning Publication, 2012

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. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, MIT Press, Second Edition, 2012.
6. Charu C. Aggarwal, “Data Classification Algorithms and Applications”, Chapman & Hall/CRC Data Mining and Knowledge Discovery Series.

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1. https://www.coursera.org/learn/machine-learning
2. https://ml-cheatsheet.readthedocs.io/en/latest/regression_algos.html
3. https://machinelearningmastery.com/a-tour-of-machine-learning-algorithms/

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	2	-	-	-	-	-	-	-	-	2	3	2
2	3	2	2	2	-	-	-	-	-	-	-	-	3	2	3
3	2	3	3	3	-	-	-	-	-	-	-	-	2	3	2
4	3	2	3	2	-	-	-	-	-	-	-	-	3	2	3
5	3	2	3	3	-	-	-	-	-	-	-	-	2	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	**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			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Evaluate the significance of value inputs in formal education and start applying them in theirlife and profession	**K2**
	CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, theSelf 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 andprofession	**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 andprofession.	**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 Fulfi 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 - ALook At Professional Ethics**	**Periods: 06**

Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct - Basis for Humanistic Education, HumanisticConstitutionand Universal Human Order-Competence in Professional Ethics-Holistic Technologies, Production Systems and Management Models- Typica 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.

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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	**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.

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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	**III**	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.

Web References

1. https://www.ielts-exam.net/grammar/
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	Data Structures							

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 nameas a result
9. Combine a machine learning model with an expert system for decision support.
10. Develop an intelligent system for personalized recommendations.

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	Python Programming							

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

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	**U23ADM303**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Climate Change**	**0**	**0**	**2**	**-**	**100**	**-**	**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

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**			**3**	**1**	**-**	**4**	**25**	**75**	**100**

Prerequisite	-		
Course Outcomes	**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**	**-**	**-**	**3**	**25**	**75**	**100**

(Common to AI & DS , Mechatronics)

Prerequisite	Digital System Design and Programming Logic	
Course Outcomes	**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	**IV**			Course Category Code: **ES**		*End Semester Exam Type: **TE**		
Course Code	**U23ITTCO2**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**Programming in Java**			**3**	**-**	**-**	**3**	**25**	**75**	**100**

Prerequisite	-		
Course Outcomes	**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, 11th 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, 9th 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	**U23ADT407**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Machine Learning Techniques**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

Prerequisite	Basic Machine Learning Techniques		
Course Outcomes	**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: **ES**			End Semester Exam Type: **TE**	
Course Code	**U23ADB401**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Linux Internals**	**2**	**-**	**2**	**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

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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**	**-**	**-**	**2**	**1**	**50**	**50**	**100**

Prerequisite	-	
Course Outcomes	**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**		**-**	**-**	**2**	**1**	**50**	**50**	**100**
Prerequisite	Digital System Design and Programming Logic								
Course Outcomes	**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.

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	**IV**			Course Category Code:**ES**		*End Semester Exam Type: **LE**		
Course Code	**U23ITPCO2**			Periods / Week		Credit	Maximum Marks	
				L	T	P	C	CAM	ESE	TM
Course Name	**Programming in Java Laboratory**			**-**	**-**	**2**	**1**	**50**	**50**	**100**
Prerequisite	-									
Course Outcomes	**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
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
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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**	**-**	**-**	**2**	**1**	**50**	**50**	**100**

Prerequisite	Basic Machine Learning Techniques, Python		
Course Outcomes	**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.

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**
(Common to AI & DS, CSE)								
Prerequisite	-							

Course Outcomes		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: **PE**			End Semester Exam Type: **TE**	
Course Code	**U23ADE401**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Introduction to Computer Vision**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Basic understanding of linear algebra, calculus, probability, programming, and machine learning is essential for understanding computer vision.		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand basic knowledge, theories and methods in image processing and computer vision.	**K2**
	CO2	Implement basic and some advanced image processing techniques in OpenCV.	**K2**
	CO3	Apply 2D a feature-based based image alignment, segmentation, and motion estimations.	**K3**
	CO4	Apply 3D image reconstruction techniques	**K3**
	CO5	Design and develop innovative image processing and computer vision applications.	**K3**

UNIT- I	**Introduction To Image Formation and Processing**	**Periods: 9**
Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.		**CO1**
UNIT- II	**Feature Detection, Matching and Segmentation**	**Periods: 9**
Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.		**CO2**
UNIT- III	**Feature-Based Alignment & Motion Estimation**	**Periods: 9**
2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.		**CO3**
UNIT- IV	**3D Reconstruction**	**Periods: 9**
Shape from X - Active rangefinding - Surface representations - Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.		**CO4**
UNIT- V	**Image-Based Rendering and Recognition**	**Periods: 9**
View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.		**CO5**

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

Textbooks

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
3. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012
4. Milan Sonka, Vaclav Hlavac, Roger Boyle “Image Processing, Analysis and Machine Vision” Springer US,2013

Reference Books
1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.
Web References
1. https://www.youtube.com/watch?v=iXNsAYOTzgM&ab_channel=freeCodeCamp.org
2. https://www.youtube.com/watch?v=2FYm3GOonhk&ab_channel=Murtaza%27sWorkshopRoboticsandAI
3. https://onlinecourses.nptel.ac.in/noc21_ee23/preview
4. https://onlinecourses.nptel.ac.in/noc21_cs93/preview
5. https://www.udacity.com/course/computer-vision-nanodegree--nd891

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	1	-	-	-	-	-	-	-	2	1	1
2	3	3	3	2	3	-	-	-	-	-	-	-	3	1	2
3	3	3	2	2	3	-	-	-	-	-	-	-	3	2	2
4	2	3	3	2	3	-	-	-	-	-	-	-	2	2	3
5	2	3	3	2	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	**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		
		L	T	P	C	CAM	ESE	TM
Course Name	**R Programming**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

Prerequisite	**Python, Mathematics and Statistics**		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand and use basic fundamental concepts to solve the real-world problem using R programming language	**K2**
	CO2	Design and implement the solution using scalar, vectors, matrices and statistical problems in R program	**K2**
	CO3	Design and implement the program using data frame, list to provide the solution for various problem	**K2**
	CO4	Understand about factors and objects to solve statistical problems	**K2**
	CO5	Implement Minimize and maximize functions, simulation , visualization and statistical analysis using R	**K3**

Unit-I	**Introduction**	**Periods: 9**
Overview of R- R data types and objects,-Reading and writing data-Essentials of the R Language- Installing R and Running R-Packages in R- Calculations and Complex numbers in R- Rounding Arithmetic and Modulo and integer quotients- Variable names and assignment- Operators, Integers, Factors and Logical operations.		**CO1**
Unit-II	**Control Structures and Vectors**	**Periods:9**
Control structures and functions: Introduction to Functions-Preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists-Data Frames and Classes Vectors-Generating sequences-Vectors and subscripts:-Extracting elements of a vector using subscripts- Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices- Adding and Deleting Vector Elements-Obtaining the Length of a Vector, Matrices and Arrays as Vectors -Vector Arithmetic and Logical Operations.		**CO2**
Unit-III	**Lists and Data Frames**	**Periods:9**
Lists: Creating Lists-General List Operations, List Indexing Adding and Deleting List Elements- Getting the Size of a List,-Extended Example- Text Concordance Accessing List Components and Values- Applying Functions to Lists-Data Frames: Creating Data Frames and Accessing Data Frames- Other Matrix-Like Operations.		**CO3**
Unit-IV	**Factors and Object-Oriented Programming**	**Periods:9**
Knowledge representation - Statistical pattern recognition - Syntactic pattern recognition - Mathematical Morphology - Morphological transformation–S Classes, S Generic Functions, and Writing S Classes- Implementing a Generic Function on an S Class-Visualization, Simulation and code profiling- Statistical Analysis with R data manipulation		**CO4**
Unit-V	**Data Visualization Using R**	**Periods:9**
Introduction,-Types of Data Visualization- Statistical graphs: Scatter Plots, Box Plots, Scatter Plots and Box and Histograms-Advanced Visualization: Using the ggplot2 package to visualize data-Applying themes from ggthemes to refine and customize charts and graphs-Building data graphics for dynamic reporting, advantages and disadvantages.		**CO5**

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

Text Books

1. Wickham, H. & Grolemund, G, “R for Data Science. O’Reilly: New York.,2018
2. Hadley, Wickham, ggplot2, Elegant Graphics for Data Analysis 2nd Edition, by Springer 2016.
3. Hadely Wickham and Garrett, Grolemund R for Data Science, Import, Tidy, Transform, Visualize and Model Data, 1st Edition, O’Reilly 2016.
4. Jakub Nowosad, Jannes Muenchow ,Geocomputation with R by Robin Lovelace 2019.
5. Robert J. Hijmans, Spatial Data Science with R,2019.

Reference Books

1.Garrett Grolemund, Hadley Wickham,”Hands-On Programming with R: Write Your Own Functions and Simulations”,2018
2. Venables , W.N.,and Ripley,”S programming“, Springer, 2019.
3. Roger D. Peng,” R Programming for Data Science “, 2016
4. Norman Matloff, ”The Art of R Programming- A Tour of Statistical Software Design”, 2018
5. Jd long, Paul Teetor, “R Cookbook 2e: Proven Recipes for Data Analysis, Statistics, and Graphics”, O’Reilly, 2019

Web References

1.https://www.r-project.org/about.html
2. https://www.tutorialspoint.com/r/index.htm
3. https://www.javatpoint.com/r-tutorial

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	3	3	-	-	-	-	-	-	-	2	2	2
2	2	2	2	2	2	-	-	-	-	-	-	-	2	2	2
3	2	2	2	2	2	-	-	-	-	-	-	-	2	2	2
4	2	2	2	2	2	-	-	-	-	-	-	-	2	3	2
5	3	3	3	3	3	-	-	-	-	-	-	-	2	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	**U23ADE403**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Tools and Techniques of Data Science**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
Prerequisite	Machine Learning							

Course Outcome			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Demonstrate the basic knowledge of data science process.	**K2**
	CO2	Setup the software environment for python and R Language and apply various techniques to work with data.	**K2**
	CO3	Manipulate and visualize the data using tools like pandas and matplotlib.	**K3**
	CO4	Develop simple data science applications.	**K4**
	CO5	Analyze the various data science related projects.	**K3**

UNIT-I	**Introduction to Data Science**	**Periods: 9**	
IThe data science process – Roles in data science project – Stages of Data Science Project – Defining the goal – Data collection and Management – Modelling – Model evaluation – Presentation and documentation – Model deployment and Maintenance.			**CO1**
UNIT-II	**Data Extraction using Python**	**Periods:9**	
Machine learning: Defining Machine Learning and Its Processes- steps of the machine learning process -machine learning terms-Learning Styles-Modeling with instances-Instance-based classifiers-K-Nearest Neighbor-Self-Organizing Map (SOM)- Locally weighted learning-Python – overview: Numbers in Python-Strings in Python-Lists in Python-Tuples in Python-Sets in Python-Dictionaries in Python -NumPy module in python-Setting up Data science toolbox			**CO2**
UNIT-III	**Data Science Tools and Environment**	**Periods:9**	
Essential concepts and tools-Executing a Command-Line Tool-Five Types of Command-Line Tools-Working with Files-Obtaining Data: Copying Local Files to the Data Science Toolbox-Local Version of Data Science Toolbox-Decompressing Files-Converting Microsoft Excel Spreadsheets-Querying Relational Databases-Downloading from the Internet-Managing Data Workflow-Introducing Drake-Techniques using Python Tools: K-Nearest Neighbor (KNN) Algorithm-Naïve Bayes Algorithm.			**CO3**
UNIT-IV	**Techniques using R Tools**	**Periods:9**	
R programming overview - Features of R Programming-Advantages of R-Loading data into R – Modeling methods –choosing and evaluating models –Mapping problems to machine learning tasks-Solving classification problems-Solving scoring problems-Linear and logistic Regression.			**CO4**
UNIT-V	**Data Manipulation and Data Visualization**	**Periods:9**	
Data Manipulation using pandas: Installing and using Pandas- Introducing pandas objects- Data Indexing and selection – handling missing data, merge and joining sets, Aggregation and grouping. **Data Visualization using Matplotlib** – Simple Line Plots- Simple Scatter plots, Multiple subplots, Visualization with seaborn.			**CO5**

Text Books

1. J. Janssens, Data science at the command line, First edition. Sebastopol, CA: O'Reilly, 2014..
2. J. Grus, Data Science from Scratch: First Principles with Python, 1st edition. Sebastopol, CA:O'Reilly Media, 2015.
3. N. Zumel and J. Mount, Practical data science with R. Shelter Island, NY: Manning Publications Co, 2014

Reference Books

1. L.Pierson and J. Porway, Data science, 2nd edition. Hoboken, NJ: John Wiley and Sons, Inc,2017.
2. C.O'Neil and R. Schutt, Doing Data Science: Straight Talk from the Frontline, 1st edition. Beijing ; Sebastopol: O'Reilly Media, 2013.
3. J VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data, First edition. Shroff/O'Reilly, 2016.
4. S.R.Das,Data Science:Theories,Models,Algorithms,and Analytics. https://srdas.github.io/MLBook/.

Web References

1.https://conductscience.com/basic-tools-and-techniques-of-data-science/?srsltid=AfmBOorY1GmQb88lf9zNMYjUTaAMcHS9BcwK7OsREl1PWLa55DRZ_joR
2. https://mrcet.com/pdf/Lab%20Manuals/IT/Tools%20and%20Techniques%20for%20Data%20Science.pdf
3. https://www.slideshare.net/slideshow/tools-and-techniques-for-data-science/69004578
4.https://www.interaction-design.org/literature/article/data-analysistechniques?srsltid=AfmBOoouchHGBFfjlnWvnuyH6ZdO-ZZvjNC7DJ9_gVqmp5sCvey_u7x-
5. https://magrittr.tidyverse.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	2	2	2	3	3	-	-	-	-	-	-	-	2	2	2
2	2	3	3	3	2	-	-	-	-	-	-	-	2	2	1
3	2	3	3	2	1	-	-	-	-	-	-	-	2	2	1
4	2	2	3	2	3	-	-	-	-	-	-	-	2	3	1
5	3	2	2	3	3	-	-	-	-	-	-	-	2	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 syllabu

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	**Data Handling and Preprocessing**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

Prerequisite	Data Structure and Data Analysis.	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand Different Data Types and Sources	**K2**
	CO2 Apply Data Transformation and Feature Engineering	**K3**
	CO3 Apply Data Integration and Reduction Methods	**K3**
	CO4 Apply Ethical Data Handling and Privacy Standards	**K3**
	CO5 Apply Data Handling Proficiency Through Real-world Applications	**K3**

UNIT – I	**Introduction to Data Handling**	**Periods:9**	
Data Types and Structures- Data Sources- Data Formats and File Handling- Data Storage and Management- Data Integrity and Validation- Data Manipulation- Data Exploration Techniques- Data Ethics- Data Analysis-Data Privacy and Security			**CO1**
UNIT – II	**Data Cleaning and Data Transformation**	**Periods:9**	
Handling Missing Data- Dealing with Duplicates- Outliers Detection and Treatment- Data Standardization- Handling Noisy Data- Data Normalization and Standardization- Encoding Categorical Data- Feature Engineering- Dimensionality Reduction- Handling Time Series Data			**CO2**
UNIT – III	**Data Integration and Reduction**	**Periods:9**	
Data Integration- Data Transformation- Data Quality Issues in Integration- Data Reduction- Data Integration in Big Data Environments- Data Reduction in Big Data Environments- Case Studies and Applications			**CO3**
UNIT – IV	**Data Handling in Big Data and Cloud Environments**	**Periods:9**	
Big Data Frameworks and Tools- Data Storage and Management in Big Data Environments- Data Preprocessing in Big Data- Real-Time Data Handling and Stream Processing- Cloud-Based Data Handling- Data Pipeline Automation in Cloud- Scalable Data Processing on the Cloud-Security and Privacy in Big Data and Cloud Environments-			**CO4**
UNIT – V	**Applications of Data Handling**	**Periods:9**	
Real-World Applications of Data Handling and Preprocessing- Data Handling and Preprocessing in Machine Learning- Data Handling in Healthcare Applications- Financial Data Preprocessing- Preprocessing in Natural Language Processing (NLP) Applications of Data Preprocessing in Social Media Analytics			**CO5**

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

Text Books

1. H.P. Kumar “Data Preprocessing Techniques in Data Mining” 1st Edition 2003.
2. Jacqueline Kazil & Katharine Jarmul, “Data Wrangling with Python”, 1st Edition,2016
3. “Python for Data Analysis” by Wes McKinney,3rd Edition,Jan 2022

Reference Books

1. Wes McKinney "Python for Data Analysis",3rd Edition 2022.
2. Foster Provost and Tom Fawcett "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking",1st Edition.
3. Marcello Trovati,Richard Hill “Big-Data Analytics and Cloud Computing: Theory, Algorithms and Applications” 1st Edition.

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1. https://www.javatpoint.com/data-types-vs-data-structure
2. https://blog.coupler.io/data-cleansing-vs-data-transformation/
3. https://www.javatpoint.com/data-integration-in-data-mining
4. https://cloud.google.com/learn/what-is-big-data
5. https://countingwell.com/blog/data_handling.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	2	2	3	-	-	-	-	-	-	-	2	1	2
2	3	2	2	2	3	-	-	-	-	-	-	-	2	1	2
3	3	3	3	2	3	-	-	-	-	-	-	-	3	2	2
4	3	3	3	2	3	-	-	-	-	-	-	-	3	2	2
5	3	3	3	3	3	-	-	-	-	-	-	-	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	5	5	5	5	5	75	100

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**	**-**	**-**	**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: -			
Course Code	**U23ADS402**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Skill Enhancement Course-II**	**-**	**-**	**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: **-**			
Course Code	**U23ADM404**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Right to Information and Good Governance**	**-**	**-**	**2**	**-**	**100**	**-**	**100**

UNIT-I	**Introduction**	**Periods: 9**	
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**	**Periods: 9**	
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**	**Periods: 9**	
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**	**Periods: 9**	
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**	**Periods: 9**	
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

Department	**Artificial Intelligence and Data Science**			Programme : **B.Tech**				
Semester	**V**			Course Category Code:**HS**		*End Semester Exam Type: **TE**		
Course Code	**U23HSTC02**			Periods/Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**Research Methodology**			**2**	**-**	**-**	**2**	**25**	**75**	**100**
Prerequisite	**Nil**									
Course Outcomes	***On completion of the course, the students will be able to***							**BT Mapping (Highest Level)**		
	CO1	Students will be able to explain the differences between various types of research and describe how different research methods are used to address engineering problems.						**K2**		
	CO2	Students will develop the ability to identify research problems, perform comprehensive literature reviews, and use various tools and services for effective information retrieval.						**K2**		
	CO3	Students will gain proficiency in designing experiments, analyzing data, and interpreting results using both numerical and graphical methods.						**K4**		
	CO4	Students will be able to apply ethical guidelines to structure and write research papers and dissertations, avoiding plagiarism.						**K3**		
	CO5	Students will understand the fundamentals of intellectual property rights, including how to protect and enforce them, which is crucial for innovation and entrepreneurship in engineering.						**K3**		
UNIT-I	**Introduction to Research**							**Periods: 6**		
Meaning and Importance of Research, Types of Research: Overview of Basic, Applied, and Developmental Research, Overview of the Research Process, Defining a Research Problem: Key Considerations, Setting Research Objectives and Research Questions, Introduction to Research Design: Basic Concepts, Approaches to Research: Quantitative vs. Qualitative.								**CO1**		
UNIT-II	**Problem Formulation and Literature Review**							**Periods: 6**		
Identifying and Formulating Research Problems, conducting a Literature Review: Essential Steps, Referencing and Citation Methods: Basic Techniques. Sources of Information: Overview of Libraries and Online Databases.								**CO2**		
UNIT-III	**Research Methods and Data Analysis**							**Periods: 6**		
Introduction to Experimental Research, Developing Hypotheses: Basic Approach. Data Collection Methods: Sampling and Surveys, Basics of Data Analysis: Numerical and Graphical Analysis, Introduction to Inferential Statistics.								**CO3**		
UNIT-IV	**Writing and Presenting Research**							**Periods: 6**		
Preparing a Research Report: Key Sections (Abstract, Introduction, Methodology, Results, Discussion, Conclusion). Referencing and Citation: Brief Overview.								**CO4**		
UNIT-V	**Ethics and Legal aspects in research**							**Periods: 6**		
Ethical Considerations in Research: Introduction to Scientific Misconduct. Basics of Intellectual Property Rights - Introduction to Patents, Copyrights, and Trademarks – Case studies on ethical dilemmas in research.								**CO5**		
Lecture Periods: 30	**Tutorial Periods:**			**Practical Periods:**				**Total Periods: 30**		

Text Books

1. Kumar, R. Research Methodology: A Step-by-Step Guide for Beginners, SAGE Publications, 5th Edition 2019.
2. Ram Ahuja,. Research methods, Rawat Publications, 2nd edition, 2022
3. Creswell, J. W., and Creswell, J. D. Research Design: Qualitative, Quantitative and Mixed Methods Approaches, SAGE Publications, 5th Edition 2018.
4. Kothari, C. R. Research methodology – Methods and Techniques. New Age International Publishers. 2023 5th Edition
5. T. Ramappa, Intellectual Property Rights under WTO, S. Chand Publishers 2008.

Reference Books

1. Thiel, D. V. Research methods for engineers. Cambridge University Press 2014.
2. Ganesan, R. Research methodology for engineers. MJP Publishers 2024.
3. Agarwal, C & Sharma, V. Research methodology in sociology. Commonwealth Publishers 2012
4. Thody, A. Writing and presenting research (SAGE Study Skills Series). SAGE Publications 2006
5. Bordens, K. S. and Abbott, B. B, Research Design and Methods – A Process Approach (d.) McGraw Hill, 8th Edition 2011.

Web References

1. https://conjointly.com/kb/
2. https://owl.purdue.edu/owl/research_and_citation/conducting_research/writing_a_literature_review.html
3. https://files.eric.ed.gov/fulltext/ED536788.pdf
4. https://researcheracademy.elsevier.com/
5. https://www.wipo.int/
6. https://www.scholastic.com/parents/school-success/homework-help/homework-project-tips/7-steps-to-successful-research-report.html
7. https://www.futurelearn.com/info/courses/business-research-methods- investigation.
8. https://articles.manupatra.com/article-details/Patent-Types-Laws-related-to-them-in-India
9. https://researchgate.net/
10. https://journals.sagepub.com/home/jmx

COs/POs 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	2	1	1	1	1	1	1	1	3	2	2	2
2	2	3	2	2	2	1	1	1	2	2	1	3	2	2	1
3	3	3	3	3	2	1	1	1	1	1	2	2	2	2	1
4	2	2	1	2	1	1	1	3	2	3	1	2	2	3	1
5	2	2	2	2	1	2	2	3	2	2	3	3	2	2	2

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	**V**	Course Category Code: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23ADT508**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**CLOUD COMPUTING AND DATA MANAGEMENT ARCHITECTURES**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI&DS								
Prerequisite	**Database Technologies**							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Interpret the concepts of Cloud Computing and realize it in real world	**K2**
	CO2	Describe and realize the virtualization techniques to scale up for resources	**K2**
	CO3	Apply various cloud technologies and advancements for their real-world scenarios	**K3**
	CO4	Interpret various types of data available in the real world and apply architecture based on the type of data	**K2, K3**
	CO5	Apply the perfect data management architecture for distributed architecture and cloud	**K3**

Unit-I	**Introduction to Cloud Computing**	**Periods: 9**
Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing –Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.		**CO1**
UNIT-II	**Cloud Enabling Technologies**	**Periods:9**
Service Oriented Architecture – REST and Systems of Systems – Web Services – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU –Memory – I/O Devices –Virtualization Support and Disaster Recovery		**CO2**
UNIT-III	**Cloud Technologies and Advancements**	**Periods:9**
Hadoop–MapReduce–VirtualBox-Google App Engine–Programming Environment for Google App Engine-Open Stack –Federation in the Cloud– Four Levels of Federation –Federated Services and Applications Future of Federation.		**CO3**
UNIT-IV	**Data Management Architectures**	**Periods:9**
Introduction to relational databases, -Database normalizations- Limitations of relational databases- Structured vs. Unstructured data- Design of MapReduce, Dataflow and Vertex-centric models for processing volume, velocity and linked datasets-Storing and querying over NoSQL datasets		**CO4**
UNIT-V	**Applications of Architecture for Management**	**Periods:9**
Distributed Systems Architecture- Database Management Systems- Data Warehousing- Cloud Computing- Data Integration and Processing Pipelines- Data Indexing and Search- Data Visualization- Data Security and Privacy		**CO5**

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

Text Books

1. Buyya R., Broberg J., Goscinski A., “Cloud Computing: Principles and Paradigm”, First Edition, John Wiley & Sons,2011. Sosinsky B., “Cloud Computing Bible”, 1st Edition,Wiley Edition, 2011
2. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 1st Edition, 2013.
3. V.K. Jain, Big Data and Hadoop, Khanna Book Publishing Company 2020,2nd Edition.

Reference Books

1. Miller Michael, “Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online”, Pearson Education India, 1st Edition
2. Smooth S., Tan N., “Private Cloud Computing”, Morgan Kauffman , 1st Edition, 2011.
3. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 1st Edition,2015.
4. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, 1st Edition, Wiley Publishers, 2015.

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1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
3. https://archive.nptel.ac.in/courses/106/105/106105167/
4. https://archive.nptel.ac.in/courses/106/105/106105175/
5. https://onlinecourses.nptel.ac.in/noc23_ar01/preview

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	2	-	-	-	-	-	-	-	2	3	3
2	2	3	3	2	2	-	-	-	-	-	-	-	3	3	3
3	2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	3
5	2	3	2	2	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	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**V**	Course Category Code: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23ADT509**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DEEP LEARNING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI&DS								
Prerequisite	Machine Learning							

Course Outcome			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Interpret Neural Network basic Architecture and various Activation functions.	**K2**
	CO2	Interpret CNN and different Neural network model	**K2**
	CO3	Apply different optimization techniques to fine tune the deep learning models	**K3**
	CO4	Interpret various deep learning models and apply them for predicting next word, spelling correction	**K2**
	CO5	Interpret various deep reinforcement techniques for learning from feeback	**K2**

UNIT-I	**Foundations of Neural Networks**	**Periods: 9**	
Neural Networks: The Biological Neuron-The Perceptron Multilayer Feed Forward Networks - Training Neural Networks: Backpropagation Learning Activation Functions: Linear Sigmoid Tanh - Hard Tanh Softmax -Rectified Linear Loss Functions: Loss Function Notation Loss Functions for Regression - Loss Functions for Classification Loss Functions for Reconstruction Hyperparameters: Learning Rate Momentum - Sparsity-Understanding Convolutions.			**CO1**
UNIT-II	**Convolutional Neural Network**	**Periods:9**	
CNN Building Blocks: Layer Type Convolutional Layer - Activation Layer - Pooling Layer - Fully Connected Layer -Batch Normalization Dropout Common architecture and Training Pattern LeNet-5 - AlexNet VGG16 net - ResNet.			**CO2**
UNIT-III	**Regularization and Optimization**	**Periods:9**	
Regularization Dropout Regularization Normalizing Inputs- Bootstrap Aggregating (Bagging)- Dropout- Pros and Cons-Multitask Learning- Data Augmentation- Adversarial Training- Vanishing / Exploding Gradients - Weight Initialization Numerical Approximation of Gradients-Gradient Checking. Gradient Descent and its Types- Mini-batch Gradient Descent-Exponentially Weighted Averages-Bias Correction in Exponentially Weighted Averages-Gradient Descent with Momentum- Optimizers:AdaGrad-RMSProp-Adam- optimizer selection.			**CO3**
UNIT-IV	**Recurrent Neural Network**	**Periods:9**	
Building and improving Feed Forward Language Model - RNN - Bidirectional RNN - LSTM-GRU - Seq2Seq paradigm – multilength - Seq2Seq.			**CO4**
UNIT-V	**Deep Reinforcement Learning**	**Periods:9**	
Value iteration Q Learning Basic Deep Q Learning Policy gradient method actor critic method - Experience replay - Basic autoencoding convolutional autoencoding - variational autoencoding - Generative Adversarial Network (GAN).			**CO5**

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

Text Books

1. Eugene Charniak, "Introduction to Deep Learning", MIT Press, 2019, Kindle Edition
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 1st Edition, 2016
3. Charu C. Aggarwal, Neural Networks and Deep Learning (Second Edition), Springer, July 2023

Reference Books

1. Cosma Rohilla Shalizi, "Advanced Data Analysis from an Elementary Point of View", Cambridge University Press, 2021.
2. Deng & Yu, "Deep Learning: Methods and Applications", Now Publishers, 2014
3. Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015
4. Josh Patterson, Adam Gibson, "Deep Learning A Practitioner's Approach", O'Reilly Media, 2017, Greyscale Indian Edition.
5. Nikhil Buduma, "Fundamentals of Deep Learning", O'Reilly, 2017, first edition.

Web References

1. https://nptel.ac.in/courses/106/106/106106184/
2. http://deeplearning.net/Dj
3. https://www.guru99.com/deep-learning-tutorial.html
4. https://www.coursera.org/specializations/deep-learning
5. http://neuralnetworksanddeeplearning.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	3	2	2	2	-	-	-	-	-	-	-	2	3	3
2	2	3	3	2	2	-	-	-	-	-	-	-	3	3	3
3	2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	3
5	2	3	2	2	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	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**V**	Course Category Code: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23ADT510**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DATA VISUALIZATION**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI&DS								
Prerequisite	**Python, Excel and Data Science**							

Course Outcome		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Interpret various charts used and apply them according to the problem given	**K2, K3**
	CO2	Describe various features used in seaborn and Bokeh and apply them for data visualization	**K2, K3**
	CO3	Interpret how the data can be visualized using Tableau	**K2**
	CO4	Customize and fine tune map aesthetics using Tableau	**K3**
	CO5	Apply Power BI basics for generating interactive reports effectively	**K3**

UNIT-I	**Introduction to Visualization**	**Periods: 9**	
Introduction to data visualization - Importance of data visualization - data wrangling - tools and libraries for visualization - types of data – Plots – line - bar - relation – scatter – bubble – heatmap – pie - Stacked Bar Chart - Venn diagram – histogram - box plot – geo plot.			**CO1**

UNIT-II	**Seaborn and Bokeh**	**Periods:9**	
Seaborn: Introduction - Controlling Figure Aesthetics - Seaborn Figure Styles -Removing Axes Spines - Colour Palettes - Kernel Density Estimation - Plotting Bivariate Distributions -Pairwise Relationships - Violin Plots - Multi-Plots in Seaborn - Facet Grid - Regression Plots. Bokeh: Introduction - Interfaces in Bokeh - Bokeh Server – Presentation – Integrating - Design - Principles of Geoplotlib - Geospatial Visualizations.			**CO2**

UNIT-III	**Visualization using Tableau**	**Periods:9**	
Connecting to data source – Creating Univariate Charts: Tables – Bar graphs – Pie charts – Sorting the graphs – Histograms – Line Charts – Using the Show Me toolbar – Stacked Bar Graphs – Box Plots –Showing Aggregate Measures. Creating Bivariate Charts: Tables – Scatter Plots – Swapping Rows and Columns – Adding trend lines – Selecting color Palettes – Using dates. Creating Multivariate Charts –Acets – Area Charts – Bullet Graphs – dual axes charts – Gantt charts – heat maps.			**CO3**

UNIT-IV	**Maps using Tableau**	**Periods:9**	
Introduction to Maps - Setting Geographic Roles – Placing marks on a Map – Overlaying Demographic data – Creating choropleth Maps – Using polygon shapes – Customizing Maps – Creating Dashboards – Creating Storyboard.			**CO4**

UNIT-V	**Power BI**	**Periods:9**	
Power BI – Creating Power BI Reports – Auto Filters – Report Visualization and Properties – Chart and map Report Properties – hierarchies and Drilldown reports – Power Querry and M Language – DAX Expressions - Data modelling – Data Transformation - Power BI Deployment and Cloud – PowerBI Cloud Operations – Improving Power BI Reports – Power BI Integration Elements.			**CO5**

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

Text Books

1. Daniel Nelson, “Data Visualization in Python”, First Edition,StackAbuse,2020.
2. Mamta Mittal,Nidhi Grover Raheja, “Data Visualization and Storytelling with Tableau” ,First Edition,CRC Press,2024.
3. Jeremey Arnold, “Learning Microsoft Power BI”, First Edition,O’Reilly Media,Inc, 2022.

Reference Books

1. Mario Dobler and Tim Grobmann, “Data Visualization with Python”, Packt Publishing Ltd., 2019.
2. Praveen Kumar, “Data Visualization with Tableau”, Gurucool Publishing,First Edition, 2020.
3. Seema Acharya., “Mastering Data Visualization using Tableau”, First Edition, Wiley India Pvt.Ltd, 2024.
4. Chandraish Sinha, “Mastering Power BI”, First Edition,BPB Publications, 2022
5. Greg Deckler,Brett Powell, “Microsoft Power BI Cookbook”, Second Edition, Packt Publishing, 2021.

Web References

1. https://www.techtarget.com/searchbusinessanalytics/definition/data-visualization
2. https://machinelearningmastery.com/data-visualization-in-python-with-matplotlib-seaborn-and-bokeh/
3. https://www.tableau.com/learn/articles/data-visualization
4. https://help.tableau.com/current/pro/desktop/en-us/buildexamples_maps.htm
5. https://learn.microsoft.com/en-us/power-bi/fundamentals/power-bi-overview

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	-	-	-	-	-	-	-	3	2	2
2	3	2	3	3	2	-	-	-	-	-	-	-	3	2	2
3	2	2	2	2	3	-	-	-	-	-	-	-	2	2	2
4	3	2	3	3	3	-	-	-	-	-	-	-	3	2	2
5	3	2	3	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	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	**V**	Course Category Code: **PC**				End Semester Exam Type: **LE**		
Course Code	**U23ADP507**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CLOUD COMPUTING AND DATA MANAGEMENT ARCHITECTURES LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
AI&DS								
Prerequisite	**Database Technologies**							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Configure various virtualization tools such as Virtual Box, VMware workstation	**K3**
	CO2	Simulate a cloud environment to implement new schedulers.	**K3**
	CO3	Set up multi-node Hadoop Clusters.	**K3**
	CO4	Apply Map Reduce algorithms for various algorithms	**K3**
	CO5	Apply instructed data processing using NoSQL and data processing using R programming	**K3**

List of Experiments

1. Create a Collaborative learning environment for a particular learning topic using Google Apps. Drive, Google Docs and Google Slides must be used for hosting e-books, important articles and presentations respectively.
2. Install Virtual box and create a windows/linux virtual image and analyze the virtual configuration.
3. Install Google App Engine. Create hello world app and other simple web applications using python/java
4. Find a procedure to transfer the files from one virtual machine to another virtual machine.
5. Installation, Configuration, and Running of Hadoop and HDFS
6. Create a application for Page Rank Computation
7. Develop a MapReduce program to find the maximum temperature in each year
8. Develop a Java application to find the maximum temperature using Spark
9. Unstructured data into NoSQL data and do all operations such as NoSQL query with API.
10. Application to adjust the Number of Bins in the Histogram using R Language

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

Reference Books

1. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 1st Edition,2015.
2. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley Publishers, 2015.1st Edition.
3. Dietmar Jannach and Markus Zanker, “Recommender Systems: An Introduction”, Cambridge University Press,1st Edition, 2010.
4. Kim H. Pries and Robert Dunnigan, “Big Data Analytics: A Practical Guide for Managers” CRC Press, 2015,1st Edition.

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1. https://davefoord.wordpress.com/2013/03/01/using-google-docs-drive-to-create-a-collaborative-learning-activity/
2. https://carleton.ca/scs/tech-support/virtual-machines/transferring-files-to-and-from-virtual-machines/
3. https://medium.com/@TadashiHomer/understanding-and-implementing-the-pagerank-algorithm-in-python-2ce8683f17a3
4. https://www.mongodb.com/resources/basics/databases/nosql-explained
5. https://www.naukri.com/code360/library/histogram-in-r-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	3	2	2	2	-	-	-	-	-	-	-	2	3	3
2	2	3	2	2	2	-	-	-	-	-	-	-	3	3	3
3	2	2	2	2	2	-	-	-	-	-	-	-	2	2	3
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	3
5	2	3	2	2	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	**V**			Course Category Code: **PC**			End Semester Exam Type: **LE**	
Course Code	**U23ADP508**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**DEEP LEARNING LABORATORY**			**0**	**0**	**2**	**1**	**50**	**50**	**100**
AI&DS										
Prerequisite	Machine Learning									
Course Outcomes	**On completion of the course, the students will be able to**									BT Mapping (Highest Level)
	CO1	Apply neural network techniques to develop and implement simple feedforward neural networks for basic classification tasks.								**K3**
	CO2	Utilize convolutional neural networks (CNN) to build deep learning models capable of classifying images								**K3**
	CO3	Implement recurrent neural networks (RNN) and LSTM models to predict time series data								**K3**
	CO4	Apply generative and transfer learning techniques to create artistic outputs								**K3**
	CO5	Apply deep learning architectures like RNNs, LSTMs, and CNN for developing AI models for domain-specific applications**.**								**K3**

List of Experiments

1. Build a simple Neural Network.
2. Build a deep learning model to Classify cat and dog using CNN
3. Build a deep learning model to predict Stock Prices using Recurrent Neural Network
4. Build a deep learning model to Forecast Sales using LSTM
5. Build a deep learning model to predict Movie box office using GRU model
6. Build a deep learning model to predict Sports result Prediction using RNN and LSTM
7. Build a deep learning model to predict cardiovascular disease using ANN
8. Build a deep learning model to create an art using Style Transfer technique
9. Build a deep learning model to a identify traffic signs from the image
10. Build a deep learning model for Fashion Recommendation System

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

Reference Books

1. Cosma Rohilla Shalizi, "Advanced Data Analysis from an Elementary Point of View", Cambridge University Press, 2015.
2. Deng & Yu, "Deep Learning: Methods and Applications", Now Publishers, 2014.
3. Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.
4. Josh Patterson, Adam Gibson, "Deep Learning A Practitioner's Approach", O'Reilly Media, Greyscale Indian Edition, 2017.
5. Nikhil Buduma, "Fundamentals of Deep Learning", O'Reilly, 1st edition, 2017

Web References

1.https://nptel.ac.in/courses/106/106/106106184/
2. http://deeplearning.net/
3. https://www.guru99.com/deep-learning-tutorial.html
4. https://www.coursera.org/specializations/deep-learning
5. http://neuralnetworksanddeeplearning.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	3	2	2	2	-	-	-	-	-	-	-	2	3	3
2	2	3	3	2	2	-	-	-	-	-	-	-	3	3	3
3	2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	3
5	2	3	2	2	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	**V**	Course Category Code: **PC**			End Semester Exam Type: **LE**		
Course Code	**U23ADP509**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**DATA VISUALIZATION LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
AI&DS								
Prerequisite	**Python and Excel**							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Apply data visualization techniques using Python libraries (Matplotlib, Seaborn) to create graphs	**K3**
	CO2	Implement advanced visualization methods in Python to generate histograms, box plots, and density plots for interpreting complex data like rainfall, apartment price distributions, and tips.	**K3**
	CO3	Develop interactive visualizations using Bokeh for in-depth analysis of financial, demographic, and market datasets	**K3**
	CO4	Apply Tableau to create complex data visualizations for analyzing stock markets, government budgets, and demographic structures.	**K3**
	CO5	Apply Power BI dashboards to present insights on population data, business trends, and geographic distributions.	**K3**

List of Experiments

1. Create a bar graph and analyze on different social media platforms over the past month using Python.
2. Create a pie chart to split the equal halves of Demographic analysis using Python.
3. Create a line graph showing a diabetes using Seaborn.
4. Display a Dot Chart in Titanic dataset using Seaborn.
5. Create a Histogram and analyze a rainfall over month using Seaborn.
6. Create a Box Plots and analyze a Tips dataset using Bokeh.
7. Create a Density Plot and evaluate a Price distribution of Apartment in Airbnb Apartments using Bokeh.
8. Build a Scatter Plot and analyze a financial status of bank over the past month using Bokeh.
9. Create a Chart Tables in Government Budget using Tableau.
10. Create a Heat Map in Stock Market using Tableau.
11. Build a Population Pyramid in Tableau.
12. Create maps using Power BI.
13. Build a Web Analytics Dashboard using Power BI.

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

Reference Books

1. Mario Dobler and Tim Grobmann, “Data Visualization with Python”, Packt Publishing Ltd., 2019.
2. Praveen Kumar, “Data Visualization with Tableau”, Gurucool Publishing, 1st Edition, 2020.
3. Seema Acharya., “Mastering Data Visualization using Tableau”, Wiley India Pvt.Ltd, 1st Edition, 2024.
4. Chandraish Sinha, “Mastering Power BI”, BPB Publications, 1st Edition, 2022
5. Greg Deckler,Brett Powell, “Microsoft Power BI Cookbook”, Packt Publishing, 2nd Edition, 2021.

Web References

1. https://www.techtarget.com/searchbusinessanalytics/definition/data-visualization
2. https://machinelearningmastery.com/data-visualization-in-python-with-matplotlib-seaborn-and-bokeh/
3. https://www.tableau.com/learn/articles/data-visualization
4. https://help.tableau.com/current/pro/desktop/en-us/buildexamples_maps.htm
5. https://learn.microsoft.com/en-us/power-bi/fundamentals/power-bi-overview

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	-	-	-	-	-	-	-	3	2	2
2	3	2	3	3	2	-	-	-	-	-	-	-	3	2	2
3	2	2	2	2	3	-	-	-	-	-	-	-	2	2	2
4	3	2	3	3	3	-	-	-	-	-	-	-	3	2	2
5	3	2	3	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	**V**	Course Category Code:**PE**			*End Semester Exam Type: **TE**		
Course Code	**U23ADE505**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**TEXT MINING AND SENTIMENT ANALYSIS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI&DS								
Prerequisite	Data Science, Natural Language Processing (NLP)							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Understand and apply key text mining techniques for extracting useful information from unstructured text	**K2**
	CO2	Design sentiment analysis using both lexicon-based and machine learning-based approaches	**K2**
	CO3	Implement machine learning models for text classification and sentiment analysis	**K3**
	CO4	identify various libraries and frameworks used in text processing and sentiment analysis	**K2**
	CO5	Apply advanced text mining techniques to solve real-world problems	**K3**

UNIT – I	**Introduction to Text Mining and Text Preprocessing**	**Periods:9**	
Introduction to Text Mining - Importance, challenges and Applications of text mining - Introduction to NLP and its role in text mining – Text Preprocessing - Tokenization, stemming, and lemmatization - Stop word removal, text normalization and case folding - Part -of-Speech (POS) tagging, Named Entity Recognition (NER) - Text Cleaning: Removing noise, special characters, punctuation, and unnecessary symbols.			**CO1**
UNIT – II	**Text Representation and Feature Extraction**	**Periods:9**	
Text Representation Models - Bag-of-Words (BoW) model: Construction and limitations - Term Frequency - Inverse Document Frequency (TF-IDF) - Word Embeddings - Introduction to Word2Vec - Differences between traditional BoW / TF- IDF and Word Embeddings - Sentence Embeddings - N-grams (bigrams, trigrams) and their significance - Dimensionality reduction techniques – PCA and LDA.			**CO2**
UNIT – III	**Text Classification and Topic Modelling**	**Periods:9**	
Supervised Learning for Text Classification - Machine learning algorithms for text classification (Naïve Bayes, Support Vector Machines, Logistic Regression) - Latent Dirichlet Allocation (LDA) for topic modelling - Identifying hidden topics in text data - Deep Learning for Text Classification - Handling Imbalanced Text Datasets.			**CO3**
UNIT – IV	**Introduction to Sentiment Analysis**	**Periods:9**	
Overview of Sentiment Analysis - applications, and challenges in sentiment analysis - Types of sentiment - Lexicon-Based Sentiment Analysis - Sentiment lexicons: SentiWordNet - Rule-based sentiment analysis techniques - Sentiment Analysis Tools - Evaluation Metrics			**CO4**
UNIT – V	**Machine Learning - Based Sentiment Analysis**	**Periods:9**	
Supervised Machine Learning for Sentiment Analysis - Training machine learning models for sentiment analysis - Deep learning approaches to sentiment analysis. Aspect-Based Sentiment Analysis (ABSA) - Analyzing sentiments toward specific aspects of a product or service - Multilingual Sentiment Analysis - Real-World Applications of Sentiment Analysis			**CO5**

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

Text Books

1. Matthew A. Russell , “Mining the Social Web”, O'Reilly Media, Inc, 2nd Edition, 2013
2. Bing Liu, "Sentiment Analysis and Opinion Mining",Morgan & Claypool Publishers, May 2012
3. Daniel Jurafsky and James H. Martin "Speech and Language Processing", Pearson, 2nd Edition, 2008

Reference Books

1. Steven Bird, Ewan Klein, and Edward Loper, "Natural Language Processing with Python", O'Reilly Media, First Edition, 2009
2. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze "Introduction to Information Retrieval", Cambridge University Press, 2008.
3. Julia Silge and David Robinson, “Text Mining with R: A Tidy Approach”, O'Reilly Media, 2017

Web References

1. https://towardsdatascience.com/sentiment-analysis-with-text-mining-13dd2b33de27
2. https://medium.com/@gladinv/introduction-to-text-mining-and-sentiment-analysis-affaaf520597

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	-	3	-	-	-	-	-	-	-	2	1	2
2	3	2	2	1	3	-	-	-	-	-	-	-	2	1	2
3	3	3	2	2	3	-	-	-	-	-	-	-	3	2	2
4	3	3	3	2	3	-	-	-	-	-	-	-	3	2	2
5	3	3	3	3	3	-	-	-	-	-	-	-	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	**V**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**U23ADE506**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**USER EXPERIENCE DESIGN**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI&DS								
Prerequisite	Software Engineering, Aesthetic sense							

Course Outcomes			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Interpret and apply the fundamental principles of user experience design to create user-centric digital products.	**K2, K3**
	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:9**	
Principles of UX design - Importance of user-centric design - Overview of UX design process - Role of UX in product development- Accessibility in UX Design- Ethical Considerations in UX Design-Human-Computer Interaction (HCI)- Industry Trends and Future Directions.			**CO1**
UNIT – II	**Research in UX Design**	**Periods:9**	
Research in Design - Techniques for user research - Developing user personas - Conducting usability testing - Analyzing research data for design insights-Developing a Research Plan- Data Collection and Analysis- Synthesizing Research Findings- Applying Research to Design- Tools and Resources.			**CO2**
UNIT – III	**Design Thinking and Strategy**	**Periods:9**	
Fundamentals of design thinking - Frameworks for UX strategy - Aligning business goals with user needs - Case studies on successful UX strategies- The Design Thinking Process, Design Thinking Tools and Techniques- Strategic Design Thinking- Implementation and Scaling- Ethical Considerations in Design Thinking.			**CO3**
UNIT – IV	**Interaction Design**	**Periods:9**	
Principles of interaction design - Designing for different devices and platforms - Prototyping methods - Accessibility and inclusive design- Prototyping and Wireframing- Usability Testing, Responsive and Adaptive Design- Advanced Interaction Techniques- Accessibility and Inclusive Design- Design Systems and Style.			**CO4**
UNIT – V	**UX Evaluation**	**Periods:9**	
Methods for evaluating user experience - Metrics and KPIs for UX - Iterative design process - Implementing feedback and continuous improvement- Usability Testing, Analytics and Metrics- User Feedback and Support, Accessibility Evaluation- Integrating Evaluation into the Design Process- Case Studies and Real-World Applications.			**CO5**

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

Text Books

1. Don Norman ,"The Design of Everyday Things", Basic Books, 1st Edition, 2015
2. "Don't Make Me Think" - Steve Krug, New Riders, 3rd Edition, 2014
3. Jeff Gothelf, Josh Seiden , "Lean UX: Designing Great Products with Agile Teams", Shroff/O'Reilly, 2nd Edition, 2016

Reference Books

1. Susan Weinschenk , "100 Things Every Designer Needs to Know About People", New Riders, 1st edition, 2011
2. "Measuring the User Experience: Collecting, Analyzing, and Presenting UX Metrics" - Tom Tullis, Bill Albert. Morgan Kaufmann, 3rd Edition, 2022
3. Elizabeth Goodman, Mike Kuniavsky, Andrea Moed,"Observing the User Experience: A Practitioner's Guide to User Research", Morgan Kaufmann, 2nd Edition, 2012

Web References

1. https://www.uxdesigninstitute.com/blog/ux-design-principles/
2. https://imaginovation.net/blog/ux-in-product-development/
3. https://mailchimp.com/resources/how-to-create-a-user-persona-ux/
4. https://uxmag.com/articles/framework-for-designing-for-multiple-devices

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	**V**			Course Category: **PE**			End Semester Exam Type: **TE**	
Course Code	**U23ADE507**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**JAVA PROGRAMMING: ESSENTIAL CONCEPTS TO ADVANCED MASTERY**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI&DS								
Prerequisite	Basic understanding of Java programming, Concepts of object-oriented Programming, web development basics, database fundamentals							
Course Outcomes	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)
	CO1	Implementing Java collections to manage and solve data-related problems.						**K3**
	CO2	Interpret unit testing and mocking techniques to assess and ensure code quality.						**K2**
	CO3	Apply JDBC to interact with and manage relational databases through SQL queries.						**K3**
	CO4	Apply various techniques to create web applications for handling requests, sessions, and data presentation.						**K3**
	CO5	Implement AJAX to improve web application performance through asynchronous data loading and interactions.						**K3**
UNIT- I	**Java Collections Framework**				**Periods: 9**			
List Interface: Dynamic User Profile Management – **Sorted Interface:** Leaderboard Rankings – **Queue Interface**: Task Scheduling System – **Dequeue Interface:** Undo/Redo Functionality - **Map Interface**: User Authentication Caching using HashMap – **Set Interface:** Adding an Elements to a HashSet of Integers.								**CO1**
UNIT- II	**Java Testing Frameworks**				**Periods: 9**			
Introduction to JUnit: Overview and purpose of JUnit in unit testing - **JUnit Features**: Key features and functionalities - **JUnit with Eclipse**: Setting up and using JUnit in the Eclipse IDE - **Assert Methods and Annotations**: Common assert methods and annotations in Junit - **Test Suite**: Creating and managing test suites - **Introduction to Mockito**: Mockito for mocking objects in tests with Real-Time Examples.								**CO2**
UNIT- III	**Database Management and SQL with JDBC**				**Periods: 9**			
Introduction to RDBMS: Basics of relational database management systems - **Oracle 11g Introduction**: Key features and functionalities of Oracle 11g - **SQL Statements**: Select Statement - Restricting and Sorting Data - DML (Data Manipulation Language) - DDL (Data Definition Language) - **Introduction to JDBC**: Establishing Connection - Executing Queries and Processing Results - Using Prepared Statements - Using Meta Data Objects - Using Callable Statements and Transactions.								**CO3**
UNIT- IV	**Web Development with Servlets and JSP**				**Periods: 9**			
Introduction to Servlets: Basics of servlet technology and lifecycle - **Servlets Get and Post Requests**: Handling GET and POST requests in servlets - **Servlets Config and Context**: Configuration and context handling in servlets - **Servlets Cookies and Session Management**: Managing cookies and sessions in servlets - **Introduction to JSP (Java Server Pages)**: Basics of JSP - **JavaBeans in JSP**: Using JavaBeans in JSP for encapsulating data.								**CO4**
UNIT- V	**Mastering AJAX: Asynchronous Data Loading and Integration**				**Periods: 9**			
Introduction to AJAX: Overview of AJAX and its benefits - **How AJAX Works**: Mechanisms of asynchronous data loading - **AJAX Application**: Practical uses of AJAX in web applications - **AJAX Database Application**: Implementing AJAX for interacting with databases.								**CO5**
Lecture Periods: 45	**Tutorial Periods:-**			**Practical Periods:-**			**Total Periods: 45**	

Textbooks

1.Herbert Schildt, "Java: The Complete Reference",12th Edition, 2024.
2. Andy Hunt and Dave Thomas, "Pragmatic Unit Testing in Java 5.0: With JUnit", 2nd Edition,2022
3. Oracle Corporation, "Oracle Database 23c: New Features",2024
4. Bryan Basham, Kathy Sierra, and Bert Bates, "Head First Servlets and JSP: Passing the Sun Certified Web Component Developer Exam" ,3rd Edition,2023.

Reference Books

1. C.J. Date, "Database Management and SQL with JDBC", 2nd Edition, 2012.
2. Bryan Basham, Kathy Sierra, and Bert Bates, "Web Development with Servlets and JSP", 2nd Edition,2008 .
3. Joshua Bloch , "Effective Java", 3rd Edition, 2008.
4. David Flanagan, "JavaScript: The ,Definitive Guide", 2021.

Web References

1. https://archive.nptel.ac.in/courses/106/105/106105191/
2. https://www.tutorialspoint.com/java/index.htm
3. https://www.javatpoint.com/java-tutorial
4. https://www.geeksforgeeks.org/java/
5. https://www.w3schools.com/java/

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	2	3	2	-	-	-	-	-	-	2	2	-
2	2	2	2	3	3	2	-	-	-	-	-	-	3	1	-
3	3	3	2	2	2	2	-	-	-	-	-	-	2	2	-
4	2	2	3	2	3	3	-	-	-	-	-	-	2	3	-
5	2	2	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	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	**V**	Course Category Code: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23ADE508**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**EXPLORATORY DATA ANALYSIS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI&DS								
Prerequisite	Basic Statistics, Data Visualization and Programming in Python							

Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret the need of exploratory data analysis	**K2**
	CO2 Identify the usage of various python libraries and functions for EDA	**K2**
	CO3 Apply univariate data exploration and analysis for EDA	**K3**
	CO4 Apply bivariate data exploration and analysis for EDA	**K3**
	CO5 Identify various techniques needed for time series analysis	**K2**

UNIT-I	**Introduction to Exploratory Data Analysis**	**Periods: 9**
EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.		**CO1**
UNIT-II	**EDA Using Python**	**Periods:9**
Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations.		**CO2**
UNIT-III	**Univariate Analysis**	**Periods:9**
Introduction to Single variable: Distribution Variables – Numerical Summaries of Level and Spread – Measures of Central Tendency – Measures of Spread – Shape of the Distribution – Data Visualization – Scaling and Standardizing – Inequality – Data Transformation – Univariate Analysis for Categorical Data.		**CO3**
UNIT-IV	**Bivariate Analysis**	**Periods:9**
Relationships between Two Variables – Percentage Tables – Analyzing Contingency Table – Handling Several Batches – Scatterplots and Resistant Lines – Bivariate Analysis Methods – types – Non-Linear Relationships – Cross-Tabulation and Chi-Square Test.		**CO4**
UNIT-V	**Multivariate and Time Series Analysis**	**Periods:9**
Introducing a Third Variable – Causal Explanations – Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time based indexing – Visualizing – Grouping – Resampling.		**CO5**

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

Text Books

1. Suresh Kumar Mukhiya and Usman Ahmed, “Hands-On Exploratory Data Analysis with Python”, First Edition, Packt Publishing, 2020.
2. Wes McKinney, “Python for Data Analysis”, Second Edition, Published by O'Reilly Media, 2017.
3. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Second Edition, O Reilly, 2023.
4. Robert H. Shumway and David S. Stoffer, “Time Series Analysis and Its Applications”, fourth edition, published by Springer in 2017.

Reference Books

1. Eric Pimpler, “Data Visualization and Exploration with R”, second edition, GeoSpatial Training service, 2020.
2. Claus O. Wilke, “Fundamentals of Data Visualization”, second edition, O’reilly publications, 2023.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, “Interactive Data Visualization: Foundations, Techniques, and Applications”, third Edition, CRC press, 2023.
4. Richard A. Johnson and Dean W. Wichern, “B Applied Multivariate Statistical Analysis”, 7th Edition, Pearson, 2022.

Web References

1. https://www.geeksforgeeks.org/exploratory-data-analysis-in-python/
2. https://towardsdatascience.com/a-gentle-introduction-to-exploratory-data-analysis/
3. https://www.analyticsvidhya.com/blog/2021/08/exploratory-data-analysis-and-visualization-techniques-in-data-science/
4. https://www.coursera.org/learn/exploratory-data-analysis/

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	3	3	3	2	-	-	-	-	-	-	2	2	2
2	2	2	3	3	2	2	-	-	-	-	-	-	2	2	2
3	2	2	2	2	1	2	-	-	-	-	-	-	2	3	1
4	2	3	2	2	2	1	-	-	-	-	-	-	2	3	1
5	3	3	3	3	3	2	-	-	-	-	-	-	2	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	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	**V**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23ADE509**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DESIGNING MACHINE LEARNING SYSTEMS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI&DS								
Prerequisite	Basic understanding of machine learning concepts and Proficiency in Python programming							

Course Outcome		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Interpret the fundamental components and design principles of machine learning systems.	**K2**
	CO2	Interpret effective data preprocessing and feature engineering techniques.	**K2**
	CO3	Deploy machine learning models to production environments and monitor system performance.	**K3**
	CO4	Deploy machine learning models with appropriate evaluation metrics.	**K3**
	CO5	Optimize, maintain, and scale machine learning systems, culminating in a capstone project.	**K3**

UNIT-I	**Introduction to Machine Learning Systems Design**	**Periods: 9**	
Overview of machine learning systems- Fundamentals of Machine Learning Systems- Key Components of ML Systems- ML System Design Principles- Case Studies: Successful ML Systems			**CO1**
UNIT-II	**Data Management and Feature Engineering**	**Periods:9**	
Data Collection: Data types, sources, and formats - Data storage solutions: relational databases, data lakes, and warehouses- Data Preprocessing for ML Systems: Dimensionality reduction techniques (PCA, t-SNE), Data augmentation techniques - Feature Engineering and transformation: Feature extraction and selection- Dealing with categorical vs. numerical features- Scaling, normalization, and encoding -Data Pipelines for ML			**CO2**
UNIT-III	**Model Building and Training**	**Periods:9**	
Model Architectures and Algorithms: Overview of different ML models (regression, decision trees, neural networks)- choosing the right mode l**- Model Training and Hyperparameter Tuning:** Training process overview-Grid search, random search, and advanced tuning techniques-Cross-validation techniques- **Handling Overfitting and Underfitting:** Regularization techniques (L1, L2)- Early stopping, dropout, and data augmentation			**CO3**
UNIT-IV	**Model Evaluation and Deployment**	**Periods:9**	
Model Evaluation Metrics: Regression & classification**- Model Validation and Testing:** Train-test split, K-fold cross-validation- Model generalization and robustness- **Model Deployment Pipelines:** Preparing models for production- ML deployment tools and frameworks (Docker, Kubernetes, TensorFlow Serving			**CO4**
UNIT-V	**Monitoring, Optimization, and Scaling**	**Periods:9**	
Post-Deployment Monitoring- **Scaling Machine Learning Systems:** Distributed training and inference-Cloud-based ML platforms (AWS, GCP, Azure)- **Optimization Techniques:** Performance optimization (batch processing, memory management) - Latency and throughput optimization			**CO5**

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

Text Books

1. Chip Huyen, “Designing Machine Learning Systems,” First Edition, O'Reilly Media, 2022.
2. Valliappa Lakshmanan, Sara Robinson, Michael Munn, “Machine Learning Design Patterns,” First Edition, O'Reilly Media, 2020.
3. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow,” Second Edition, O'Reilly Media, 2019.

Reference Books

1. Emmanuel Ameisen, “Building Machine Learning Powered Applications: Going from Idea to Product,” First Edition, O'Reilly Media, 2020.
2. Giuseppe Bonaccorso, “Machine Learning Algorithms,” Second Edition, Packt Publishing, 2020.
3. Ethem Alpaydin, “Introduction to Machine Learning,” Fourth Edition, MIT Press, 2020.

Web References

1. https://github.com/chiphuyen/dmls-book
2. https://towardsdatascience.com/data-pipeline-design-patterns-100afa4b93e3
3. https://github.com/tensorflow/tensorflow

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	3	2	-	-	-	-	-	-	2	1	3	2
2	3	3	3	2	2	-	-	-	-	-	-	2	1	3	2
3	3	3	3	2	2	-	-	-	-	-	-	3	1	3	2
4	3	3	3	2	2	-	-	-	-	-	-	3	1	3	2
5	3	3	3	2	2	-	-	-	-	-	-	3	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	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	**V**	Course Category Code: **PA**				*End Semester Exam Type: **-**		
Course Code	**U23ADW501**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MICRO PROJECT**	**0**	**0**	**2**	**1**	**100**	**-**	**100**
AI & DS								
Prerequisite	Artificial Intelligence, Machine Learning, Deep Learning, Programming in C, Python, Java							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify the problem statement for the micro project work through the literature survey	**K2**
	CO2 Choose the proper components as per the requirements of the design/ system**.**	**K2**
	CO3 Apply the acquainted skills to develop final model/system	**K3**

There shall be a Micro Project, which the student shall pursue as a team consists of maximum 4 students during the third year, fifth semester. The aim of the micro project is that the student has to understand the real time hardware / software applications. The student should gain a thorough knowledge in the problem he/she has selected and in the hardware / software he/she using in the Project. The Micro-project is an application that should be formally initiated and should be developed and also to be implemented by the respective team.

The Micro Project shall be submitted in a report form along with the hardware model / software developed, duly approved by the department internal evaluation committee. It shall be evaluated for 100 marks as Continuous Assessment. The department internal evaluation committee shall consist of faculty coordinator, supervisor of the project and a senior faculty member of the department. There shall be two reviews that will be considered for assessing a Micro Project work with weightage as indicated evaluation Methods.

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

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	-	-	-	-	3	3	-	1	1	1	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	2	2
3	3	2	2	1	-	2	-	-	3	3	3	1	3	3	3

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

Evaluation Method

Assessment	**Review 1**			**Review 2**				**Total Marks**
	Novelty	**Presentation**	**Viva**	**Presentation**	**Demonstration**	**Viva**	**Report**	
Marks	10	20	10	20	20	10	10	100

Department	**Artificial Intelligence and Data Science**	Programme: **B. Tech.**						
Semester	**V**	Course Category: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23ADC5XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - V**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
Prerequisite	**-**							

Students shall choose an International / Reputed organization certification course of 40-50 hours duration specified in the curriculum (It is mandatory to do a minimum of six courses) which will be offered through the Centre of Excellence. These courses have no credit and will not be considered for CGPA calculation.

(i) Certification Courses are required to be completed to fulfil the degree requirements. All Certification courses are assessed internally for 100 marks.

(ii) The Course coordinator handling the course will assess the student through attendance and MCQ test, and declare the student as “pass” on satisfactory completion. A letter grade “P” is awarded to declare pass.

(iii) The marks scored in these courses will not be taken into consideration for the SGPA / CGPA calculations in the grade sheet.

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	**V**	Course Category Code: **MC**			*End Semester Exam Type: **-**			
Course Code	**U23ADM505**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**	**2**	**0**	**0**	**-**	**100**	**-**	**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 philosophy of Indian culture	**K2**
CO2	Distinguish the Indian languages and literature	**K2**
CO3	Describe the philosophy of ancient, medieval and modern India	**K2**
CO4	Illustrate the information about the fine arts in India	**K2**
CO5	Describe the contribution of scientists of different eras	**K2**

UNIT- I	**Introduction To Culture**	**Periods:06**
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India		**CO1**
UNIT- II	**Indian Languages, Culture and Literature**	**Periods:06**
Indian Languages and Literature - I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India Indian Languages and Literature-II: Northern Indian languages & literature		**CO2**
UNIT- III	**Religion and Philosophy**	**Periods:06**
Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)		**CO3**
UNIT- IV	**Fine Arts in India (Art, Technology and Engineering)**	**Periods:06**
Indian Painting, Indian handicrafts, Music, divisions of Indian classical music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India		**CO4**
UNIT-V	**Education System in India**	**Periods:06**
Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India		**CO5**

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

Reference Books

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”, ISBN: 81246033375, 2005
2. “Science in Samskrit”, Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450 494-X, 200
4. S. Narain, “Examinations in ancient India”, Arya Book Depot, 1993
5. M. Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN 13: 978 - 8120810990, 2014

Web References

1. https://nptel.ac.in/courses/109/104/109104102/
2. https://nptel.ac.in/courses/101/104/101104065/
3. https://nptel.ac.in/courses/109/108/109108158/
4. https://nptel.ac.in/courses/109/106/109106059/
5. https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-ae01/

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	1	-	1
2	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
3	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
4	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1

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

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	**VI**	Course Category Code: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23ADTC02**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**NLP AND CHATBOT**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Common to AI & DS, CSE & BS

Prerequisite	Machine Learning, Deep Learning and Programming in Python	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret fundamental concepts of NLP and apply them for text processing	**K2**
	CO2 Apply different parsing techniques for syntactic and semantic analysis	**K3**
	CO3 Apply machine translation techniques for summarizing text and question answering.	**K3**
	CO4 Understand the structure and technology behind human-computer conversations for building chatbots	**K2**
	CO5 Determine various techniques to build a conversational interface	**K3**

UNIT-I	**Introduction**	**Periods: 9**	
Introduction to NLP – NLP preprocessing steps – NLP Feature Engineering - Words - Structure - spellcheck, morphology using FSTs - Semantics - Lexical Semantics, word count vector, WordNet and WordNet based similarity measures, Distributional measures of similarity, Concept Mining - Word Sense Disambiguation - supervised, unsupervised and semi-supervised approaches - Parts of Speech.			**CO1**

UNIT-II	**Language Modelling**	**Periods:9**	
Sentences - Basic ideas in compositional semantics, Classical Parsing – different types of parsing - Bottom up, top down, Dynamic Programming - Parsing using Probabilistic Context Free Grammars and Expectation - Maximization based approaches for learning PCFG parameters. Language Modelling.			**CO2**

UNIT-III	**Machine Translation**	**Periods:9**	
Machine Translation - rule-based techniques, Statistical Machine Translation, parameter learning using Expectation - Maximization - Information Extraction - Introduction to Named Entity Recognition and Relation Extraction - Natural Language Generation - the potential of using ML - Advanced Language Modelling – Applications - summarization, question answering.			**CO3**

UNIT-IV	**Chatbot**	**Periods:9**	
Chatbot – Design of a Chatbot - Introduction to Conversational Interface - Preliminaries, developing a speech based Conversational Interface, Conversational Interface and devices - Technology of Conversation: Introduction - Conversation as Action - The structure of Conversation - The language of Conversation.			**CO4**

UNIT-V	**Conversational Interface**	**Periods:9**	
Developing a Speech-Based Conversational Interface - Implementing Text to Speech - Text Analysis - Wave Synthesis - Implementing Speech Recognition - Language Model, Acoustic Model - Decoding - Speech Synthesis Mark-up Language - Advanced voice user interface design – Advanced Chatbots.			**CO5**

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

Text Books

1. R. James Allen, “Natural Language Understanding”, 3rd Edition, Pearson Education, 2019.
2. Srini Janarthanam, “Hands-On Chatbots and Conversational UI Development: Build chatbots”, Published by Packet Publishing Ltd., Second Edition, 2020.
3. Daniel Jurafsky and James H Martin,” Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, Prentice Hall, 3rd Edition, 2024.
4. Philipp Koehn “Neural Machine Translation” to Neural Machine Translation, Cambridge University Press, 1st edition, 2020.

Reference Books

1. Sohom Ghosh, Dwight Gunning, “Natural Language Processing Fundamentals”, Packt Publishing Ltd., 1st edition, 2019.
2. Jacob Eisenstein,” Introduction to Natural Language Processing”, MIT Press, 1st Edition, 2019.
3. Cathy Pearl, “Designing Voice User Interfaces: Principles of Conversational Experiences”, Shroff/O’Reilly, First Edition, 2017.
4. Abhishek Singh, Karthik Ramasubramanian, Shrey Shivam, “Building an Enterprise Chatbot: Work with Protected Enterprise Data using Open-Source Frameworks”, Apress, 2019.
5. Michael McTear,” Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots", Publishing Springer 1st Edition 2020.

Web References

1. https://onlinecourses.nptel.ac.in/noc23_cs45/preview
2. https://towardsdatascience.com/
3. https://www.geeksforgeeks.org/natural-language-processing-nlp-tutorial/
4. https://www.analyticsvidhya.com/blog/2021/02/basics-of-natural-language-processing/

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	3	3	2	-	-	-	-	-	-	2	2	2
2	2	3	3	3	2	1	-	-	-	-	-	-	2	2	1
3	2	3	3	2	1	-	-	-	-	-	-	-	2	2	1
4	2	2	3	2	3	2	-	-	-	-	-	-	2	3	1
5	3	2	2	3	3	1	-	-	-	-	-	-	2	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	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	**VI**	Course Category Code: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23ADT611**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**ROBOTIC PROCESS AUTOMATION – UI PATH**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI & DS								
Prerequisite	**Machine Learning**							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Describe RPA, where it can be applied and how it's implemented	**K2**
	CO2	Describe the different types of variables, Control Flow and data manipulation techniques.	**K2**
	CO3	Identify and understand Image, Text and Data Tables Automation.	**K2**
	CO4	Describe how to handle the User Events and various types of Exceptions and strategies.	**K2**
	CO5	Examine the research areas in Artificial Intelligence with respect to RPA.	**K3**

UNIT-I	**Introduction To Robotic Process Automation**	**Periods: 9**
Scope and techniques of automation, Robotic process automation - What can RPA do?, Benefits of RPA, Components of RPA, RPA platforms, The future of automation.		**CO1**
UNIT-II	**RPA Basics**	**Periods:9**
History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Development methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.		**CO2**
UNIT-III	**UI Path Introduction and Exploration**	**Periods:9**
Introduction: Installing UiPath Studio community edition - The User Interface - Keyboard Shortcuts About Updating - About Automation Projects - Introduction to Automation Debugging - Managing Activation Packages - Reusing Automations Library - Installing the Chrome Extension – Variables - Control Flow - Data Manipulation - Recording and Advanced UI Interaction - Selectors.		**CO3**
UNIT-IV	**UI Path Advanced Automation**	**Periods:9**
Image, Text and Advanced Citrix Automation - Excel Data Tables and PDF - Email Automation -Debugging and Exception Handling - Project Organization. Orchestrator: Tenants – Authentication– Users – Roles – Robots – Environments - Queues and Transactions - Schedules.		**CO4**
UNIT-V	**Artificial Intelligence and RPA**	**Periods:9**
Research on application of RPA for Machine Learning, Agent awareness - Natural Language Processing - Computer Vision, etc, Case studies and projects on applying RPA for designing and developing robots for real-world problems.		**CO5**

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

Text Books

1. A. Tripathi, “Learning Robotic Process Automation: Create Software robots and automatebusiness processes with the leading RPA tool - UiPath: Create Software robots with the leadingRPA tool – UiPath”, Packt Publishing, 2018.
2. K. Wibbenmeyer, “The Simple Implementation Guide to Robotic Process Automation (RPA): How to Best Implement RPA in an Organization", iUniverse,2018.
3. S. Merianda, “Robotic Process Automation Tools, Process Automation and Their Benefits: Understanding RPA and Intelligent Automation”, Createspace.,2018.

Reference Books

1. M. Lacity, L. Willcocks, “Robotic Process and Cognitive Automation: The Next Phase”, SteveBrookes Publishing.
2. Tom Taulli, “The Robotic Process Automation Handbook: A Guide to Implementing RPASystems”, 2020.
3. Nandan Mullakara, “Robotic Process Automation Projects: Build real-world RPA solutions usingUiPath and Automation Anywhere”, 2020**.**
4. Gerardus Blokdyk, “RPA robotic process automation”, Second Edition, Paper Back, 2018.
5. S. Muhkerjee, “Essentials of Robotics Process Automation”, Khanna Publishing, 2019.

Web References

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com
3. https://www.edx.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	1	2	3	2	1	2	-	-	-	-	-	-	2	3	2
2	1	2	3	2	3	2	-	-	-	-	-	-	3	3	2
3	2	2	2	3	3	1	-	-	-	-	-	-	3	2	3
4	2	2	3	1	3	3	-	-	-	-	-	-	3	3	2
5	2	2	3	2	3	3	-	-	-	-	-	-	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	**Computer Science and Engineering**	Programme: **B. Tech**						
Semester	**III/ V**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23CSTC07**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**WEB DESIGNING**	3	-	-	3	25	75	100

(Common to CSE and AI&DS)

Prerequisite	Basic knowledge in Programming and Database	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand HTML and CSS	**K2**
	CO2 Implement client-side programming using JavaScript.	**K3**
	CO3 Understand the concepts of PHP and PHP Forms.	**K2**
	CO4 Connect PHP scripts with databases.	**K4**
	CO5 Implement the web hosting processes.	**K3**

UNIT - I	**WEB BASICS, HTML AND CSS**	**Periods:09**
Web Basics: The Internet – World wide web – DNS – URI and URL – HTTP – web client and web server. Introduction to HTML: HTML Syntax – Structure of HTML Documents – HTML Elements: Headings – Links – Images – Lists – Tables – Forms. Introduction to CSS: CSS Syntax – Location of Styles – Selectors – Box Model – Text Styling – CSS Layout: Positioning Elements – Floating Elements.		**CO1**
UNIT - II	**JAVASCRIPT**	**Periods:09**
JavaScript Introduction: Syntax – Variables – Operators – Data Types – Functions – Objects – String Methods – Number Methods – Arrays – Array Methods – Conditions – Loops – Popup Alert – Events – Event Listener.JavaScript Objects: Object Definitions – Object Properties –Object Methods– Object Display.		**CO2**
UNIT - III	**INTRODUCTION TO PHP AND FORMS**	**Periods:09**
Introduction to PHP: Variables – Data Types – Constants – Echo / Print. Operators: Arithmetic – Comparison – Logical – String – If...Else...Elseif – Switch – Loops – Arrays – Functions – Super globals – RegEx. PHP Form: Form Handling – GET/POST – Using Bootstarp – Form Validation – Form Required – Form Submission. Data: Date and Time – File Upload – Cookies – Sessions – Include – Exceptions.		**CO3**
UNIT - IV	**PHP WITH DATABASE CONNECTIVITY**	**Periods:09**
Introduction to Database: Essential SQL – Creating a MySQL Database – Creating a New Table – Putting Data into the New Database – Accessing the Database in PHP – Updating Databases – Inserting New Data Items into a Database – Deleting Records – Sorting the Data.		**CO4**
UNIT - V	**WEB HOSTING**	**Periods:09**
Introduction to Web Hosting: Creating the website – Working on the site – Sending email and access other websites – Registering domains – Themes Publishing web sites – Maintaining a website.		**CO5**

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

Text Books

1. Randy Connolly and Ricardo Hoar, “Fundamentals of Web Development”, Pearson Education Inc, Third Edition, 2022.
2. Steven Holzner, "PHP: The Complete Reference", McGraw Hill Education, 3rd Edition, 2020.
3. Jon Dukett, “JavaScript and JQuery: Interactive Front–End Web Development”, Paperback, 2018.

Reference Books

1. Lyza Danger Gardner, "Java Script on Things: Hacking Hardware for Web Developers", Dreamtech Press,1st edition, 2018.
2. Laura Lemay, Rafe Colburn, "Mastering HTML, CSS & Javascript Web", BPB Publications, First edition, 2016.
3. Alex Libby, Gaurav Gupta, Asoj Talesra, “Responsive Web Design with HTML5 and CSS3 Essentials”, Packt Publishing, 2nd edition, 2016
4. Bassett, Lindsay, “Introduction to JavaScript object notation: a to-the-point guide to JSON", O'Reilly Media, 2015.
5. Nixon Robin, “Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5”, O’Reilly Media, 5th edition, 2018.

Web References

1. https://developer.mozilla.org/en-US/docs/Learn
2. https://www.w3schools.com/sql/default.asp
3. https://www.smashingmagazine.com/2021/03/complete-guide-accessible-front-end-components/
4. https://alistapart.com/article/mobile-first-css-is-it-time-for-a-rethink/
5. https://css-tricks.com/tag/view-transitions/
6. https://www.tutorialspoint.com/php/php_introduction.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	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	2	-	-	-	-	-	-	-	-	1	2
2	3	2	1	1	2	-	-	-	-	-	-	-	-	1	2
3	2	2	3	-	2	1	-	1	-	-	-	-	-	1	2
4	2	2	3	2	2	2	-	2	-	-	-	-	-	1	2
5	2	2	3	1	-	1	-	2	-	-	-	-	-	1	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	**VI**	Course Category: **PC**				End Semester Exam Type: **TE**	
Course Code	**U23ADB602**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**BLOCKCHAIN AND CRYPTOGRAPHY**	**2**	**0**	**2**	**3**	**50**	**50**	**100**
AI & DS								
Prerequisite	Basic Networking Concepts and Good Mathematical Skills							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the use of distributed systems in blockchain technology and write smart contracts	**K2**
	CO2 Describe the technologies behind cryptocurrencies.	**K2**
	CO3 Acquire knowledge on standard algorithms used to provide confidentiality, integrity, and authenticity.	**K2**
	CO4 Apply and Implement the Blockchain Concepts and creating basic blocks, Markle tree, Crypto-currency Wallet.	**K3**
	CO5 Apply and implement the algorithms DES, RSA and Diffie-Hellman.	**K3**

UNIT-I	**Introduction to Blockchain Technology**	**Periods: 10**	
Distributed systems – The history of blockchain – CAP theorem and blockchain – Benefits and limitations of blockchain – Decentralization using blockchain - Methods of decentralization – Routes to decentralization-Consensus Algorithms. Smart Contract: History of Smart Contract – Ricardian contracts - The DAO.			**CO1**

UNIT-II	**Cryptocurrency (Bitcoin)**	**Periods: 10**	
Bitcoin - Introduction – Transactions – Structure - Transactions types – The structure of a block– The genesis block – The bitcoin network– Wallets and its types– Bitcoin payments– Bitcoin investment and buying and selling bitcoins – Bitcoin installation – Bitcoin programming and the command-line interface – Bitcoin improvement proposals (BIPs).			**CO2**

UNIT-III	**Cryptography Techniques and Authentication Algorithms**	**Periods: 10**	
Symmetric Key Encryption- Simple DES, Linear and Differential cryptanalysis, DES, Modes of operation, Triple DES, AES – Public Key Cryptography - Factorization problem and RSA, Diffie Hellman Key Exchange, Elliptic curve cryptography. Authentication Algorithms: Message Digest- SHA-1, MD5.			**CO3**

UNIT-IV	**Laboratory Exercises**	**Periods: 15**	
• Creating Merkle tree • Creation of Block • Implementation of blockchain in Merkle Trees • Implementation of peer-to-peer network using block chain • Creating a Crypto-currency Wallet			**CO4**

UNIT-V	**Laboratory Exercises**	**Periods: 15**	
• Implementation of the following cipher techniques to perform encryption and decryption: a) Caesar Cipher, b) Substitution Cipher, c) Hill Cipher. • Implementation of DES algorithm logic. • Implementation of RSA Encryption algorithm • Applythe Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob). • Applythe message digest of a text using the MD5 algorithm			**CO5**

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

Textbooks
1. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Blockchain Technology: Cryptocurrency and Applications, Oxford University Press 2019.
2. Van Haren Publishing (Editor), "Introduction to Blockchain Technology: The Many Faces of Blockchain Technology in the 21st Century", Paperback Import, 2019.
3. Adrian Mcnulty, "Blockchain: The Complete and Comprehensive Guide to Understanding Blockchain Technologies", Createspace Independent Pub, 2018.
4. William Stallings, "Cryptography and Network Security – Principles and Practices", Pearson Education; Seventh edition, 2017.
Reference Books
1 Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Gold Feder, Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
2. William Mougayar, "Business Blockchain Promise, Practice and Application of the Next Internet Technology", John Wiley & Sons 2016.
3. Don, Alex Tapscott, "Blockchain Revolution". Portfolio Penguin 2016.
4. Wade Trappe and Lawrence C. Washington, Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education, 2007.
5. Atul Kahate, Cryptography and Network Security, 2nd Edition, Tata McGraw Hill, 2008.
Web References
1.https://www.tutorialspoint.com/cryptography/cryptography_need_for_encryption.htm
2. https://www.simplilearn.com/tutorials/blockchain-tutorial
3. https://www.javatpoint.com/blockchain-tutorial
4. https://www.geeksforgeeks.org/difference-between-rsa-algorithm-and-dsa/
5. https://www.includehelp.com/cryptography/digital-signature-algorithm-dsa.aspx

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	-	-	-	-	-	3	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 Method

Assessment	Continuous Assessment Marks (CAM) – Maximum 50 Marks									#End Semester Examination (ESE) Marks (Theory)	Total Marks
	Continuous Assessment (Theory)					Continuous Assessment (Practical)					
	CAT1	CAT2	Model	Attendance	Total	Conduction of Practical	Report	Viva	Total	#End Semester Examination (ESE) Marks (Practical-Internal Evaluation)	
Marks	5	5	5	5	20*	15	10	5	30*	30	75**	100
*To be weighted for 10 Marks					10	*To be weighted for 10 Marks			10		*To be weighted for 50 Marks	

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **PC**				End Semester Exam Type: **LE**		
Course Code	**U23ADP610**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**NLP AND CHATBOT LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
AI & DS								
Prerequisite	Machine Learning, Deep Learning and Programming in Python							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Apply and develop machine learning models for NLP in Python	**K3**
	CO2 Apply NLP techniques to improve information retrieval.	**K3**
	CO3 Apply and build predictive models.	**K3**
	CO4 Apply various machine learning algorithms for optimizing NLP programs	**K3**
	CO5 Create and implement chatbots and OCR models	**K3**

List of Experiments

1. Design an application for Sentiment Analysis Using Machine Learning
2. Implementation of Resume Screening using Python
3. Creation of Named Entity Recognition using spacy
4. Implement an information retrieval system using cosine similarity and word embeddings (Word2Vec or GloVe) to match user queries to relevant documents.
5. Create a language model using n-grams or neural networks (e.g., LSTM or GPT) to predict the next word in a sequence.
6. Compare and evaluate various machine learning algorithms (e.g., Naive Bayes, SVM, Random Forest) for NLP tasks like sentiment analysis, text classification, or NER.
7. Create a rule-based or ML-based chatbot using frameworks like Rasa or NLTK, capable of holding basic conversations with users.
8. Develop an OCR system using Python's DocTR library to extract text from images or scanned documents.
9. Create a rule-based or ML-based chatbot using frameworks like Rasa or NLTK, capable of holding basic conversations with users.
10. Implement a speech-to-text (STT) and text-to-speech (TTS) system using Python libraries like Google Speech API or pyttsx3.

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

Reference Books

1. "Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit", Steven Bird, Ewan Klein, and Edward Loper ,2nd Edition (2023)
2. Deep Learning with Python",2nd Edition (2021), François Chollet.
3. "Building Chatbots with Python: Using Natural Language Processing and Machine Learning" by Sumit Raj,1st Edition (2019)
4. "Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2".,3rd Edition (2022), Sebastian Raschka and Vahid Mirjalili

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1. https://realpython.com/
2. https://www.analyticsvidhya.com/blog/2021/06/nlp-application-named-entity-recognition-ner-in-python-with-spacy/
3. https://realpython.com/python-nltk-sentiment-analysis/
4. https://realpython.com/build-a-chatbot-python-chatterbot/
5. https://nanonets.com/blog/ocr-with-tesseract/

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	-	-	1	-	-	-	-	-	-	3	2	-
2	3	2	3	-	-	1	-	-	-	-	-	-	3	2	-
3	3	2	3	-	-	1	-	-	-	-	-	-	3	2	-
4	3	2	3	-	-	1	-	-	-	-	-	-	3	2	-
5	3	2	3	-	-	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
	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	**VI**	Course Category Code: **PC**				End Semester Exam Type: **LE**		
Course Code	**U23ADP611**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ROBOTIC PROCESS AUTOMATION – UI PATH LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
AI & DS								
Prerequisite	**UI Path Tools**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Implementation of RPA – UI path	**K3**
	CO2 Develop an application for web scraping, data mitigation and entry process.	**K3**
	CO3 Apply query processing in email and customer support emails.	**K3**
	CO4 Develop credit card applications.	**K3**
	CO5 Apply the automation process in excel and pdf.	**K3**

List of Exercises

1. Extract data from Google Contacts using an API and store it in a structured file format (e.g., CSV, Excel).
2. Extract data from an Excel file based on specific conditions and store the results in a new Excel file.
3. Segregate emails based on email IDs and organize them into respective folders within Outlook using automation.
4. Extract data from various invoice documents, store the data in an Excel file, and automatically send an email to the specified email addresses.
5. Develop a system to send automated replies to emails that contain specific text in the subject line.
6. Automate the scheduling and processing of daily financial reports using UiPath to streamline reporting for a company.
7. Automate the approval process of corporate expense reports using UiPath to enhance efficiency in expense management.
8. Automate the process of credit card application processing, including validation and approval workflows, using UiPath.
9. Automate the calculation of employee payroll by extracting data from Excel sheets, applying business rules, and generating the final payroll.
10. Extract data from PDF invoices and automate the process of storing this information in an organized format (e.g., Excel) using UiPath.

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

Reference Books

1.A. Tripathi, “Learning Robotic Process Automation: Create Software robots and automatebusiness processes with the leading RPA tool - UiPath: Create Software robots with the leadingRPA tool – UiPath”, Packt Publishing, 2018.
2.K. Wibbenmeyer, “The Simple Implementation Guide to Robotic Process Automation (RPA): How to Best Implement RPA in an Organization", iUniverse,2018.
3.S. Merianda, “Robotic Process Automation Tools, Process Automation and Their Benefits: Understanding RPA and Intelligent Automation”, Createspace.,2018.
4.M. Lacity, L. Willcocks, “Robotic Process and Cognitive Automation: The Next Phase”, Steve Brookes Publishing.
5.Tom Taulli, “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, 2020.

Web References

1.https://www.edureka.co/blog/rpa-projects
2.https://www.edureka.co/blog/uipath-automation-examples
3.https://mindmajix.com/30-rpa-examples

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	2	-	-	-	-	-	-	-	2	3	3
2	2	3	3	2	2	-	-	-	-	-	-	-	3	3	3
3	2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	3
5	2	3	2	2	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	**III/ V**	Course Category: **PC**				End Semester Exam Type: **P**		
Course Code	**U23CSPC06**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**WEB DESIGNING LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to CSE and AI&DS)

Prerequisite	Basic knowledge in Programming and Database	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Construct and display webpage with HTML and CSS elements	**K3**
	CO2 Implement JavaScript programming for website creation	**K3**
	CO3 Design PHP Forms	**K3**
	CO4 Implement Database connectivity using PHP	**K3**
	CO5 Web hosting PHP applications.	**K3**

List of Exercises

1. (a) Design a home page which displays information about your college department using headings, HTML entities and paragraphs.
   (b) Create a webpage for any clinic using marquee and HTML formatting tags.
2. Design a timetable and display it in tabular format.
3. Design an admission form for any course in your college with text, password fields, drop-down list, check-boxes, radio buttons, submit and reset button etc.
4. Design a web page of your home town with an attractive background color, text color, an image, font face by using Inline CSS formatting.
5. (a) Design a web page by using different CSS border styles.
   (b) Demonstrate the use of CSS Box Model.
6. Write a JavaScript program to remove a character at the specified position of a given string and return the new string.
7. Develop and demonstrate a HTML file that includes JavaScript script for taking a number n as input using prompt and display first n Fibonacci numbers in a paragraph.
8. Design HTML form for keeping student record, apply JavaScript validation in it for restriction of mandatory fields, numeric field, email-address field, specific value in a field etc.
9. Write a program in PHP for processing a simple form (use controls like checkbox, radio buttons and options).
10. Write a program in PHP for a simple POST and GET functions
11. Design a login form using cookies, bootstrap, PHP, Database.
12. Design a student form with add, update, delete, display all and search option using student database.

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

Reference Books

1. Nixon Robin, “Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5”, O’Reilly Media, 5th edition, 2018.
2. Lyza Danger Gardner, "Java Script on Things: Hacking Hardware for Web Developers", Dreamtech Press, 1st Edition, 2018.
3. Steven Suehring, Janet Valade, “PHP, MySQL, JavaScript & HTML5 All-in-One”, John Wiley and Sons Inc, 2017.
4. Keith Wald, Jason Lengstorf, “Pro PHP and jQuery”, Paperback, 2016.
5. Laura Lemay, Rafe Colburn, "Mastering HTML, CSS and Javascript Web", BPB Publications, First edition, 2016.

Web References

1. https://www.w3schools.com/php/DEFAULT.asp
2. https://www.tutorialspoint.com/php/index.html
3. https://www.phptpoint.com/php-tutorial/
4. https://www.javatpoint.com/php-tutorial
5. https://www.w3schools.com/html/default.asp

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	3	3	3	3	3	-	2	3	-	3	3	3
2	3	3	3	3	-	3	-	3	-	2	-	2	2	2	-
3	2	2	2	2	2	2	3	3	-	3	3	-	2	2	2
4	2	2	2	2	2	2	-	3	-	3	-	3	3	3	-
5	3	3	3	3	3	3	3	3	-	3	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
	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	**VI**	Course Category Code: **PE**			End Semester Exam Type: **TE**		
Course Code	**U23ADE610**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**SPEECH PROCESSING AND ANALYTICS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI & DS								
Prerequisite	Natural Language Processing							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Identify the different linguistic components of natural language	**K2**
	CO2	Interpret a morphological analyzer for a given natural language and apply it for analyzing speech effectively	**K2**
	CO3	Decide on the appropriate parsing techniques necessary for a given language and application	**K2**
	CO4	Apply new tag set and a tagger for a given natural language	**K3**
	CO5	Interpret various techniques in speech recognition and apply them for text to speech conversion	**K2**

UNIT-I	**Speech Processing**	**Periods: 9**	
Phonetics –Articulatory Phonetics -Phonological Categories -Acoustic Phonetics and Signals Speech Synthesis –Text Normalization –Phonetic and Acoustic Analysis -Diphone Waveform synthesis –Evaluation-Automatic Speech Recognition – Architecture -Hidden Markov Model to Speech -MFCC vectors -Acoustic Likelihood Computation -Evaluation. Triphones – Discriminative Training -Modeling Variation. Computational Phonology- Finite-State Phonology –Syllabification -Learning Phonology and Morphology			**CO1**
UNIT-II	**Speech Analysis**	**Periods:9**	
Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths			**CO2**
UNIT-III	**Speech Modeling**	**Periods:9**	
Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units, Applications and present status.			**CO3**
UNIT-IV	**Speech Recognition**	**Periods:9**	
Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, The Homomorphic Vocoder.			**CO4**
UNIT-V	**Speech Synthesis**	**Periods:9**	
Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.			**CO5**

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

Text Books

1. K. Sreenivasa Rao and Manjunath K E, “Speech Recognition Using Articulatory and Excitation Source Features”, 2017
2. Uday Kamath, John Liu and James Whitaker, “Deep Learning for NLP and Speech Recognition”, 2019
3. Fouad Sabry, “Speech Recognition: Fundamentals and Applications”, 2023
4. Jurafsky and Martin, “Speech and Language Processing”, Pearson Prentice Hall, Second Edition, 2008.

Reference Books

1. Saxena, V. N, “Speech Signal Processing: Using Matlab”, Khanna Publishing, 2017.
2. Vuppala, R. A. O, “Speech Processing in Mobile Environments”, Springer, 2018.
3. Udayashankara. V**, “**Modern Digital Signal Processing”, PHI Learning, 2017.

Web References

1. https://onlinecourses.nptel.ac.in/noc24_ee118/previewhttps://www.electrical4u.com/
2. https://www.coursera.org/courses?query=speech%20recognition
3. https://www.shiksha.com/online-courses/speech-recognition-certification
4. https://web.ece.ucsb.edu/Faculty/Rabiner/ece259/speech%20course.h

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	2	3	-	-	-	-	-	-	-	3	2	1
2	3	3	3	2	3	-	-	-	-	-	-	-	3	3	2
3	3	3	3	2	3	-	-	-	-	-	-	-	3	2	2
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	2
5	3	3	3	3	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	10		5	5	5	75	100

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

Department	**Information Technology**	Programme: **B.Tech.**						
Semester	**VIII/VI**	Course Category Code: **PE**			*End Semester Exam Type:**TE**			
Course Code	**U23ITEC05**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Augmented Reality and Virtual Reality**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(Common to IT, AIDS and ECE)								

Prerequisite	Computer Graphics	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the fundamentals of Virtual reality	**K2**
	CO2 Explain the concepts of motion and tracking in VR systems	**K2**
	CO3 Describe the importance of interaction and audio in VR systems	**K2**
	CO4 Understand and work on Augmented Reality environment	**K2**
	CO5 Explore the application area of augmented and virtual reality	**K3**

Unit- I	**Introduction**	**Periods: 09**
Definition - History - Bird's-Eye View - The Geometry of Virtual Worlds - Geometric Models - Changing Position and Orientation - Axis-Angle Representations of Rotation - Viewing Transformations - Chaining the Transformations - Human Eye - The Physiology of Human Vision : Eye movements - Implications for VR.		**CO1**
Unit- II	**Visual Perception & Rendering**	**Periods: 09**
Visual Perception - Visual Rendering - Ray Tracing and Shading Models – Rasterization - Correcting Optical distortions - Improving Latency and Frame Rates - Motion in Real and Virtual Worlds – Tracking - Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies.		**CO2**
Unit- III	**Interaction & Audio**	**Periods: 09**
Interaction - Motor Programs and Remapping – Locomotion – Manipulation - Social Interaction - Audio - The Physics of Sound - The Physiology of Human Hearing - Auditory Perception – Auditory Rendering - Case Studies: Side effects of using VR systems/ VR sickness		**CO3**
Unit- IV	**Fundamentals of AR**	**Periods: 09**
Introduction to Augmented Reality – Origin of AR – Definition - The Relationship Between Augmented Reality and Other Technologies – AR Concepts – AR Content – Interaction – Mobile AR.		**CO4**
Unit- V	**Applications of Augmented and Virtual Reality**	**Periods: 09**
Applications - Gaming and Entertainment - Science and Engineering - Health and Medicine - Aerospace and Defence – Education.		**CO5**

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

Text Books

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2023
2. Alan B. Crai`g, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013
3. Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability),Steve Aukstakalnis, Addison-Wesley Professional; 1 edition, 2016

Reference Books

1. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006
2. Alan Craig, William Sherman, Understanding Virtual Reality, Second Edition, Morgan Kaufmann, 2018.
3. Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016. ISBN: 9780321883575
4. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India;First edition (12 October 2016), ISBN-10: 9332578494

Web References

1. https://nptel.ac.in/courses/121106013
2. https://onlinecourses.swayam2.ac.in/nou24_ge37/preview
3. http://cambum.net/course-2.htm
4. https://www.youtube.com/watch?v=MGuSTAqlZ9Q

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	2	-	-	-	-	-	-	-	3	2	1
2	2	3	2	2	3	-	-	-	-	-	-	-	3	3	2
3	3	3	3	1	2	-	-	-	-	-	-	-	3	2	1
4	1	2	1	3	3	-	-	-	-	-	-	-	2	2	1
5	2	1	2	3	2	-	-	-	-	-	-	-	1	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		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	**VI**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23ADE611**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ADVANCED JAVA PROGRAMMING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

AI & DS

Prerequisite	Fundamentals of Java Programming, Web Technology	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret and apply the concepts of Java utility packages to create data structures	**K2**
	CO2 Apply proficiency in data structures using Java Collection Framework	**K3**
	CO3 Apply Spring framework in Java for building enterprise Java Applications and auto configure it using YAML	**K3**
	CO4 Interpret various Spring Databases to handle databases at the backend	**K2**
	CO5 Interpret how microservices are helpful in communication using API	**K2**

UNIT-I	**Java Utility Package**	**Periods: 9**	
Introduction to java utility package – Array list – List Interface – HashMap Interface – Set Interface – Queue Interface – Dequeue Interface – Key classes – Utility classes			**CO1**
UNIT-II	**Java Collection Framework**	**Periods: 9**	
Data Augmentation using java collection – linked list – queue – stack – graph – tree – stream API and Functional Programming: Introduction to Streams - Functional Interfaces and Lambda Expression - Optional Class			**CO2**
UNIT-III	**Spring Framework**	**Periods: 9**	
Introduction to spring – bean – dependency injection – inversion of control – bean factory – application context – concepts of auto configuration – properties – yaml			**CO3**
UNIT-IV	**Spring Databases**	**Periods: 9**	
Introduction to spring data – Spring databases – Spring data access - Spring data access– Spring data JPA – MongoDB – spring data JDBC – Spring Boot Integration – Spring Data REST – Spring AOP			**CO4**
UNIT-V	**Microservices in Java**	**Periods: 9**	
Microservices: spring cloud gateway – spring cloud circuit breakers – Open Feign – spring cloud sleuth – Microservices Patterns: aggregators – SAGA-CQRS-event sourcing – Rest API – HTTP method: post-get-put-delete-options-trace – HTTP status codes			**CO5**

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

Text Books

1. Uttam K. Roy, “Advanced Java Programming”, Oxford University Press, 2015
2. Claudio Eduardo de Oliveira, Greg L. Turnquist, Alex Antonov, “Developing Java Applications with Spring and Spring Boot”, Packt Publishing, 7th edition ,2018.
3. John Carnell and Illary Huaylupo Sanchez , "Spring Microservices in Action" , Manning Publications Co ,2nd edition 2021.
4. Craig Walls, “Spring in Action”, Manning, 5th edition, 2018
5. B. Prasanalakshmi , “Advanced Java Programming”, CBS Publishers & Distributors, 2015

Reference Books

1. Cay. S Horstmann and Gary Cornell, “Core Java : Volume II - Advanced Features”, Pearson, 12th Edition, 2023.
2. Rod Johnson, Juergen Hoeller, Alef Arendsen, Thomas R, “Professional Java Development With The Spring Framework”, Wiley India Pvt. Limited, 2009
3. Dr.Rajendra Kawale, “Advanced Java”, Devraj Publications, Mumbai, 2018
4. Holzner, Steven et.al, “Java 2 Programming Black Book”,DreamTech Press, New Delhi, 2009
5. Herbert Schildt, “Complete Reference Java”, Mcgraw Hill Education, New Delhi, 7th Edition, 2021

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1. https://nptel.ac.in/courses/106105084/30
2. https://www.javatpoint.com/java
3. https://www.tutorialspoint.com/java
4. https://javabrains.io/
5. https://spring.io/projects/spring-cloud

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
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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 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	**VI**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23ADE612**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PREDICTIVE DATA ANALYTICS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI & DS								
Prerequisite	Mathematics and Statistics, Python or R, Problem solving skill, Data visualization							

Course Outcomes			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Interpret basic principles of predictive analytics and apply it for building models and applications	**K2**
	CO2	Differentiate various statistical methods used for prediction and evaluate model performance	**K2**
	CO3	Apply classification methods for predictive modeling	**K3**
	CO4	Apply Specialized Techniques to forecast future trends and feature engineering	**K3**
	CO5	Apply Model Interpretability and Integration into Decision-Making	**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		**CO4**
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", OTexts publications, 2nd Edition 2018
2. Friedman, J., Hastie, T., & Tibshirani, R." The Elements of Statistical Learning: Data Mining, Inference, and Prediction," Springer, 2nd Edition, 2009.
3. Hyndman, R. J., & Athanasopoulos, G. Forecasting: Principles and Practice. OTexts, 3rd Edition, 2021

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
3. Bishop, C. M., "Pattern Recognition and Machine Learning", Springer, 2006.
4. James, G., Witten, D., Hastie, T., & Tibshirani, R, "An Introduction to Statistical Learning with Applications in R". Springer, 2013.

Web References

1. https://machinelearningmastery.com/tutorial-first-neural-network-python-keras/
2. https://www.sas.com/en_in/insights/analytics/predictive-analytics.html
3. https://www.kaggle.com/datasets
4. https://archive.ics.uci.edu/ml/index.php
5. https://data.gov/

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	3	-	-	-	-	-	-	-	3	3	-
2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
3	3	3	2	2	3	-	-	-	-	-	-	-	3	3	-
4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
5	3	2	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
	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	**VI**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23ADE613**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ADVANCED NATURAL LANGUAGE PROCESSING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI & DS								
Prerequisite	Python and Natural Language Processing							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Describe the fundamentals of natural language processing and apply it for language modeling	**K2**
	CO2	Interpret various word level analysis for syntactic parsing	**K2**
	CO3	Interpret various techniques for handling word senses and semantics	**K2**
	CO4	Apply different and advanced techniques for handling discourses and Lexical Resources.	**K3**
	CO5	Interpret the modern NLP concepts and apply in it in building real time applications.	**K2,K3**

UNIT-I	**Introduction**	**Periods: 9**
Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.		**CO1**

UNIT-II	**Word Level Analysis**	**Periods:9**
Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Hidden Markov and Maximum Entropy models. syntactic analysis-Context-Free Grammars, Grammar rules for English, Dynamic Programming, Parsing – Shallow 85 parsing –PCFG, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures**.**		**CO2**

UNIT-III	**Semantics and Pragmatics**	**Periods:9**
Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.		**CO3**

UNIT-IV	**Discourse Analysis and Lexical Resources**	**Periods:9**
Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).		**CO4**

UNIT-V	**Modern NLP**	**Periods:9**
Language encoding and decoding - Multilingual multimedia Encoding - Deep Neural Networks for NLP - Meta-learning for NLP - Joint Neural Networks For Information Extraction - Multilingual Information Extraction - Multimedia Information Extraction - Open DOmain Information Extraction - Schema Induction and Knowledge Acquistion - Misinformation detection - Question Answering - Natural Language Generation - Knowledge Controlled Language Generation.		**CO5**

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

Text Books

1. Raymond S.T.Lee, “Natural Language Processing:A Textbook with Python Implementation”, Springer Nature, 2023.
2. Yue Zhang and Zhiyang Teng, “Natural Language Processing:A Machine Learning Perspective”, Cambridge University Press,2021
3. Irum Hafeez Sodhar and Abdul Hafeez Buler, “Natural Language Processing:Applications,techniques and Challenges”, Akinik Publications, 2020.

Reference Books

1. Roussanka Loukanova, “Natural Language Processing in Artificial Intelligence” ,Springer Nature,2020.
2. Akshay kulkarani and Adarsha Shivananda, “Natural Language processing Recipes”, Apress,2019.
3. Brian McMahan and Delip Rao,”Natural Language Processing with Pytorch:Build Intelligent Language Applications using Deep Learning”, O’Reilly Media, 2019.
4. Sowmya Vajjala,Bodhisattwa Majumder,Anuj Gupta and Harshit Surana, “Practical Natural Language Processing” ,First Edition,O’Reilly Media, 2020
5. Lewis Tunstall,Leondro von Werra,Thomas Wolf, “Natural Language Processing with Transformers:Building Language Applications with Hugging Face,Revised Colour Edition”, First Edition, Shroff/O.Reilly Media, 2022.

Web References

1. https://aws.amazon.com/whatis/nlp/#:~:text=Natural%20language%20processing%20(NLP)%20is,manipulate%2C%20and%20comprehend%20human%20language.https://www.electrical4u.com/
2. https://www.tutorialspoint.com/natural_language_processing/natural_language_processing_syntactic_analysis.htm
3. https://linguistics.uga.edu/research/content/pragmatics-and-discourse-analysis#:~:text=Pragmatics%20and%20Discourse%20Analysis%20involve,relation%20to%20its%20social%20context.
4. https://nlpoverview.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	-	2	2	-	-	-	-	-	-	1	-	2	2
2	3	2	-	2	2	-	-	-	-	-	-	1	-	2	2
3	3	2	-	2	2	-	-	-	-	-	-	1	-	2	2
4	3	2	-	2	2	-	-	-	-	-	-	1	-	2	2
5	3	2	-	2	2	-	-	-	-	-	-	1	-	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	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	**VI**	Course Category Code: **PA**				*End Semester Exam Type: **-**		
Course Code	**U23ADW602**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MINI PROJECT**	**0**	**0**	**2**	**1**	**100**	**-**	**100**
AI & DS								
Prerequisite	Artificial Intelligence, Machine Learning, Deep Learning, Programming in C, Python, Java							

Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Identify the problem statement for the mini project work through the literature survey	**K2**
	CO2	Choose the proper components as per the requirements of the design/ system**.**	**K2**
	CO3	Apply the acquainted skills to develop final model/system	**K3**

There shall be a Mini Project, which the student shall pursue as a team consists of maximum 4 students during the third year, fifth semester. The aim of the mini project is that the student has to understand the real time hardware / software applications. The student should gain a thorough knowledge in the problem he/she has selected and in the hardware / software he/she using in the Project. The Mini-project is an application that should be formally initiated and should be developed and also to be implemented by the respective team.

The Mini Project shall be submitted in a report form along with the hardware model / software developed, duly approved by the department internal evaluation committee. It shall be evaluated for 100 marks as Continuous Assessment. The department internal evaluation committee shall consist of faculty coordinator, supervisor of the project and a senior faculty member of the department. There shall be two reviews that will be considered for assessing a Mini Project work with weightage as indicated evaluation Methods.

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

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	-	-	-	-	3	3	-	1	1	1	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	2	2
3	3	2	2	1	-	2	-	-	3	3	3	1	2	2	2

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

Evaluation Method

Assessment	**Review 1**			**Review 2**				**Total Marks**
	Novelty	**Presentation**	**Viva**	**Presentation**	**Demonstration**	**Viva**	**Report**	
Marks	10	20	10	20	20	10	10	100

Department	**Artificial Intelligence and Data Science**	Programme: **B. Tech.**						
Semester	**VI**	Course Category: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23ADC6XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - VI**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
AI & DS								
Prerequisite	**-**							

Students shall choose an International / Reputed organization certification course of 40-50 hours duration specified in the curriculum (It is mandatory to do a minimum of six courses) which will be offered through the Centre of Excellence. These courses have no credit and will not be considered for CGPA calculation.

(i) Certification Courses are required to be completed to fulfil the degree requirements. All Certification courses are assessed internally for 100 marks.

(ii) The Course coordinator handling the course will assess the student through attendance and MCQ test, and declare the student as “pass” on satisfactory completion. A letter grade “P” is awarded to declare pass.

(iii) The marks scored in these courses will not be taken into consideration for the SGPA / CGPA calculations in the grade sheet.

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	**VI**	Course Category: **MC**			End Semester Exam Type: -			
Course Code	**U23ADM606**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**GENDER EQUALITY**	**2**	**0**	**0**	**-**	**100**	**-**	**100**

Prerequisite	**-**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the general identity, social construction of gender roles.	**K2**
	CO2 Illustrate the causes and issues of gender discrimination in Indian society.	**K2**
	CO3 Describe the workplace discrimination, media influences on gender and culture.	**K2**
	CO4 Familiarize with international and Indian frameworks on gender equality.	**K2**
	CO5 Illustrate the current challenges in gender equality, including the glass ceiling and the role of technology.	**K2**

UNIT – I	**Introduction to Gender Equality**	**Periods:06**
Gender equality – exploring gender identity and expression, Understanding the social construction of general roles and norms, historical perspectives on gender roles, Analyzing key milestones in the fight for gender equality.		**CO1**
UNIT – II	**Gender Inequality and Its Manifestations**	**Periods:06**
Gender discrimination in Indian society – causes of gender inequality – Illiteracy, patriarchal set up, lack of awareness, social beliefs, practice and custom – Issues of gender discrimination – Child marriage, child domestic work, poor education and health, violence and exploitation in workplace.		**CO2**
UNIT – III	**Gender and Culture**	**Periods:06**
Workplace discrimination, Media influences on gender and culture, Gender and power dynamics in society. Strategies for promoting gender equality and cultural understanding.		**CO3**
UNIT – IV	**Promoting Gender Equality**	**Periods:06**
Gender Equality and Human Rights – International frameworks and Conventions on Gender Equality – Equality under the Indian Constitution – Policies and initiatives for gender mainstreaming – Strategies for promoting Gender Equality in various contexts.		**CO4**
UNIT – V	**Contemporary Challenges and Future Directions**	**Periods:06**
Current challenges and emerging issues in gender equality – Glass ceiling – role of technology in continuing or challenging gender inequality – Exploring possibilities for transformative change and envisioning a gender-equal future.		**CO5**

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

Text Books

1. "Gender and Society" by Raewyn Connell – This book provides a comprehensive overview of gender roles, power dynamics, and the social construction of gender.
2. "The Second Sex" by Simone de Beauvoir – A historical and philosophical examination of women's oppression and gender inequality.
3. "Women and Gender in the Indian Society" by Neera Desai and Usha Thakkar – Focuses on the context of gender roles, inequality, and feminist movements in India.

Reference Books

1. Woman in early Indian societies, New Delhi: Manohar Publications. Sita A. Raman (2009).
2. A social and Cultural history, Volume1. Connecticut: Oxford: Praeger. Sita Raman (2009).
3. A social and Cultural history, Volume2. Connecticut: Oxford: Praeger.
4. Iftikhar R. (2016). Indian Feminism: Class, Gender and Identity in Medieval Ages. Chennai: Notion Press. Iftikhar, R. (2012).

Web References

1. https://www.unwomen.org
2. https://ncw.nic.in
3. https://en.unesco.org/themes/gender-equality
4. https://www.weforum.org/reports
5. https://wcd.nic.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	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
2	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
3	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
4	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1

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

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	**V/VI**	Course Category Code: **OE**			*End Semester Exam Type:**TE**		
Course Code	**U23ADDC02**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**PRINCIPLE OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics)

Prerequisite	NIL	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret foundational principles of artificial intelligence	**K2**
	CO2 Identify formal methods of knowledge representation	**K2**
	CO3 Interpret the fundamental issues and challenges of Reasoning	**K2**
	CO4 Apply mathematical relationships with Machine Learning algorithms for real world applications	**K3**
	CO5 Identify various deep learning and reinforcement learning techniques to improve the efficiency of models	**K2**

Unit- I	**Introduction**	**Periods: 09**	
Introduction to Artificial Intelligence - Artificial Intelligence Problems -Timelines of Artificial Intelligence - Production Systems - State Space Representation - Branches of Artificial Intelligence - Application of Artificial Intelligence.			**CO1**
Unit- II	**Knowledge Representation**	**Periods: 09**	
Knowledge Management - Types of Knowledge - Knowledge representation - Approaches to Knowledge representation - Issues in Knowledge representation - Knowledge base. First order Logic – Frames — Conceptual Dependency.			**CO2**
Unit- III	**Reasoning**	**Periods: 09**	
Types of reasoning - reasoning with Fuzzy Logic - Rule based Reasoning - Diagnosis Reasoning.			**CO3**
Unit- IV	**Learning**	**Periods: 09**	
Types of Learning - Machine Learning - Intelligent agents - Association Learning: Apriori Algorithm - Case Study: Customer Sequence and SCADA Application – k-Means Clustering - Fuzzy Clustering - Cluster Similarity			**CO4**
Unit- V	**Reinforcement and Statistical Learning**	**Periods: 09**	
Markov Decision Problem - Hidden Markov Model - Linear Classifier - decision Trees: Random forest - Bayesian Network – ANN - ANN Learning process - Types of Network – Perceptron - RBF Network - Case studies: Character recognition.			**CO5**

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

Text Books

1. Anand Hareendran S., Anand Hareendran, And Vinod Chandra S.S. “Artificial Intelligence and Machine Learning” PHI Publication, 2014.
2. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Science, 1997.
3. Peter Harrington, “Machine Learning in action”, Manning Publication, 2012.

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.

Web References

1. https://www.coursera.org/learn/machine-learning
2. https://ml-cheatsheet.readthedocs.io/en/latest/regression_algos.html
3. https://machinelearningmastery.com/a-tour-of-machine-learning-algorithms

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	-	-	-	-	-	-	-	2	2	2
2	1	2	2	–	–	-	-	-	-	-	-	-	1	1	-
3	2	2	1	2	–	-	-	-	-	-	-	-	-	1	1
4	3	2	2	2	1	-	-	-	-	-	-	-	1	-	1
5	2	2	2	2	1	-	-	-	-	-	-	-	1	1	2

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	**V/VI**	Course Category Code: **OE**			*End Semester Exam Type:**TE**			
Course Code	**U23ADOC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INTRODUCTION TO DATA SCIENCE**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics)

Prerequisite	NIL	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explore the fundamental concepts of data science.	**K2**
	CO2 Interpret the Mathematical Knowledge for Data Science requires to manipulate the given data	**K2**
	CO3 Visualize and present the inference using various tools.	**K3**
	CO4 Identify different opportunities in Industries and realize it in applications	**K2, K3**
	CO5 Interpret the ethics needed for maintaining privacy, data sharing and decision-making.	**K2**

Unit- I	**Introduction to Data Science**	**Periods: 09**
Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Who is Data Scientist - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modeling – Presentation.		**CO1**
Unit- II	**Mathematical Preliminaries**	**Periods: 09**
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.		**CO2**
Unit- III	**Data Science Tools**	**Periods: 09**
Introduction to Data Science Tool – Data Cleaning Tools – Data Munging and Modelling Tools – Data Visualization Tools – Tools for Data Science.		**CO3**
Unit- IV	**Industrialization, Opportunities and Applications**	**Periods: 09**
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.		**CO4**
Unit- V	**Ethics and Recent Trends**	**Periods: 09**
Data Science Ethics – Doing good data science – Owners of the data - Valuing different aspects of privacy - Getting informed consent - The Five Cs – Diversity – Inclusion – Future Trends.		**CO5**

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

Text Books

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, “Introducing Data Science”, Manning Publications Co., 1st edition, 2016.
2. Chirag Shah, “A Hands on Introduction to Data Science“, Cambridge University Press, 2020.
3. SinanOzdemir, “Principles of Data Science”, Packt Publication, 2016.
4. D J Patil, Hilary Mason, Mike Loukides, “Ethics and Data Science”, O’ Reilly, 1st edition, 2018.

Reference Books

1. Hector Guerrero, “Excel Data Analysis: Modeling and Simulation”, Springer International Publishing, 2nd Edition, 2019.
2. Paul Curzon, Peter W. Mc Owan, “The Power of Computational Thinking”, World Scientific Publishing, 2017.
3. Steven S. Skiena, “Data Science Design Manual”, Spring International Publication, 2017.
4. Rajendra Akerkar, Priti Srinivas Sajja, “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.youtube.com/watch?v=-ETQ97mXXF0&ab_channel=edureka%21
2. https://www.javatpoint.com/data-science
3. https://www.coursera.org/browse/data-science /

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	2	2	2	2	-	-	-	-	-	-	-	-	-	-
2	2	2	2	1	1	-	-	-	-	-	-	-	-	-	-
3	2	1	2	2	1	-	-	-	-	-	-	-	-	1	-
4	1	2	2	1	1	-	-	-	-	-	-	-	-	-	-
5	2	1	1	2	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
	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

	DATA SCIENCE APPLICATION OF VISION	L	T	P	C	Hrs
U23ADOC02	(Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To understand the capability of a machine to get and analyze visual information and make decisions
- To learn methods and algorithms for Vision
- To learn how to use deep learning for Vision tasks
- To understand the neural network concepts
- To study the real world applications using computer vision

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the methods and algorithms for image processing. **(K2)**
CO2 - Apply object detection and segmentation concepts for image processing. **(K4)**
CO3 - Apply scalable algorithms for large datasets in vision. **(K4)**
CO4 - Analyze deep learning and neural network architectures for image and video processing. **(K3)**
CO5 - Apply vision-based solutions for specific real-world applications. **(K4)**

UNIT I IMAGE FUNDAMENTALS (9 Hrs)

Pixels - The Building Blocks of Images - The Image Coordinate System - RGB and BGR Ordering - Scaling and Aspect Ratios. Image filters - Gaussian blur - Median filter - Dilation and erosion - Custom filters - Image thresholding - Edge detection - Sobel edge detector - Canny edge detector.

UNIT II OBJECT DETECTION AND SEGMENTATION (9 Hrs)

Image Features - Harris corner detection - Local Binary Patterns - Image stitching - Segmentation: Contour detection - The Watershed algorithm - Super pixels - Normalized graph cut.

UNIT III MACHINE LEARNING WITH COMPUTER VISION (9 Hrs)

Data pre-processing - Image translation through random cropping - Image rotation and scaling - Applications of machine learning for computer vision - Logistic regression - Support vector machines - K-means clustering.

UNIT IV IMAGE CLASSIFICATION USING NEURAL NETWORKS (9 Hrs)

Image Classification Basics Types of Learning - The Deep Learning Classification Pipeline - Introduction to Neural Networks - The Perceptron Algorithm - Backpropagation and Multi-layer Networks - The Four Ingredients in a Neural Network Recipe - Weight Initialization - Constant Initialization - Uniform and Normal Distributions - LeCun Uniform and Normal - Understanding Convolutions - CNN Building Blocks - Common Architectures and Training Patterns.

UNIT V COMPUTER VISION AS A SERVICE (9 Hrs)

Computer vision as a service – architecture - Developing a server-client model - Computer vision engine.

Text Books

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2009.
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis and Machine Vision”, Third Edition, Cengage Learning, 2007.
3. Gary Bradski, “Learning OpenCV”, First Edition, 2008.

Reference Books

1. Alok Kumar Singh Kushwaha, Rajeev Srivastava, “Recognition of Humans and Their Activities for Video Surveillance”, IGI Global, 2014.
2. Ying-li Tian, Arun Hampapur, Lisa Brown, Rogerio Feris, Max Lu, Andrew Senior, “Event Detection, Query, and Retrieval for Video Surveillance”, IGI Global, 2009.
3. Matthew Turk, Gang Hua, “Vision-based Interaction”, First Edition, Morgan Claypool, 2013.
4. Ian Goodfellow, Yoshuo Bengio, Aaron Courville, “Deep Learning (Adaptive Computation and Machine Learning series)”, MIT Press, 2017.
5. Fan Jiang, “Anomalous Event Detection from Surveillance Video”, ProQuest, 2012.

Web Resources

1. https://www.kaggle.com/learn/computer-vision
2. https://machinelearningmastery.com/what-is-computer-vision/
3. https://www.udemy.com/course/pythoncv/
4. https://www.analyticsvidhya.com/blog/2019/03/opencv-functions-computer-vision-python/
5. https://www.youtube.com/watch?v=N81PCpADwKQ&ab_channel=ProgrammingKnowledge

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	2	-
2	2	1	1	2	–	-	-	-	-	-	-	-	1	1	1
3	2	2	2	1	–	-	-	-	-	-	-	-	-	-	1
4	1	2	2	2	1	-	-	-	-	-	-	-	1	2	-
5	2	1	2	2	1	-	-	-	-	-	-	-	1	1	1

U23ADOC03	ARTIFICIAL INTELLIGENCE APPLICATIONS (Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To study the basic design concept of AI.
- To understand the Machine learning concepts.
- To learn the concept of Deep learning and its applications
- To learn the concept of RPA.
- To acquire the skill to design a chatbot using NLP.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Apply the concept of data science. **(K4)**

CO2 - Understand the concept of Machine learning. **(K2)**

CO3 - Understand the concept of Deep Learning. **(K2)**

CO4 - Apply the design ideas in RPA. **(K4)**

CO5 - Make use of NLP concepts to create chatbot. **(K3)**

UNIT I INTRODUCTION (9 Hrs)

Introduction – Alan Turing and Turing test - The rise and fall of expert system - technological drivers of modern AI - Structure of AI - Data: types of Data - Big Data - Database and other tools - Data Process - Ethics and Governance - Data terms.

UNIT II MACHINE LEARNING (9 Hrs)

Machine learning - Standard deviation - the normal distribution - Naive Bayes Classifier - K-Nearest Neighbor - Linear regression - K-Means Clustering.

UNIT III DEEP LEARNING (9 Hrs)

Deep Learning - Difference between Deep Learning and Machine learning – ANN – Backpropagation – RNN – CNN – GAN - Deep Learning Applications - Use Case: detecting Alzheimer's Disease - Deep Learning Hardware - When to use Deep Leaning? - Drawbacks of deep learning.

UNIT IV ROBOTIC PROCESS AUTOMATION (9 Hrs)

RPA - pros and cons of RPA - Determine the right function to automate - assess the processes - RAP and AI - RPA in the real world.

UNIT V NATURAL LANGUAGE PROCESSING (9 Hrs)

Challenges of NLP - Understanding How AI translated Language - NLP in real World - Voice Commerce - Virtual assistants – Chatbot - Future of NLP - The Future of AI.

Text Books

1. Daniel Jurafsky, James H. Martin, "Speech and Language Processing" Third Edition. 2000.
2. S. Kanimozhi Suguna, M. Dhivya, Sara Paiva, "Artificial Intelligence (AI) Recent Trends and Applications" CRC Press, 2021.
3. Navin Sabharwal; Amit Agrawal, "Cognitive Virtual Assistants Using Google Dialogflow" Apress, 2020.

Reference Books

1. Durkin, J., "Expert systems Design and Development", Macmillan, 1994.
2. Peter Jackson, "Introduction to Expert Systems", Addison Wesley Longman, 1999.
3. Amir Shevat," Designing Bots: Creating Conversational Experiences" O'Reilly, 2017.
4. Anik Das and Rashid Khan,"Build Better Chatbots: A Complete Guide to Getting Started with Chatbots" Apress,2017.
5. Akhil Mittal "Getting Started with Chatbots: Learn and create your own chatbot with deep understanding of Artificial Intelligence and Machine Learning" BPB Publications,2019

Web Resources

1. https://www.javatpoint.com/application-of-ai

2. https://pytorch.org/tutorials/beginner/chatbot_tutorial.html
3. https://www.mygreatlearning.com/blog/basics-of-building-an-artificial-intelligence-chatbot/
4. 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/
5. http://www.umsl.edu/~joshik/msis480/chapt11.htm

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	1	1	-	-	-	-	-	-	-	-	1	2
2	2	1	1	1	2	-	-	-	-	-	-	-	1	1	1
3	2	2	1	2	2	-	-	-	-	-	-	-	-	1	1
4	1	2	2	2	1	-	-	-	-	-	-	-	2	-	1
5	2	2	2	2	1	-	-	-	-	-	-	-	1	1	-

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **PC**				*End Semester Exam Type:**TE**		
Course Code	**U23ADH401**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Parallel Programming and High Performance Computing** (AI&DS)	**3**	**1**	**-**	**4**	**25**	**75**	**100**

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	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	2	3	3	2	3	-	-	-	-	-	-	-	2	3	3
5	3	3	3	2	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		5	5	5	75	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**V**	Course Category: **PC**			*End Semester Exam Type:**TE**			
Course Code	**U23ADH502**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Deep Learning** (AI&DS)	**3**	**1**	**-**	**4**	**25**	**75**	**100**

Prerequisite	Machine Learning Techniques	
Course Outcome	**On of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand basic neural network activation function and loss functions.	**K3**
	CO2 Able to apply different Convolutional Neural Network.	**K3**
	CO3 Understand different deep learning regularization and optimization methods.	**K3**
	CO4 Understand different Neural Network Model	**K3**
	CO5 Analyze main variants of deep learning (convolutional, recurrent, reinforcement and generative architectures), and their typical applications	**K4**

UNIT – I completion	**Foundations Of Neural Networks**	**Periods:9**
Neural Networks: The Biological Neuron-The Perceptron - Multilayer Feed - Forward Networks - Training Neural Networks: Backpropagation Learning - Activation Functions: Linear – Sigmoid – Tanh - Hard Tanh – Softmax -Rectified Linear - Loss Functions: Loss Function Notation - Loss Functions for Regression - Loss Functions for Classification - Loss Functions for Reconstruction - Hyperparameters: Learning Rate – Momentum – Sparsity -Understanding Convolutions.		**CO1**
UNIT – II	**CNN**	**Periods:9**
CNN Building Blocks: Layer Type - Convolutional Layer - Activation Layer - Pooling Layer - Fully Connected Layer -Batch Normalization – Dropout - Common architecture and Training Pattern - LeNet-5 - AlexNet - VGG16 net - ResNet.		**CO2**
UNIT – III	**Optimization**	**Periods:9**
Regularization - Dropout Regularization - Normalizing Inputs- Vanishing / Exploding Gradients - Weight Initialization - Numerical Approximation of Gradients - Gradient Checking. Mini-batch Gradient Descent - Exponentially Weighted Averages - Bias Correction in Exponentially Weighted Averages - Gradient Descent with Momentum - Adam Optimization Algorithm - Learning Rate Decay - The Problem of Local Optima - Transfer learning and Fine tuning.		**CO3**
UNIT – IV	**RNN**	**Periods:9**
Building and improving Feed Forward Language Model - RNN - Bidirectional RNN – LSTM – GRU - Seq2Seq paradigm - multilength Seq2Seq.		**CO4**
UNIT – V	**Deep Generative Models**	**Periods:9**
Neural nets for sequences-Recurrent Nets Long-Short-Term-memory-Introduction to Deep unsupervised learning autoencoders-PCA to autoencoders- Deep Generative Models- Generative Models and Variational Inference-Autoregressive Models and Invertible Transformations - Adversarial Learning -Adversarial Variational Bayes: Unifying Variational Autoencoders and Generative Adversarial Networks - Adversarial Autoencoders- Evaluation of Generative Models-A Lagrangian Perspective on Latent Variable Generative Modeling-Geometry Of Deep Generative Models-Application-Model based Reinforcement Learning		**CO5**

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

Textbooks

1. Eugene Charniak, “Introduction to Deep Learning”, MIT Press, 2019.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 1st Edition, 2016
3. Charu C. Aggarwal, “Neural Networks and Deep Learning”, Springer, 2018

References

1. Cosma Rohilla Shalizi, “Advanced Data Analysis from an Elementary Point of View”, Cambridge University Press, 2015.
2. Deng & Yu, “Deep Learning: Methods and Applications”, Now Publishers, 2014
3. Michael Nielsen, “Neural Networks and Deep Learning”, Determination Press, 2015.
4. Josh Patterson, Adam Gibson, “Deep Learning A Practitioner's Approach”, O'Reilly Media, 2017.
5. Nikhil Buduma, “Fundamentals of Deep Learning”, O’Reilly, 2017.

Web References
1. https://nptel.ac.in/courses/106/106/106106184/
2. http://deeplearning.net/Dj
3. https://developer.nvidia.com/blog/even-easier-introduction-cuda/

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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	2	3	3	2	3	-	-	-	-	-	-	-	2	3	3
5	3	3	3	2	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		5	5	5	75	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**VI**	Course Category: **PC**			*End Semester Exam Type:**TE**			
Course Code	**U23ADH603**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Reinforcement Learning** (AI&DS)	**3**	**1**	**-**	**4**	**25**	**75**	**100**

Prerequisite	Artificial Intelligence, Deep Learning	
Course Outcome	**On of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the basics of probability	**K3**
	CO2 Formalize problems as Markov Decision Processes	**K3**
	CO3 Understand basic exploration methods and the exploration/exploitation trade-offs	**K3**
	CO4 Understand value functions, as a general-purpose tool for optimal decision-making	**K3**
	CO5 Know how to implement dynamic programming as an efficient solution approach to an industrial control problem	**K4**

UNIT – I	**Introduction and Probability Primer**	**Periods:9**
Course logistics and overview. Origin and history of Reinforcement Learning research. Its connections with other related fields and with different branches of machine learning. Brush up of Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence.		**CO1**

UNIT – II	**Markov Decision Process**	**Periods:9**
Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.		**CO2**

UNIT – III	**Prediction and Control by Dynamic Programing**	**Periods:9**
Overview of dynamic programing for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evaluation and value iteration algorithms, DP extensions. Monte Carlo Methods for Model Free Prediction and Control Overview of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling.		**CO3**

UNIT – IV	**TD Methods and Function Approximation Methods**	**Periods:9**
Getting started with the function approximation methods, Revisiting risk minimization, gradient descent from Machine Learning, Gradient MC and Semi-gradient TD(0) algorithms, Eligibility trace for function approximation, Afterstates, Control with function approximation, Least squares, Experience replay in deep Q-Networks		**CO4**

UNIT – V	**Policy Gradients**	**Periods:9**
Getting started with policy gradient methods, Log-derivative trick, Naive REINFORCE algorithm, bias and variance in Reinforcement Learning, Reducing variance in policy gradient estimates, baselines, advantage function, actor-critic methods.		**CO5**

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

Textbooks

1. Richard S. Sutton and Andrew G. Barto ,"Reinforcement Learning: An Introduction", 2nd Edition
2. R.S. Sutton and A.G. Barto, “Reinforcement Learning: An Introduction”, 2nd Edition, MIT Press, 2018,

References

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective",
2. Alberto Leon-Garcia, “Probability, Statistics, and Random Processes for Electrical Engineering", 3rd Edition

Web References

1. https://onlinecourses.nptel.ac.in/noc22_cs75/preview
2. http://Reinforcementlearning.net/Dj
3. https://developer.nvidia.com/blog/even-easier-introduction-cuda/

COs/POs/PSOs Mapping

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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	2	3	3	2	3	-	-	-	-	-	-	-	2	3	3
5	3	3	3	2	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		5	5	5	75	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**VII**	Course Category: **PC**			*End Semester Exam Type:**TE**			
Course Code	**U23ADH704**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Image and Video Analytics**	**3**	**1**	**-**	**4**	**25**	**75**	**100**
(AI&DS)								
Prerequisite	Deep Learning							

Course Outcome		**On of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Learn about Digital image and video processing	**K2**
	CO2	Understand Concept of Image and Video enhancement and restoration.	**K2**
	CO3	Learn Various concepts of Image analysis and Implementation of Video analysis.	**K2, K3**
	CO4	Implement various concept Feature Detection And Description	**K3**
	CO5	Concept of Object detection and recognition	**K2**

UNIT – I completion	**Introduction to Digital Image and Video Processing**	**Periods:9**	
Digital image representation - Sampling and Quantization - Types of Images - Basic Relations between Pixels – Neighbors – Connectivity - Distance Measures between pixel - Linear and Non Linear Operations - Introduction to Digital Video - Sampled Video - Video Transmission. **Gray-Level Processing:** Image Histogram - Linear and Non-linear point operations on Images - Arithmetic Operations between Images - Geometric Image Operations.**Binary Image Processing:** Image Thresholding - Region labeling - Binary Image Morphology**.**			**CO1**
UNIT – II	**Image and Video Enhancement and Restoration**	**Periods:9**	
Spatial domain - Linear and Non-linear Filtering - Morphological filtering - Frequency domain– Homomorphic Filtering - Blotch Detection and Removal - Blotch Detection - Motion Vector Repair and Interpolating Corrupted Intensities - Intensity Flicker Correction – Flicker Parameter Estimation - Brief introduction towards Wavelets - Wavelet based image denoising - Basic methods for image restoration using deconvolution filters.			**CO2**
UNIT – III	**Image and Video Analysis**	**Periods:9**	
Image Compression: Huffman coding - Run length coding - LZW coding - Lossless Coding - Wavelets based image compression. **Video Compression**: Basic Concepts and Techniques of Video Coding and the H.264 Standard - MPEG-1 and MPEG-2 Video Standards**.**			**CO3**
UNIT – IV	**Feature Detection and Description**	**Periods:9**	
Introduction to feature detectors - descriptors - matching and tracking - Basic edge detectors– canny – sobel - prewitt etc. - Image Segmentation - Region Based Segmentation – Region Growing and Region Splitting and Merging - Thresholding– Basic global thresholding - optimum global thresholding using Otsu's Method			**CO4**
UNIT – V	**Object Detection and Recognition.**	**Periods:9**	
Object detection and recognition in image and video - basic texture descriptors - GLCM - LBP and its applications in image and video analysis - object tracking in videos.			**CO5**
LecturePeriods:45	**TutorialPeriods:0**	**Practical Periods: -0**	**TotalPeriods:45**

Textbooks

1. Alan Bovik, "Handbook of Image and Video Processing" , Second Edition, Academic Press, 2005.
2. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2008.
3. Richard Szeliski, "Computer Vision – Algorithms and Applications ", Springer, 2011.
4. Ali Ismail Awad and Mahmoud Hassaballah, "Image Feature Detectors and Descriptors", Foundations and Applications, Springer; 1st ed. 2016 edition (2 March 2016).
5. Xiaoyue Jiang and Abdenour Hadid, "Deep Learning in Object Detection and Recognition Hardcover", Springer; 1st ed. 2019 edition (27 November 2019).

References

1. Xiaoyue Jiang and Abdenour Hadid, "Deep Learning in Object Detection and Recognition Hardcover", Springer; 1st ed. 2019 edition (27 November 2019).
2. Davut Armagan Kaya, "Feature Detection and Matching", Grin Verlag (17 January 2021).

Web References
1. https://www.geeksforgeeks.org/digital-image-processing-basics/
2. https://www.javatpoint.com/digital-image-processing-tutorial
3. https://www.tutorialspoint.com/dip/index.htm

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3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
4	2	3	3	2	3	-	-	-	-	-	-	-	2	3	3
5	3	3	3	2	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		5	5	5	75	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**VIII**	Course Category: **PC**				*End Semester Exam Type:**TE**		
Course Code	**U23ADH805**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Prompt Engineering**	**3**	**1**	**-**	**4**	**25**	**75**	**100**
	(AI&DS)							
Prerequisite	Artificial Intelligence,							

Course Outcome		On of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Understand the basic concepts and importance of prompt engineering, including various types of prompts and their applications.	**K2**
	CO2	Develop skills in designing effective prompts with clear structure and contextual relevance, avoiding common pitfalls.	**K3**
	CO3	Gain proficiency in evaluating prompt performance using various metrics and feedback, and improve prompt effectiveness.	**K3**
	CO4	Explore advanced techniques in prompt engineering, including machine learning integration, personalization, and ethical considerations. the different types of Graphs.	**K3**
	CO5	Apply prompt engineering concepts in various industries through case studies and projects, understanding future trends and building interactive systems.	**K4**

UNIT – I	**Introduction to Prompt Engineering**	**Periods:9**	
Introduction – Importance and Applications – Types of Prompts – Components of Effective Prompts – Challenges and Solutions – Case Studies in Prompt Engineering.			**CO1**
UNIT – II	**Designing Effective Prompts**	**Periods:9**	
Principles of Prompt Design – Structuring Prompts – Contextual Relevance – Clarity and Precision – Examples and Best Practices – Common Pitfalls and How to Avoid Them.			**CO2**
UNIT – III	**Evaluating Prompt Performance**	**Periods:9**	
Metrics for Prompt Effectiveness – User Feedback and Iteration – Testing and Validation Methods – Analyzing User Engagement – Improving Prompt Responsiveness – Tools for Evaluation and Optimization.			**CO3**
UNIT – IV	**Advanced Techniques in Prompt Engineering**	**Periods:9**	
Adaptive Prompting Techniques – Leveraging Machine Learning for Prompt Improvement – Multi-turn Prompts and Conversations – Personalization and Customization – Integrating Prompts with AI Systems – Ethical Considerations and Bias Mitigation.			**CO4**
UNIT – V	**Case Studies and Applications**	**Periods:9**	
Industry-Specific Prompt Engineering Applications – Healthcare, Finance, Education, and Customer Service – Building Interactive Systems with Prompts – Real-world Case Studies and Success Stories – Future Trends in Prompt Engineering – Capstone Project: Designing a Prompt System			**CO5**

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

Textbooks

1. John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy, "Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies," MIT Press, 2015.
2. Christopher Manning, Hinrich Schütze, and Prabhakar Raghavan,"Introduction to Information Retrieval," Cambridge University Press, 2008.
3. Kathleen R. McKeown,"Introduction to Natural Language Processing," McGraw-Hill, 1992.

References

1. Daniel Jurafsky and James H. Martin,"Speech and Language Processing," 3rd Edition, Pearson, 2021.
2. Yoav Goldberg,"Neural Network Methods for Natural Language Processing," Morgan & Claypool Publishers, 2017.
3. Christopher D. Manning and Hinrich Schütze, "Foundations of Statistical Natural Language Processing," MIT Press, 1999.
4. Mike Lewis and Tom Kwiatkowski, "Advanced Methods for Natural Language Processing," Springer, 2022.
5. Daniel Jurafsky and James H. Martin,"Speech and Language Processing," 3rd Edition, Pearson, 2021.

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1. https://www.nltk.org/book/
2. https://towardsdatascience.com/prompt-engineering-7e1666f71e7f
3. https://github.com/f/awesome-chatgpt-prompts

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	2	3	3	2	3	-	-	-	-	-	-	-	2	3	3
5	3	3	3	2	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		5	5	5	75	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**					
Semester	**VII**	Course Category Code: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23ADT712**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**INTELLIGENT SYSTEMS AND CONTROL**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI & DS								
Prerequisite	**Neural Networks & Deep Learning**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the fundamentals of intelligent control systems and their applications.	**K2**
	CO2 Apply fuzzy logic and neural networks to design intelligent controllers.	**K3**
	CO3 Implement Neural network control strategies.	**K3**
	CO4 Implement reinforcement learning-based control strategies.	**K3**
	CO5 Describe hybrid intelligent control systems combining multiple AI techniques.	**K2**

Unit-I	**Introduction to Intelligent Systems and Control**	**Periods: 9**	
Overview of conventional vs. intelligent control-Applications in robotics, automation, and real-world systems-Basics of knowledge-based and learning-based control-Transfer functions, state-space modelling-Stability analysis: Routh-Hurwitz, Nyquist, Bode plots			**CO1**
UNIT-II	**Fuzzy Logic Control**	**Periods:9**	
Introduction to fuzzy sets and membership functions-Fuzzy inference systems (Mamdani & Sugeno models)-Design of fuzzy logic controllers (FLC)-Applications of fuzzy control in real-world systems			**CO2**
UNIT-III	**Neural Networks in Control**	**Periods:9**	
Basics of artificial neural networks (ANN)-Multi-layer perceptron (MLP) and backpropagation-Adaptive control using neural networks -Case studies in neural control			**CO3**
UNIT-IV	**Genetic Algorithms & Reinforcement Learning for Control**	**Periods:9**	
Introduction to genetic algorithms (GA) -Evolutionary strategies for optimization -Applications in controller tuning- Fundamentals of reinforcement learning (RL) -Q-learning and policy gradient methods -Deep reinforcement learning for control applications			**CO4**
UNIT-V	**Hybrid Intelligent Control Systems**	**Periods:9**	
Combining fuzzy logic, neural networks, and genetic algorithms-Adaptive neuro-fuzzy inference systems (ANFIS)-Hybrid models for intelligent control-Real-world applications of hybrid control systems			**CO5**

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

Text Books

1. K.S. Narendra and K. Parthasarathy, Intelligent Control Systems with an Introduction to System of Systems Engineering, 1st Edition, CRC Press.2009.
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3rd Edition, Wiley Publication, 2016
3. Laxmi P. Prajapati and S. P. Harsha, Intelligent Systems: Architecture, Design, and Control, 1st Edition CRC Press.2016.
4. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition Pearson 2020.
5. Nikolaus Correll, Bradley Hayes, Introduction to Autonomous Robots: Mechanisms, Sensors, Actuators, and Algorithms, 1st Edition MIT Press.2017.

Reference Books

1. M. Gopal, Intelligent Control Systems, 2st Edition, Wiley-Blackwell.2008.
2. Jerry M. Mendel, Fuzzy Control and Fuzzy Systems, 1st Edition, Prentice Hall ,2012
3. Ogata Katsuhiko, Modern Control Engineering. 5th Edition, Prentice Hall, 20210

Web References

1. https://onlinecourses.nptel.ac.in/noc25_ee89/preview
2. https://www.sc.iitb.ac.in/courses.html#602
3. https://www.baeldung.com/cs/genetic-algorithms-vs-neural-networks

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	2	-	-	-	-	-	-	-	2	3	3
2	2	3	3	2	2	-	-	-	-	-	-	-	3	3	3
3	2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	3
5	2	3	2	2	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	5	5	5	5	5	75	100

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

Department	**Artificial Intelligence and Data Science**	Name of the Programme: **B.Tech**						
Semester	**VII**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23ADT713**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**IOT SYSTEMS AND ANALYTICS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI&DS								

Prerequisite	Basics of Programming (C, C++), Computer Networks and Communication Protocols		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Explain the concept of IoT.	**K2**
	CO2	Describe various protocols for IoT.	**K2**
	CO3	Design a IoT system using Rasperry Pi/Arduino.	**K3**
	CO4	Explain the concept of data analytics and use cloud offerings related to IoT.	**K2**
	CO5	Design and Develop a IoT application in real time scenario.	**K3**

UNIT – I	**Fundamentals of IoT**	**Periods:9**	
volution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional ai Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, SAI mart Objects and Connecting Smart Objects			**CO1**
UNIT – II	**IoT Protocols**	**Periods: 9**	
IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT			**CO2**
UNIT – III	**Design and Development**	**Periods: 9**	
Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.			**CO3**
UNIT – IV	**Data Analytics and Supporting Services**	**Periods: 9**	
Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS s for IoT – System Management with NETCONF-YANG			**CO4**
UNIT – V	**Case Studies/Industrial Applications**	**Periods: 9**	
Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control			**CO5**

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

Textbooks

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017
2. Jean Philippejava Vasseur and Adam Dunkels, “Interconnecting Smart Objects with IP, The Next Internet”, Morgan Kaufmann, Elsevier, 2016.
3. Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach‖, Universities Press, 2018.
4. Andy King, “Programming the Internet of Things” Oreilly Publications, 2020

References

1. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocolsǁ, Wiley, 2016 (for Unit 2).
2. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2018.
3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Thingsǁ, Springer, 2018.

Web References

. 1. https://www.sciencedirect.com/science/article/pii/S1877050916316428
2. https://www.tibco.com/reference-center/what-is-iot-analytics
3. https://mite.ac.in/wp-content/uploads/2021/04/iot_module4.pdf

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	2	-	-	-	-	-	-	-	2	3	3
2	2	3	3	2	2	-	-	-	-	-	-	-	3	3	3
3	2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	3
5	2	3	2	2	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	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	**VI**			Course Category Code: **PC**		End Semester Exam Type: **TE**		
Course Code	**U23ADT714**			Periods/Week		Credit	Maximum Marks	
				L	T	P	C	CAM	ESE	TM
Course Name	**IMAGE PROCESSING AND COMPUTER VISION**			**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI & DS										
Prerequisite	Artificial Intelligence, Quantum Mechanics									
Course Outcomes	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)			
	CO1	Recognize and describe both the theoretical and practical aspects of computing with images.					**K2**			
	CO2	Explain object segmentation methods.					**K2**			
	CO3	Describe shape representation methods.					**K2**			
	CO4	Implement deep learning techniques for vision tasks.					**K3**			
	CO5	Apply emerging trends and advanced applications in computer vision.					**K3**			

UNIT-I	**Foundations of Image Processing**	**Periods: 9**	
Digital image representation (grayscale, RGB, HSV) – Sampling - quantization and color spaces – Histograms - point operations and contrast enhancement - Linear/non-linear filtering (Gaussian, median, bilateral).			**CO1**
UNIT-II	**OBJECT SEGMENTATION**	**Periods:9**	
Image smoothing - Edge Detectors – Scaling - Canny Edge Detector - Image Segmentation: Thresholding, Region-Based Segmentation – Contour Detection and Shape Analysis – Morphological Operations: Dilation, Erosion, Opening, Closing.			**CO2**
UNIT-III	**Shape Representation**	**Periods:9**	
Region identification - contour based shape representation - simple geometric border representation - Fourier transform of boundaries - region based shape representation - convex hull - region decomposition - region neighbourhood graphs.			**CO3**
UNIT-IV	**Deep Learning for Computer Vision**	**Periods:9**	
Deep Learning Frameworks (TensorFlow, PyTorch) – Autoencoders and GANs – Image Segmentation using Deep Learning (U-Net, Mask R-CNN) – Video Processing and Action Recognition – 3D Computer Vision – Face Detection and Recognition.			**CO4**
UNIT-V	**Advanced Topics and Applications**	**Periods:9**	
Explainable AI in Computer Vision – Vision Transformers (ViTs) – Augmented and Virtual Reality – Robotics and Autonomous Systems – Real-time Applications – Ethical Considerations and Bias in Computer Vision – Research Trends.			**CO5**

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

Text Books

1. Richard Szeliski, Computer Vision: Algorithms and Applications, 3rd ed., Springer, 2024.
2. R. C. Gonzalez, R. E. Woods, Digital Image Processing, 5th ed., Pearson, 2024.
3. Milan Sonka, Vaclav Hlavac, Roger Boyle “Image Processing, Analysis and Machine Vision”, Springer US,2013
4. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012

Reference Books

1. Adrian Rosebrock, Practical Python and OpenCV: An Introductory Guide to Computer Vision, 4th ed., 2023.
2. François Chollet, Deep Learning with Python, 2nd ed., Manning, 2021.
3. D. Forsyth, J. Ponce, Computer Vision - A Modern Approach, 3rd ed., Pearson, 2024.
4. D. Forsyth and J. Ponce, "Computer Vision - A modern approach" McGraw-Hill, 2012
5. Richard Szeliski, "Computer Vision: Algorithms and Applications", 2nd ed. 2020.

Web References

1. https://www.coursera.org/specializations/computer-vision
2. https://www.tensorflow.org/tutorials/images
3. https://www.pyimagesearch.com/ https://onlinecourses.nptel.ac.in/noc25_ee13/preview
4. https://www.youtube.com/watch?v=iXNsAYOTzgM&ab_channel=freeCodeCamp.org
5. https://www.youtube.com/watch?v=2FYm3GOonhk&ab_channel=Murtaza%27sWorkshopRoboticsandAI

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	3	3	2	-	-	-	-	-	-	2	2	2
2	2	3	3	3	2	1	-	-	-	-	-	-	2	2	1
3	2	3	3	2	1	-	-	-	-	-	-	-	2	2	1
4	2	2	3	2	3	2	-	-	-	-	-	-	2	3	1
5	3	2	2	3	3	1	-	-	-	-	-	-	2	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	**VII**	Course Category Code: **PC**				End Semester Exam Type: **LE**		
Course Code	**U23ADP712**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INTELLIGENT SYSTEMS AND CONTROL LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
AI & DS								
Prerequisite	**Machine Intelligence**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Implement fundamental AI and ML algorithms for controlling a system	**K3**
	CO2 Apply supervised and unsupervised learning techniques to solve real-world programs	**K3**
	CO3 Optimize deep learning models for improved performance and efficiency	**K4**
	CO4 Utilize natural language processing (NLP) tools for text analysis and language understanding	**K3**
	CO5 Implement and simulate intelligent robotic systems for automated decision-making	**K3**

List of Experiments

1. Develop a fuzzy logic controller for a simple dynamic system.
2. Train an artificial neural network (ANN) to approximate a nonlinear system
3. Design and analyze a Proportional-Integral-Derivative (PID) controller for a DC motor.
4. Implement an adaptive control system that adjusts parameters in real time.
5. Use a genetic algorithm to optimize PID parameters for a given system.
6. Develop a Q-learning algorithm for an autonomous agent in a simulated environment.
7. Implement MPC for trajectory optimization in robotic control.
8. Implement A* or Dijkstra's algorithm for robot navigation.
9. Use OpenCV and deep learning for real-time object detection in a robotic system.
10. Simulate swarm intelligence (e.g., ant colony or particle swarm optimization) for collaborative robotics.

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

Reference Books

1. M. Gopal, Intelligent Control Systems, 2st Edition, Wiley-Blackwell.2008.
2. Jerry M. Mendel, Fuzzy Control and Fuzzy Systems, 1st Edition, Prentice Hall ,2012
3. Ogata Katsuhiko, Modern Control Engineering. 5th Edition, Prentice Hall, 20210

Web References

1. https://onlinecourses.nptel.ac.in/noc25_ee89/preview
2. https://www.sc.iitb.ac.in/courses.html#602

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	2	-	-	-	-	-	-	-	2	3	3
2	2	3	3	2	2	-	-	-	-	-	-	-	3	3	3
3	2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	3
5	2	3	2	2	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			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Artificial Intelligence and Data Science**	Name of the Programme: **B.Tech**						
Semester	**VII**	Course Category: **PC**			*End Semester Exam Type: **LE**			
Course Code	**U23ADP713**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**IOT SYSTEMS AND ANALYTICS LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
AI&DS								

Prerequisite	Basic knowledge of electronics, programming (C/C++ for Arduino, Python for Raspberry Pi)	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Implement the fundamentals of the Internet of Things (IoT) and its hardware and software components in a simple application	**K3**
	CO2 Interface I/O devices, sensors, and communication modules with microcontrollers and microprocessors.	**K3**
	CO3 Implement wireless communication between IoT devices for data exchange.	**K3**
	CO4 Utilize cloud platforms to upload, retrieve, and analyze sensor data	**K3**
	CO5 Develop an IoT-based real-time system integrating devices, gateways, and data management techniques.	**K4**

List of Experiments

1. Introduction to Arduino platform and programming
2. Interfacing of temperature sensor LM35 with Arduino.
3. Interfacing of the Active Buzzer with Arduino
4. Building Intrusion Detection System with Arduino and Ultrasonic Sensor.
5. Interfacing Arduino to Bluetooth Module.
6. Introduction to Raspberry PI platform and python programming
7. Interfacing sensors to Raspberry PI.
8. Communicate between Arduino and Raspberry PI using any wireless medium
9. Interface on Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
10. Design a real time IOT based system.

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

References Books

1. Shahidul Islam Khan, Internet of Things (IoT): Concepts and Applications, CRC Press, 2023.
2. Rajiv Pandey, Munesh C. Trivedi, Vishnu Swaroop, Internet of Things: Architecture, Implementation, and Security, Springer, 2022.
3. Peter Waher, Learning Internet of Things, 2nd Edition, Packt Publishing, 2021.
4. Donald Norris, The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi, and BeagleBone Black, 2nd Edition, McGraw-Hill, 2020.Jeremy Blum, Exploring Arduino: Tools and Techniques for Engineering Wizardry, 2nd Edition, Addison-Wesley, 2019.
5. Simon Monk, Raspberry Pi Cookbook, 3rd Edition, O'Reilly Media, 2019.
6. Peter Waher, Mastering IoT with Arduino and Raspberry Pi, Packt Publishing, 2018.

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1. https://www.arduino.cc/en/Guide/Introduction
2. https://tutorials-raspberrypi.com/connect-and-control-raspberry-pi-sensors/
3. https://www.mathworks.com/help/thingspeak/retrieve-data-from-channel-feed.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	3	3	2	2	-	-	-	-	-	-	-	2	3	3
2	3	2	2	2	2	-	-	-	-	-	-	-	2	3	3
3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
5	3	3	3	2	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	**VII**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23ADE714**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**AI ETHICS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI&DS								
Prerequisite	Basic understanding of AI, Basic knowledge of Ethics, Computer science and Engineering Fundamental, data science or data analytics knowledge, Social implication Knowledge							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the ethical considerations in Artificial Intelligence (AI)	**K2**
	CO2 Differentiate between human intelligence and machine intelligence.	**K2**
	CO3 Describe privacy concerns related to AI applications	**K2**
	CO4 Identify and explain bias in AI decision-making	**K2**
	CO5 Apply ethical principles to assess the impact of AI in real-life scenarios.	**K3**

UNIT- I	**Introduction**	**Periods: 9**	
The AI Hype and Fears – The Real and Pervasive Impact of AI – Ethical and Societal Problems – Superintelligence and Transhumanism – Frankenstein's New Monster – Transcendence and the AI Apocalypse			**CO1**
UNIT- II	**AI and Humans**	**Periods:9**	
Fundamental Differences between Humans and Machines – Modernity, Posthumanism, and Postphenomenology – Questioning the Moral Status of AI – Moral Agency – Moral Patiency – Toward More Practical Ethical Issues			**CO2**
UNIT- III	**Privacy and the Other Usual Suspects**	**Periods:9**	
Privacy and Data Protection – Manipulation, Exploitation, and Vulnerable Users – Negative use of AI – Safety and Security – Moral Responsibility – Transparency and Explainability			**CO3**
UNIT- IV	**Bias and Challenges of Policymakers**	**Periods:9**	
Bias, Challenges, and Solutions – Future of Work and Life – Key Questions for Policymakers – Ethical Principles and Justifications – Technological Solutions and Implementation – Proactive and Practice-Oriented Ethics – Positive Ethics – Interdisciplinarity and Transdisciplinarity – Risk of AI Winter and Unregulated AI Use – Solutions for Bias Mitigation, Ethical AI Governance, and Sustainable AI Policies.			**CO4**
UNIT- V	**AI in Everyday Life**	**Periods:9**	
The Integration of AI in Daily Activities - AI in Healthcare, Education, and Entertainment - The Role of AI in Consumer Behavior and Personalization - Ethical Concerns in Everyday AI Applications-The Future of AI in Personal Life and Society.			**CO5**

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

Text Books

1. Genesis: Artificial Intelligence, Hope, and the Human Spirit," Published by Penguin Press, 2024.
2. The Alignment Problem: Machine Learning and Human Values," Published by W.W. Norton & Company, October 6, 2020.
3. Mark Coeckelbergh, "AI Ethics", MIT Press, 2020.
4. S. Matthew Liao, "Ethics of Artificial Intelligence", Oxford University Press, 2020.
5. Frank Pasquale, Markus Dirk Dubber, Sunit Das, "The Oxford Handbook of Ethics of AI", Oxford University Press, 2020

Reference Books

1. Paula Boddington, “Towards a Code of Ethics for Artificial Intelligence”, Springer International Publishing, 2017.
2. Abhivardhan, "Artificial Intelligence Ethics and International Law", BPB Publications, 2019
3. Saswat Sarangi, Pankaj Sharma, “Artificial Intelligence: Evolution, Ethics and Public Policy”, Taylor & Francis, 2018
4. Keith Frankish, William M. Ramsey, “The Cambridge Handbook of Artificial Intelligence”, Cambridge University Press, 2014
5. Ingrid Vasiliu-Feltes, Jane Thomason, “Applied Ethics in a Digital World”, IGI Global, 2021

Web References

1. https://www.techtarget.com/whatis/definition/AI-code-of-ethics
2. https://www.onespan.com/blog/trustworthy-ai-why-we-need-it-and-how-achieve-it
3. www. tutorialspoint.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	2	1	-	-	-	-	-	1	1	1	2	1	-
4	3	2	2	1	-	-	-	-	-	1	1	1	2	1	-
5	3	2	3	1	-	-	-	-	-	1	1	1	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	5	5	5	5	5	75	100

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

Department	**Artificial Intelligence and Data Science**	**B.Tech**						
Semester	**VIII**	Course Category: **PE**			*End Semester Exam Type: **TE**			
Course Code	**U23ADE715**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROMPT ENGINEERING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI & DS								
Prerequisite	Strong understanding of Natural Language Processing, familiarity with Machine Learning models and techniques.							

Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Interpret the basic concepts and importance of prompt engineering, including various types of prompts and their applications.	**K2**
	CO2	Apply skills in designing effective prompts with clear structure and contextual relevance, avoiding common pitfalls.	**K3**
	CO3	Apply various metrics and feedback, and improve prompt effectiveness.	**K3**
	CO4	Apply advanced techniques in prompt engineering for handling different types of prompts	**K3**
	CO5	Apply prompt engineering concepts in various for building interactive systems.	**K3**

UNIT-I	**Introduction to Prompt Engineering**	**Periods: 9**
Introduction – Importance and Applications – Types of Prompts – Components of Effective Prompts – Challenges and Solutions – Case Studies in Prompt Engineering.		**CO1**
UNIT-II	**Designing Effective Prompts**	**Periods: 9**
Principles of Prompt Design – Structuring Prompts – Contextual Relevance – Clarity and Precision – Examples and Best Practices – Common Pitfalls and How to Avoid Them.		**CO2**
UNIT-III	**Evaluating Prompt Performance**	**Periods: 9**
Metrics for Prompt Effectiveness – User Feedback and Iteration – Testing and Validation Methods – Analyzing User Engagement – Improving Prompt Responsiveness – Tools for Evaluation and Optimization.		**CO3**
UNIT-IV	**Advanced Techniques in Prompt Engineering**	**Periods: 9**
Adaptive Prompting Techniques – Leveraging Machine Learning for Prompt Improvement – Multi-turn Prompts and Conversations – Personalization and Customization – Integrating Prompts with AI Systems – Ethical Considerations and Bias Mitigation.		**CO4**
UNIT-V	**Case Studies and Applications**	**Periods: 9**
Industry-Specific Prompt Engineering Applications – Healthcare, Finance, Education, and Customer Service – Building Interactive Systems with Prompts – Real-world Case Studies and Success Stories – Future Trends in Prompt Engineering – Capstone Project: Designing a Prompt System.		**CO5**

LecturePeriods:45	**TutorialPeriods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy, "Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies," MIT Press, 2015.
2. Christopher Manning, Hinrich Schütze, and Prabhakar Raghavan,"Introduction to Information Retrieval," Cambridge University Press, 2008.
3. Kathleen R. McKeown,"Introduction to Natural Language Processing," McGraw-Hill, 1992.
4. Jacob Andreas, "Task-Oriented Dialogue Systems for Conversational AI," Springer, 2020.

Reference Books
1. Daniel Jurafsky and James H. Martin,"Speech and Language Processing," 3rd Edition, Pearson, 2021. 2. Yoav Goldberg,"Neural Network Methods for Natural Language Processing," Morgan & Claypool Publishers, 2017. 3. Christopher D. Manning and Hinrich Schütze, "Foundations of Statistical Natural Language Processing," MIT Press, 1999. 4. Mike Lewis and Tom Kwiatkowski, "Advanced Methods for Natural Language Processing," Springer, 2022.
Web References
1. https://www.nltk.org/book/ 2. https://github.com/dennybritz/deeplearning-pytorch 3. https://towardsdatascience.com/prompt-engineering-7e1666f71e7f 4. https://github.com/f/awesome-chatgpt-prompts 5. https://ai.googleblog.com/search/label/Dialog%20Systems

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	3	3	-	-	-	-	-	-	-	3	3	2
2	3	3	3	3	1	-	-	-	-	-	-	-	3	3	2
3	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	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

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

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**VII**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23ADE716**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ETHICS IN DATA SCIENCE**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI & DS								
Prerequisite	Data Science							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Describe the fundamental principles of ethics in data science, recognizing the importance of ethical decision-making in the field.	**K2**
	CO2	Apply techniques to protect data privacy in various contexts and analyze privacy concerns and data protection laws	**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.	**K2**
	CO5	Apply 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:9**	
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:9**	
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:9**	
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:9**	
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:9**	
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:-**	**Practical Periods:-**	**TotalPeriods:45**

Text Books

1. Mike Loukides, Ethics and Data Science, O'Reilly Media, 2018.
2. Gry Hasselbalch, Pernille Tranberg, Data Ethics: The New Competitive Advantage, DataEthics.eu, 2019.
3. Michael Kearns, Aaron Roth, The Ethical Algorithm, Oxford University Press, 2019.
4. Kirsten Martin, Ethics of Data and Analytics: Concepts and Cases, First Edition, Taylor & Francis, 2022.
5. Anne L. Washington, Ethical Data Science Prediction in the Public Interest, Oxford, 2023

Reference Books

1. Safiya Umoja Noble, Algorithms of Oppression, New York University Press, 2018.
2. Linnet Taylor, Gargi Sharma, Aaron Martin, Shazade Jameson (Eds.), Data Justice and COVID-19: Global Perspectives, Routledge, 2021.
3. Julia Lane, Victoria Stodden, Stefan Bender, Helen Nissenbaum (Eds.), Privacy, Big Data, and the Public Good: Frameworks for Engagement, Cambridge University Press, 2014.

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 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	**VII**	Course Category: **PE**				End Semester Exam Type:**TE**		
Course Code	**U23ADE717**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CLOUD BASED MACHINE LEARNING PLATFORMS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI & DS								
Prerequisite	Programming Skills (Python), Basics of Machine Learning, Cloud Computing basics							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the basics of cloud computing and its role in machine learning.	**K2**
	CO2 Describe the fundamental cloud-based machine learning platforms and tools.	**K2**
	CO3 Apply cloud-based machine learning models using AWS, Google Cloud, and Azure.	**K3**
	CO4 Deploy and manage machine learning models on cloud platforms.	**K3**
	CO5 Implement a cloud-based ML project with real-world applications.	**K3**

UNIT-I	**Introduction to Cloud and Machine Learning**	**Periods: 9**
Basics of Cloud Computing – Why use Cloud for Machine Learning? – Introduction to Cloud Services (AWS, Google Cloud, Azure) – Basics of Machine Learning (Supervised, Unsupervised, Deep Learning) – Setting up a Cloud ML environment.		**CO1**
UNIT-II	**Building Machine Learning Models on Cloud**	**Periods: 9**
Uploading and Managing Data on the Cloud – Training Simple ML Models using Cloud Tools (Google Colab, AWS SageMaker, Azure ML) – AutoML: Training Models Without Coding – Understanding Cloud Storage and Databases.		**CO2**
UNIT-III	**Cloud-Based ML Platforms**	**Periods: 9**
Overview of AWS, Google Cloud, and Azure ML Services – Hands-on with Google Vertex AI and AWS SageMaker – Running Jupyter Notebooks on the Cloud – Introduction to Cloud AI APIs (Vision, Speech, Translation).		**CO3**
UNIT-IV	**Deploying and Using ML Models on Cloud**	**Periods: 9**
Model Deployment – Deploying ML Models on Google Cloud and AWS – Using Pre-trained AI Models – Creating a Simple Web App for ML Predictions – Basics of Cloud Security for ML Applications.		**CO4**
UNIT-V	**Mini Project: Cloud ML Application**	**Periods: 9**
Choosing a Simple ML Problem – Building and Training a Model on Cloud – Deploying the Model as a Web Application – Testing and Improving the Model – Real-world Case Studies of Cloud ML Applications.		**CO5**

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

Textbooks

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow, O'Reilly Media, 3rd Edition, 2022.
2. Luis Pedro Coelho, Building Machine Learning Systems with Python, Packt Publishing, 2nd Edition, 2013.
3. Valliappa Lakshmanan, Martin Görner, Ryan Gillard, Machine Learning Design Patterns: Solutions to Common Challenges in Data Preparation, Model Building, and MLOps, O'Reilly Media, 1st Edition, 2020.
4. Mark C. Chu-Carroll, Cloud Native Data Center Networking: Architecture, Protocols, and Tools for a New Age of Application Delivery, O'Reilly Media, 2019.

Reference Books

1. Jake VanderPlas, Machine Learning with Google Cloud Platform, O'Reilly Media, 2nd Edition, 2022.
2. Giuseppe Bonaccorso, Machine Learning Algorithms, Packt Publishing, 2nd Edition, 2020.
3. Nishant Shukla, Machine Learning with TensorFlow, Manning Publications, 2nd Edition, 2018.
4. Emmanuel Raj, Applied Machine Learning and AI for Engineers, Apress, 2021.
5. S. Girija, R. Arvind, Cloud Computing for Machine Learning and Cognitive Applications, CRC Press, 2020.

Web References
1.https://cloud.google.com/ai-platform – Google Cloud AI Platform Documentation
2. https://aws.amazon.com/machine-learning – AWS Machine Learning Services
3.https://azure.microsoft.com/en-us/products/machine-learning – Microsoft Azure Machine Learning
4.https://www.tensorflow.org/cloud – TensorFlow Cloud Guide

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	2	-	-	-	-	-	-	-	3	2	1
2	2	3	2	2	3	-	-	-	-	-	-	-	3	3	2
3	3	3	3	1	2	-	-	-	-	-	-	-	3	2	1
4	1	2	1	3	3	-	-	-	-	-	-	-	2	2	2
5	2	1	2	3	2	-	-	-	-	-	-	-	1	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	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	**VI**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23ADE718**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**QUANTUM AI**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
AI & DS								
Prerequisite	Artificial Intelligence, Quantum Mechanics							

Course Outcomes			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Comprehend key concepts of quantum computing.	**K2**
	CO2	Explain quantum algorithms and apply their efficiency in comparison to classical algorithms	**K2, K3**
	CO3	Apply quantum computing to accelerate machine learning tasks	**K3**
	CO4	Apply quantum computing tools like Qiskit and explore practical applications of Quantum AI in real-world scenarios.	**K3**
	CO5	Apply quantum AI concepts to address decoherence, hybrid systems, optimization, and future research trends	**K3**

UNIT-I	**Introduction to Quantum Computing**	**Periods: 9**	
Introduction to Quantum Computing, Quantum Mechanics Basics: Qubits, quantum states, quantum gates. Quantum Circuits: Building simple circuits, quantum measurement. Quantum Computers and Architectures: Gate-based models, quantum processors (D-Wave, IonQ), coherence time, and error correction.			**CO1**
UNIT-II	**Quantum Algorithms**	**Periods:9**	
Quantum vs. Classical Algorithms, Quantum Superposition and Interference in Algorithms. Quantum Search Algorithms: Grover's Algorithm, Quantum Fourier Transform (QFT), Shor's Algorithm. Variational Quantum Algorithms (VQA): Quantum variational circuits, Quantum Approximate Optimization Algorithm (QAOA), AI applications in optimization.			**CO2**
UNIT-III	**Quantum Machine Learning (QML)**	**Periods:9**	
Introduction to QML: Classical ML vs. Quantum ML, Quantum-enhanced learning models, Quantum Data Encoding. Quantum Neural Networks (QNN): Quantum perceptron, hybrid QNN architectures, applications in pattern recognition. Quantum Support Vector Machines (QSVM).			**CO3**
UNIT-IV	**Quantum AI Tools and Platforms**	**Periods:9**	
Introduction to Quantum Development Platforms: Overview of Qiskit and Cirq, Building Quantum Circuits in Qiskit, Implementing Quantum Teleportation. Quantum AI Use Cases: Applications in finance and healthcare. Quantum Noise and Error Mitigation: Decoherence and error correction techniques.			**CO4**
UNIT-V	**Challenges and Future Directions in Quantum AI**	**Periods:9**	
Current Limitations: Quantum decoherence, scalability issues. Hybrid Quantum-Classical Systems: Combining classical and quantum AI. Quantum AI for Optimization Problems: Applications in logistics and supply chain. Future Directions: Research trends in Quantum AI.			**CO5**

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

Text Books

1. Jack D. Hidary,"Quantum Computing: An Applied Approach", Springer, 2nd Edition, 2021
2. Michael A. Nielsen, Isaac L. Chuang,"Quantum Computation and Quantum Information", Cambridge University Press, 10th Anniversary Edition,2010
3. Phillip Kaye, Raymond Laflamme, Michele Mosca,"An Introduction to Quantum Computing", Oxford University Press, 2007
4. Peter Wittek," Quantum Machine Learning: What Quantum Computing Means to Data Mining", Academic Press,1st Edition, 2014.

Reference Books

1. Hassi Norlén et al.,"Learning Quantum Computation Using Qiskit",IBM Quantum Experience, 2019,
2. Eleanor G. Rieffel, Wolfgang H. Polak, "Quantum Computing: A Gentle Introduction",MIT Press, 2014
3. Jack D. Hidary,"Quantum Computing: An Applied Approach",Springer (1st Edition), 2019
4. Eric R. Johnston, Nic Harrigan, Mercedes Gimeno-Segovia,"Programming Quantum Computers: Essential Algorithms and Code Samples", O'Reilly Media, 2019.
5. Elias F. Combarro, Leandro A. Fernandez, "Quantum Machine Learning",Springer, 2023.

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	3	3	2	-	-	-	-	-	-	2	2	2
2	2	3	3	3	2	1	-	-	-	-	-	-	2	2	1
3	2	3	3	2	1	-	-	-	-	-	-	-	2	2	1
4	2	2	3	2	3	2	-	-	-	-	-	-	2	3	1
5	3	2	2	3	3	1	-	-	-	-	-	-	2	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**	**B.Tech**						
Semester	**VII**	Course Category Code: **PA**				End Semester Exam Type: **LE**		
Course Code	**U23ADW703**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROJECT PHASE-I**	**0**	**0**	**4**	**2**	**50**	**50**	**100**
AI & DS								
Prerequisite	Artificial Intelligence, Machine Learning, Deep Learning, Programming in C, Python, Natural Language Processing							

Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Identify and define a real-world problem relevant to their field of study.	**K2**
	CO2	Formulate clear problem objectives and project requirements.	**K2**
	CO3	Apply appropriate concepts and techniques to design a preliminary solution.	**K3**
	CO4	Develop an initial model or prototype using selected tools and technologies.	**K4**
	CO5	Document and present the project proposal and preliminary findings effectively.	**K6**

The project work involves developing a solution to a real-world problem using emerging technologies and engineering principles. Students will work in teams to analyze, design, develop, and evaluate a functional prototype or software application. The project must demonstrate the application of theoretical knowledge to practical challenges, integrating concepts from the core areas of the curriculum.

The project spans an academic term and includes multiple reviews to assess progress, quality, and implementation. Students are expected to conduct literature reviews, define clear objectives, apply suitable methodologies, perform data collection and analysis, and present their findings in a comprehensive report.

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

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	-	-	-	-	-	2	-	2	3	3	-
2	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-
3	3	3	3	-	3	-	-	-	2	2	-	-	3	3	-
4	3	-	3	2	3	-	-	-	2	2	-	-	3	3	3
5	-	-	-	-	2	-	-	-	3	3	3	2	-	-	3

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

Evaluation Method

Assessment	CAM				ESE			Total
	Review 1		Review 2		Report	Presentation and Viva	Demo	
	Presentation and Viva	Supervisor	Presentation and Viva	Supervisor				
	15	10	15	10	15	20	15	100
CAM/ESE Marks	CAM Marks=50				ESE Marks =50			

Department	**Artificial Intelligence and Data Science**	**B.Tech**						
Semester	**VII**	Course Category Code: **PA**				End Semester Exam Type: **-**		
Course Code	**U23ADW704**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INTERNSHIP / IN PLANT TRAINING**	**0**	**0**	**2**	**1**	**100**	**-**	**100**
AI & DS								

The student is required to undergo 'internship' in industry / research laboratory / higher learning institution for a minimum period of 4 weeks during vacations and shall complete the internship before the completion of 7th semester.

i) The internship carries 1 credit.

ii) Each spell of internship shall be for a period not less than 2 weeks.

iii) The main purpose of internship is to enhance the general professional outlook and capability of the student to advance his/her chances of improving the career opportunities. The student should get prior approval from the Head of the Department and Training and Placement cell at the college before undertaking the internship and submit a detailed report after completion for the purpose of assessment. The internship marks will be given in 7th semester mark sheet.

iv) The project work carried out in industry in the eighth semester is not to be treated as internship.

Evaluation Methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Report	**Presentation**	
Marks	50	50	100

Honour / Minor in Artificial Intelligence and Machine Learning

Department	**Artificial Intelligence and Data Science**	Name of the Programme: **B.Tech / (Honour / Minor) – Artificial Intelligence and Machine Learning**						
Semester	**IV**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23MXT401**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PARALLEL PROGRAMMING AND HIGH PERFORMANCE COMPUTING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Common to all Branches except AI & DS								
Prerequisite	Basics of Programming (C, C++), Linux Operating Systems							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Apply MPI framework for passing message parallelly across processes	**K3**
	CO2	Apply Pthreads for creating shared memory parallel programs	**K3**
	CO3	Apply OpenMP paradigms to create shared memory parallel programs	**K3**
	CO4	Apply either OpenMP, MPI for parallel algorithms for searching and sorting	**K3**
	CO5	Apply CUDA programming for configuring hardware and transfer data across GPU and CPU	**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 warp Size thread blocks – block with more than one warp			**CO5**

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

Textbooks

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

References

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/

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	3	3	-	-	-	-	-	-	-	3	3	2
2	3	3	3	3	1	-	-	-	-	-	-	-	3	3	2
3	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	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##		
Test Marks	50*	50*	75*	20*	5	75	
Weightage for CAM	5	5	5	5	5	75	
CAM / ESE Marks	CAM Marks = 25					ESE Marks = 75	100

#Open Book Analytical Exam/Analyse Real world problems and propose solutions/ Tool or Subject Proficiency Analysis –
Test the Students skill by giving individual task/ Paper Presentation/Micro Project Presentation/Idea Presentation for the Societal Problem;
Distribution of Marks for Attendance, the Question Paper Pattern for Model and ESE are same as given in
B. Tech. Regulations R2023 for Theory Courses.

Department	**Artificial Intelligence and Data Science**	Name of the Programme: **B.Tech / (Honour / Minor) – Artificial Intelligence and Machine Learning**						
Semester	**V**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23MXB501**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ADVANCED DEEP LEARNING**	**3**	**0**	**2**	**4**	**50**	**50**	**100**
Common to all Branches except AI & DS								
Prerequisite	Solid understanding of basic machine learning concepts and neural network architectures, Proficiency in Python Programming							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Apply different Convolutional Neural Network for processing images effectively, and to apply generative models for image synthesis, style transfer, and data augmentation tasks	**K3**
	CO2	Apply advanced sequence models for NLP tasks like text generation, summarization, and multimodal learning and apply reinforcement learning concepts in AI, robotics, and autonomous systems.	**K3**
	CO3	Apply techniques such as neural architecture search and meta-learning to optimize models for edge devices and energy-efficient AI systems.	**K3**
	CO4	Implement practical solutions for real-world problems using deep learning and RL	**K3**
	CO5	Implement practical solutions for real-world problems using optimization Tools	**K3**

UNIT – I	**Artificial Neural Networks and Convolution Neural Networks**	**Periods:10**	
Basics of Neural Networks: Perceptron, activation functions (Sigmoid, ReLU, Softmax), backpropagation, loss functions, Convolutional Neural Networks (CNNs): Convolution, pooling, architectures of VGG, ResNet, DenseNet, Inception, and their architectures. Transfer Learning: EfficientNet: Pre-trained models, fine-tuning, domain adaptation.			**CO1**
UNIT – II	**Sequence Models, NLP**	**Periods:10**	
Recurrent Neural Networks (RNNs): Advanced concepts in LSTMs, GRUs, and bidirectional RNNs. Transformers: Architecture, self-attention mechanism, positional encoding. BERT, GPT, T5 Models: Pre-training, fine-tuning, masked language models. Multimodal Learning: Combining text, images, and audio for richer representations.			**CO2**
UNIT – III	**Neural Architecture Search and Model Optimization**	**Periods:10**	
Neural Architecture Search (NAS): ENAS, AutoML, Model Pruning and Quantization, Knowledge Distillation: Transfer of knowledge from large to smaller models, Meta-Learning: Few-shot learning, model adaptation, Applications: Optimizing models for edge devices, mobile AI, energy-efficient deep learning			**CO3**
UNIT – IV	**Laboratory Exercises**	**Periods:15**	
• Implement CNNs for image classification and object detection. • Train and evaluate GANs for image synthesis and style transfer. • Apply transfer learning with pre-trained models. • Build and train RNNs and Transformers for NLP tasks. • Multimodal Sentiment Analysis Using Text and Audio			**CO4**
UNIT – V	**Laboratory Exercises**	**Periods:15**	
• Experiment with NAS tools to design optimized architectures. • Apply pruning, quantization, and knowledge distillation. • Develop models for mobile AI applications. • Implement a NAS algorithm for image classification. • Apply meta-learning techniques for few-shot learning.			**CO5**

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

Textbooks

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", MIT Press, 1st Edition, 2016.
2. Charu C. Aggarwal, "Neural Networks and Deep Learning", Springer, 2018.
3. Denis Rothman, "Transformers for Natural Language Processing",Packt Publishing, 1st Edition,2021.
4. Frank Hutter, Lars Kotthoff, and Joaquin Vanschoren, "AutoML: Methods, Systems, Challenges", Springer Cham, 1st Edition, 2021.

References

1. Cosma Rohilla Shalizi, “Advanced Data Analysis from an Elementary Point of View”, Cambridge University Press, 2015.
2. Deng & Yu, “Deep Learning: Methods and Applications”, Now Publishers, 2014.
3. Michael Nielsen, “Neural Networks and Deep Learning”, Determination Press, 2015.
4. Josh Patterson, Adam Gibson, “Deep Learning A Practitioner's Approach”, O'Reilly Media, 2017.
5. Nikhil Buduma, “Fundamentals of Deep Learning”, O’Reilly, 2017.

Web References

1. https://nptel.ac.in/courses/106/106/106106184/
2. http://deeplearning.net/Dj
3. https://www.guru99.com/deep-learning-tutorial.html
4. https://www.coursera.org/specializations/deep-learning
5. http://neuralnetworksanddeeplearning.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	3	3	3	3	-	-	-	-	-	-	-	3	3	2
2	3	3	3	3	1	-	-	-	-	-	-	-	3	3	2
3	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM) – Maximum 50 Marks									End Semester Examination (ESE) Marks (Theory)	Total Marks (CAM+ ESE)
	Continuous Assessment (Theory)					Continuous Assessment (Practical)					
	CAT 1	CAT 2	Model ##	Attendance##	Total	Conduction of Practical	Report	Viva	Total	End Semester Examination (ESE) Marks (Practical)		
Marks	50	50	75	5		15	10	5	30*	30	75 *(To be weighted for* 50 Marks)	
Weightage of CAM	2.5	2.5	2.5	2.5	**10**	**To be weighted for 10 Marks*			**10**	**30**		
CAM / ESE Marks	***CAM Marks =10+10+30=50***										***ESE Marks = 50***	**100**

Distribution of Marks for Attendance, the Question Paper Pattern for Model and ESE are same as given in B. Tech. Regulations R2023 for Theory cum practical Courses

Department	**Artificial Intelligence and Data Science**	Name of the Programme: **B.Tech / (Honour / Minor) – Artificial Intelligence and Machine Learning**						
Semester	**VI**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23MXB602**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**REINFORCEMENT LEARNING**	**3**	**0**	**2**	**4**	**50**	**50**	**100**

Common to all Branches except AI & DS

Prerequisite	Machine Learning, Programming in Python, knowledge of Probability and statistics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Apply reinforcement learning algorithms to real-world problem	**K3**
	CO2 Apply advanced techniques for building models	**K3**
	CO3 Apply, train, and evaluate RL models	**K3**
	CO4 Implement practical solutions for sequential decision-making problems	**K3**
	CO5 Implement practical solutions using advanced techniques	**K3**

UNIT-I	**Foundations of Reinforcement Learning**	**Periods: 10**	
RL Framework, Intelligent Agents, Problem-Solving, Searching, Probability Axioms, Random Variables, PMF, PDF, Agent-Environment Interface, Goals, Rewards, Returns, Policies, Value Function, Notation for episodic and continuing tasks.			**CO1**
UNIT-II	**Dynamic Programming and Monte Carlo Methods**	**Periods: 10**	
Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Monte Carlo Methods: Prediction, Estimation of Action Values, Control with and without Exploring Starts, Model-Free Prediction and Control: Monte Carlo Control in unknown environments.			**CO2**
UNIT-III	**Temporal-Difference Learning and Advanced Techniques**	**Periods: 10**	
Temporal-Difference (TD) Learning: TD Prediction, TD (0) Method, Sarsa (on-policy), Q-learning (off-policy), Eligibility Traces: Forward and Backward View, Planning and Learning: Dyna-Q, Prioritized Sweeping, Real-time DP, Monte Carlo Tree Search (MCTS): Planning at Decision Time.			**CO3**
UNIT-IV	**Laboratory Exercises**	**Periods: 15**	
• Implement a basic RL environment with OpenAI Gym. • Develop a simple agent for a grid-world environment. • Analyze agent behavior with different reward settings. • Build and analyze MDP models. • Implement Monte Carlo Prediction and Control			**CO4**
UNIT-V	**Laboratory Exercises**	**Periods: 15**	
• Develop Q-learning agents for maze navigation. • Experiment with policy evaluation and improvement • Develop a TD learning agent. • Implement Monte Carlo Tree Search for game playing. • Explore Dyna-Q with planning and learning components			**CO5**

LecturePeriods:30	**TutorialPeriods:-**	**PracticalPeriods: 30**	**Total Periods:60**

Text Books

1. Russell, S. J., & Norvig, P. “Artificial Intelligence: A Modern Approach”, 4th Edition, Pearson, 2020.
2. Busoniu, L., Babuška, R., & De Schutter, B., “Reinforcement Learning and Dynamic Programming Using Function Approximators”. CRC Press, 2010
3. Richard S. Sutton, Andrew G. Barto, “Reinforcement Learning,An Introduction: Adaptive Computation and Machine Learning series”, MIT Press, 4th edition,2018
4. Paul A. Gagniuc, “Markov Chains: From Theory to Implementation and Experimentation”, John Wiley & Sons, 2017.

Reference Books

1. Sutton, R. S., & Barto, A. G. "Reinforcement Learning: An Introduction", 2nd Edition, 2018.
2. Silver, D."UCL Course on Reinforcement Learning" , 2015..
3. Mnih, V., et al., "Human-level control through deep reinforcement learning". Springer Nature, 2015.

Web References

1. https://www.datacamp.com/tutorial/reinforcement-learning-python-introduction
2. https://medium.com/analytics-vidhya/a-beginners-guide-to-reinforcement-learning-and-its-basic-implementation-from-scratch-2c0b5444cc49
3. https://towardsdatascience.com/reinforcement-learning-101-e24b50e1d292
4. https://towardsdatascience.com/introduction-to-reinforcement-learning-rl-part-5-monte-carlo-methods-25067003bb0f

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	3	3	-	-	-	-	-	-	-	3	3	2
2	3	3	3	3	1	-	-	-	-	-	-	-	3	3	2
3	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM) – Maximum 50 Marks									End Semester Examination (ESE) Marks (Theory)	Total Marks (CAM+ ESE)
	Continuous Assessment (Theory)					Continuous Assessment (Practical)					
	CAT 1	CAT 2	Model	Attendance	Total	Conduction of Practical	Report	Viva	Total	End Semester Examination (ESE) Marks (Practical)		
Marks	50	50	75	5		15	10	5	30*	30	75 *(To be weighted for* 50 Marks)	
Weightage of CAM	2.5	2.5	2.5	2.5	**10**	**To be weighted for 10 Marks*			**10**	**30**		
CAM / ESE Marks	***CAM Marks =10+10+30=50***										***ESE Marks = 50***	**100**

Distribution of Marks for Attendance, the Question Paper Pattern for Model and ESE are same as given in B. Tech. Regulations R2023 for Theory cum practical Courses

Department	**Artificial Intelligence and Data Science**	**B.Tech / (Honour / Minor) – Artificial Intelligence and Machine Learning**						
Semester	**VII**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23MXT702**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**IMAGE AND VIDEO ANALYTICS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Common to all Branches except AI & DS								
Prerequisite	Basic image processing concepts, knowledge of Machine Learning and Deep Learning fundamentals							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret Digital image and video processing techniques for processing image and video files	**K2**
	CO2 Interpret the concepts of Image and Video enhancement and restoration for effective image analysis	**K2**
	CO3 Apply various concepts of Image analysis and video analysis.	**K3**
	CO4 Apply multifarious feature detection and description techniques for image analytics	**K3**
	CO5 Apply various object detection and recognition techniques for tracking objects in videos	**K3**

UNIT-I	**Introduction to Digital Image and Video Processing**	**Periods: 9**
Digital image representation - Sampling and Quantization - Types of Images - Basic Relations between Pixels – Neighbors – Connectivity - Distance Measure, Introduction to Digital Video - Sampled Video - Video Transmission. Gray-Level Processing: Image Histogram, Arithmetic Operations between Images - Geometric Image Operations. Binary Image Processing, Binary Image Morphology.		**CO1**
UNIT-II	**Image and Video Enhancement and Restoration**	**Periods: 9**
Spatial domain - Linear and Non-linear Filtering - Morphological filtering, Homomorphic Filtering, Blotch Detection - Motion Vector Repair and Interpolating Corrupted Intensities - Intensity Flicker Correction – Flicker Parameter Estimation - Wavelet based image denoising - Basic methods for image restoration using deconvolution filters.		**CO2**
UNIT-III	**Image and Video Analysis**	**Periods: 9**
Image Compression: Huffman coding - Run length coding - LZW coding - Lossless Coding - Wavelets based image compression. Video Compression: Basic Concepts and Techniques of Video Coding and the H.264 Standard - MPEG-1 and MPEG-2 Video Standards.		**CO3**
UNIT-IV	**Feature Detection and Description**	**Periods: 9**
Introduction to feature detectors - descriptors - matching and tracking - Basic edge detectors– canny – sobel - prewitt etc. - Image Segmentation - Region Based Segmentation – Region Growing and Region Splitting and Merging - Thresholding– Basic global thresholding - optimum global thresholding using Otsu's Method		**CO4**
UNIT-V	**Object Detection and Recognition**	**Periods: 9**
Object detection and recognition in image and video - basic texture descriptors - GLCM - LBP and its applications in image and video analysis - object tracking in videos.		**CO5**

LecturePeriods:45	**TutorialPeriods: -**	**PracticalPeriods: -**	**Total Periods:45**

Text Books

1. Alan Bovik, "Handbook of Image and Video Processing" , 2nd Edition, Academic Press, 2005.
2. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2008.
3. Richard Szeliski, "Computer Vision – Algorithms and Applications ", Springer, 2011.
4. Ali Ismail Awad and Mahmoud Hassaballah, "Image Feature Detectors and Descriptors", Foundations and Applications, Springer; 1st ed. 2016 edition.
5. Xiaoyue Jiang and Abdenour Hadid, "Deep Learning in Object Detection and Recognition Hardcover", Springer; 1st ed. 2019 edition (27 November 2019).

Reference Books
1. Anil K Jain, “Fundamentals of Digital Image Processing “, PHI, 2011.
2. Oge Marques, “Practical Image and Video Processing Using MatLab “, Wiley, 2011.
3. John W. Woods,” Multidimensional Signal, Image, Video Processing and Coding “, Academic Press, 2006.
4. Mohammed Salemdeeb, “Object Detection and Recognition Using Deep Learning”, Scholars' Press, 2020.
5. Davut Armagan Kaya, “Feature Detection and Matching”, Grin Verlag , 1st edition, 2021).
Web References
1. https://www.geeksforgeeks.org/digital-image-processing-basics/ 2. https://www.javatpoint.com/digital-image-processing-tutorial 3. https://www.tutorialspoint.com/dip/index.htm

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	3	3	-	-	-	-	-	-	-	3	3	2
2	3	3	3	3	1	-	-	-	-	-	-	-	3	3	2
3	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	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##		
Test Marks	50*	50*	75*	20*	5	75	100
Weightage for CAM	5	5	5	5	5	75	
CAM / ESE Marks	CAM Marks = 25					ESE Marks = 75	

#Open Book Analytical Exam/Analyse Real world problems and propose solutions/ Tool or Subject Proficiency Analysis – Test the Students skill by giving individual task/ Paper Presentation/Micro Project Presentation/Idea Presentation for the Societal Problem;
Distribution of Marks for Attendance, the Question Paper Pattern for Model and ESE are same as given in B. Tech. Regulations R2023 for Theory Courses.

Department	**Artificial Intelligence and Data Science**	**B.Tech / (Honour / Minor) – Artificial Intelligence and Machine Learning**						
Semester	**VIII**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23MXT803**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROMPT ENGINEERING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Common to all Branches except AI & DS								
Prerequisite	Strong understanding of Natural Language Processing, familiarity with Machine Learning models and techniques.							

Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Interpret the basic concepts and importance of prompt engineering, including various types of prompts and their applications.	**K2**
	CO2	Apply skills in designing effective prompts with clear structure and contextual relevance, avoiding common pitfalls.	**K3**
	CO3	Apply various metrics and feedback, and improve prompt effectiveness.	**K3**
	CO4	Apply advanced techniques in prompt engineering for handling different types of prompts	**K3**
	CO5	Apply prompt engineering concepts in various for building interactive systems.	**K3**

UNIT-I	**Introduction to Prompt Engineering**	**Periods: 9**
Introduction – Importance and Applications – Types of Prompts – Components of Effective Prompts – Challenges and Solutions – Case Studies in Prompt Engineering.		**CO1**
UNIT-II	**Designing Effective Prompts**	**Periods: 9**
Principles of Prompt Design – Structuring Prompts – Contextual Relevance – Clarity and Precision – Examples and Best Practices – Common Pitfalls and How to Avoid Them.		**CO2**
UNIT-III	**Evaluating Prompt Performance**	**Periods: 9**
Metrics for Prompt Effectiveness – User Feedback and Iteration – Testing and Validation Methods – Analyzing User Engagement – Improving Prompt Responsiveness – Tools for Evaluation and Optimization.		**CO3**
UNIT-IV	**Advanced Techniques in Prompt Engineering**	**Periods: 9**
Adaptive Prompting Techniques – Leveraging Machine Learning for Prompt Improvement – Multi-turn Prompts and Conversations – Personalization and Customization – Integrating Prompts with AI Systems – Ethical Considerations and Bias Mitigation.		**CO4**
UNIT-V	**Case Studies and Applications**	**Periods: 9**
Industry-Specific Prompt Engineering Applications – Healthcare, Finance, Education, and Customer Service – Building Interactive Systems with Prompts – Real-world Case Studies and Success Stories – Future Trends in Prompt Engineering – Capstone Project: Designing a Prompt System.		**CO5**

LecturePeriods:45	**TutorialPeriods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy, "Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies," MIT Press, 2015.
2. Christopher Manning, Hinrich Schütze, and Prabhakar Raghavan,"Introduction to Information Retrieval," Cambridge University Press, 2008.
3. Kathleen R. McKeown,"Introduction to Natural Language Processing," McGraw-Hill, 1992.
4. Jacob Andreas, "Task-Oriented Dialogue Systems for Conversational AI," Springer, 2020.

Reference Books

1. Daniel Jurafsky and James H. Martin,"Speech and Language Processing," 3rd Edition, Pearson, 2021.
2. Yoav Goldberg,"Neural Network Methods for Natural Language Processing," Morgan & Claypool Publishers, 2017.
3. Christopher D. Manning and Hinrich Schütze, "Foundations of Statistical Natural Language Processing," MIT Press, 1999.
4. Mike Lewis and Tom Kwiatkowski, "Advanced Methods for Natural Language Processing," Springer, 2022.

Web References

1. https://www.nltk.org/book/
2. https://github.com/dennybritz/deeplearning-pytorch
3. https://towardsdatascience.com/prompt-engineering-7e1666f71e7f
4. https://github.com/f/awesome-chatgpt-prompts
5. https://ai.googleblog.com/search/label/Dialog%20Systems

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	3	3	-	-	-	-	-	-	-	3	3	2
2	3	3	3	3	1	-	-	-	-	-	-	-	3	3	2
3	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	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##		
Test Marks	50*	50*	75*	20*	5	75	
Weightage for CAM	5	5	5	5	5	75	
CAM / ESE Marks	CAM Marks = 25					ESE Marks = 75	100

#Open Book Analytical Exam/Analyse Real world problems and propose solutions/ Tool or Subject Proficiency Analysis – Test the Students skill by giving individual task/ Paper Presentation/Micro Project Presentation/Idea Presentation for the Societal Problem;
Distribution of Marks for Attendance, the Question Paper Pattern for Model and ESE are same as given in B. Tech. Regulations R2023 for Theory Courses.

Department	**Artificial Intelligence and Data Science**	**B.Tech / (Honour / Minor) – Artificial Intelligence and Machine Learning**							
Semester	**VI**	Course Category Code: **PA**				End Semester Exam Type: **PA**			
Course Code	**U23MXW801**	Periods / Week			Credit	Maximum Marks			
		L	T	P	C	CAM	ESE	TM	
Course Name	**PROJECT**	**0**	**0**	**4**	**2**	**50**	**50**	**100**	
Common to all Branches except AI & DS									
Prerequisite	Artificial Intelligence, Machine Learning, Deep Learning, Programming in C, Python								

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Identify and define a real-world problem relevant to their field of study.	**K2**
	CO2	Develop and implement the proposed solution using appropriate tools and technologies.	**K3,K5**
	CO3	Present the project findings effectively through a structured report and oral presentation.	**K6**

The project work involves developing a solution to a real-world problem using emerging technologies and engineering principles. Students will work individually to analyze, design, develop, and evaluate a functional prototype or software application. The project must demonstrate the application of theoretical knowledge to practical challenges, integrating concepts from the core areas of the curriculum.

The project spans an academic term and includes multiple reviews to assess progress, quality, and implementation. Students are expected to conduct literature reviews, define clear objectives, apply suitable methodologies, perform data collection and analysis, and present their findings in a comprehensive report.

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

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	2	2	1	-	1	3	3	-	1	3	3	2
2	3	3	3	3	3	1	2	1	3	3	3	1	2	3	3
3	2	2	3	2	2	1	-	1	3	3	3	1	2	2	2

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

Evaluation Method

Assessment	**CAM**				**ESE**			**Total**
	Review 1		**Review 2**		**Report**	**Presentation and Viva**	**Demo**	
	Presentation and Viva	**Supervisor**	**Presentation and Viva**	**Supervisor**				
	15	**10**	**15**	**10**	**15**	**20**	**15**	**100**
CAM/ESE Marks	**CAM Marks=50**				**ESE Marks =50**			