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

Minutes of 8th Board of Studies Meeting

Venue
AI & ML Lab, University Block, Lower Ground Floor
Sri ManakulaVinayagar Engineering College
Madagadipet, Puducherry – 605 107

Date & Time
10.09.2024 & 10.30 AM Onwards

The Eighth Board of Studies meeting for Department of Artificial Intelligence and Data Science was held on 10th September 2024 at 10:30 A.M in the AI & ML Lab, University Block, Lower Ground Floor, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting.

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

14	Mrs. N.Jayapratha, Assistant Professor Specialization: Networking	Member
15	Mrs. Subashini M, Assistant Professor Specialization:Wireless Communication	Member
16	Mrs.J. Roselin Lourd, Assistant Professor Specialization: IoT	Member
17	Mr. Dhanapathy,Assistant Professor Specialization: Computer Networks	Member
18	Dr. M. Ganesan, Professor / CSE Specialization: Internet of Things	Member
3. Two subject experts from outside the Parent University are nominated by the Academic Council.		
19a	Dr. R. Srinivasa Perumal Professor SCOPE Vellore Institute of Technology, Vellore 8870537819 Mail id: Asstdean.acad3@vit.ac.in	Subject Expert
19b	Dr. N. Bhalaji M.E., Ph.D Principal Rajalakshmi Institute of Technology (An Autonomous Instituition) Chennai Ph:95000 86801 Mail id: bhalajin@ssn.edu.in	Subject Expert
4. One expert is nominated by the Vice-Chancellor from a panel of six recommended by the Autonomous College Principal as a University Nominee.		
20	Dr. N. Sreenath Professor Department of CSE Puducherry Technological University Puducherry Ph: 9443289642 Mail id: nsreenath@ptuniv.edu.in	University Nominee
5. One representative from industry/corporate sector/allied areasis nominated by the Principal as a Industry Nominee.		
21	Mr. E. Marie Joseph Antony Patrick Lead Software Engineer Freshworks Chennai Ph: 9677488961 Mail id: patrick.ernest@freshworks.com	Industry Expert
6. One member of the College alumni is nominated by the Principal.		
22	Ms. Madhu Srinvasan Engineer Director EMIS Health India Pvt. Ltd. Chennai Ph:99942 69567 Mail id: madhu_anusri@hotmail.com	Alumni

7. Experts from outside the Autonomous College, whenever special courses of studies are to be formulated, nominated by the Principal.		
23	Dr. V. Prasanna Venkatesan Professor Department of Banking Technology School of Management Pondicherry University prasanna.btm@pondiuni.edu.in +91 94887 34883	Member

AGENDA OF THE MEETING

B.Tech

1. Welcome Address and review of the seventh meeting of Board of Studies held on 04.03.2024.
2. To apprise about achievements of the institution and department
3. To discuss and approve syllabi of fifth and sixth Semesters for the B. Tech Artificial Intelligence and Engineering students admitted from the academic year 2023-24 under R-2023 Regulation.
4. To apprise and get approval for Honours Degree – Courses, Syllabus and Credits
5. To discuss and get approval for evaluation Systems for regulation R-2023.
6. To discuss and get approval for the academic calendar for the odd semester 2024-25.
7. To apprise the End Semester Results of the students in the even semester
8. To apprise the schedule of the End Semester Examination to be conducted in the month of Nov/Dec 2024 and to discuss and recommend the panel of examiners to the Academic Council
9. To Discuss about Equivalence of Degree

M.Tech

1. To showcase the syllabus for the fourth semester M. Tech professional electives PE-IV, PE-V, PE-VI
2. To get suggestions from the members regarding the project domain selection and project proposal
3. To apprise about the List of Courses for Professional Electives / Ability Enhancement Courses / Mandatory Courses under R-2023 for the students admitted from the academic Year 2024-25.
4. To discuss about academic results

Minutes of the Meeting

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

BoS/8/2024/ AD /UG/8.1	The BoS Chairperson apprised the board regarding the minutes of 7th BoS
BoS/8/2024/AD /UG/8.2	The BoS Chairperson apprised about the Achievements of College and Department. He portrayed the achievement of students in terms of co-curricular activities and placement records

BoS/8/2024/AD /UG/8.3	The BoS Chairperson apprised about the syllabus of V and VI Semester of R-2023. The syllabus was showcased to the BoS members and got concurrence and approval with minor modifications to be incorporated. 1. The expert members have told to change the professional elective course Ethical Hacking U23ADE717 offered in VII semester to Quantum AI U23ADE717. The subject name has been changed. 2. The subject code for the subject NLP and Chatbot has been changed from U23ADT611 to U23ADTC02 as it is going to be treated as common syllabus. AI & DS is going to offer this syllabus to CSE & BS. The expert members have ratified it.

Sl. No	Regulation	Semester	Subject Name with Code	Unit	Particulars
1	R-2023	V	Data Visualization U23ADT511	V	BoS Members have suggested to change the title from Introduction to Power BI to Power BI. The change has been incorporated. **Kindly refer Annexure II**
2	R-2023	VI	Web Technology U23ADT614	IV & V	BoS Members have suggested to change the contents of unit IV and V entirely to cover the broad aspects of PHP in web designing. Since CSE department is offering the same syllabus, with the concurrence of the BoS members department of CSE is offering syllabus for this subject under the name Web Designing / U23ADDC07. **Kindly refer Annexure I and II**
3	R-2023	VI	Data Science for Business Analytics U23ADE613	All units	The BoS Members have suggested to change the subject as it has replication of concepts in Machine Learning basics to Predictive Data Analytics / U23ADE612. The Subject has been changed**. Refer Annexure I and II**

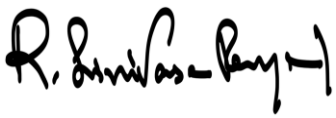
BoS/8/2024/AD /UG/8.4	The BoS Chairperson apprised and got approval for Honours Degree – Courses, Syllabus and Credits. **Refer Annexure III**

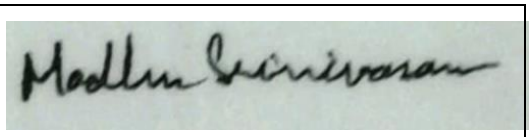
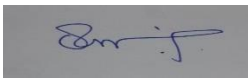
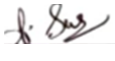
BoS/8/2024/AD /UG/8.5	The BoS Chairperson discussed about evaluation Systems for regulation R-2023 and got approval for the same.
BoS/8/2024/AD /UG/8.6	The BoS Chairperson discussed about the academic calendar for the odd semester 2024-25 and got approval
BoS/8/2024/AD /UG/8.7	The BoS Chairperson apprised the End Semester Results of the students in the even semester. The BoS expert members appreciated the results and asked about the remedial measures for failed students and the BoS Chairperson explained the steps taken for remedial measures.
BoS/8/2024/AD /UG/8.8	The BoS Chairperson apprised the schedule of the End Semester Examination to be conducted in the month of Nov/Dec 2024 and showcased the panel of examiners.
BoS/8/2024/AD /UG/8.9	The BoS Chairperson discussed about Equivalence of Degree. He explained how the equivalence of 76% with Pondicherry University CSE curriculum and 80% with CSE curriculum of SMVEC. The BoS members have accepted the justification.

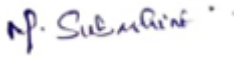
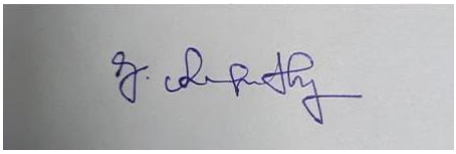
M.Tech Artificial Intelligence and Data Science

BoS/8/2024/ AD /PG/8.1	The BoS Chairperson apprised the board regarding the minutes of 7th BoS The BoS Chairperson imparted about the list of subjects offered as professional electives PE-IV, PE-V, PE-VI and showcased the syllabus and the BoS members approved it gracefully. Kindly **Refer Annexure IV and V**
BoS/8/2024/AD /PG/8.2	The BoS Chairperson got suggestions from the members regarding the project domain selection and project proposal
BoS/8/2024/AD /PG/8.3	The BoS Chairperson apprised about the List of Courses for Professional Electives / Ability Enhancement Courses / Mandatory Courses under R-2023 for the students admitted from the academic Year 2024-25 and the BoS members approved it. **Refer Annexure IV and V**
BoS/8/2024/AD /PG/8.4	The BoS Chairperson showcased the results of the II semester and highlighted a student named Jeevitha. K has secured 10 on 10 CGPA in the semester exam and the BoS appreciated.

The meeting was concluded at 12.36 PM with a vote of thanks by **Dr. J. Madhusudanan**, Head of Department, Artificial Intelligence and Data Science.

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

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

21	Mrs. Subashini M, Assistant Professor Specialization:Wireless Communication	Member	
22	Mrs.J. Roselin Lourd,Assistant Professor Specialization: IoT	Member	
23	Mr. Dhanapathy,Assistant Professor Specialization: Computer Networks	Member	
24	Dr. M. Ganesan, Professor / CSE Specialization: Internet of Things	Member	

Annexure-I

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	Security in AI and ML
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	U23ADX01	Parallel Programming and High Performance Computing	PC	3	1	0	4	25	75	100
2	V	U23ADX502	Advanced Deep Learning	PC	3	1	0	4	25	75	100
3	VI	U23ADX603	Reinforcement Learning	PC	3	1	0	4	25	75	100
4	VII	U23ADX704	Image and Video Analytics	PC	3	1	0	4	25	75	100
5	VIII	U23ADX805	Prompt Engineering	PC	3	1	0	4	25	75	100
	Total							**20**	**125**	**375**	**500**
Equivalent NPTEL courses##											
1	Parallel Computing							**3**	**12 Weeks Course**		
2	Deep Learning for Computer Vision							**3**			
3	Reinforcement Learning							**3**			
4	Image Processing and Computer Vision							**3**			
5	Natural Language Processing							**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.

Annexure-II

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.

Web References

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.

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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

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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

Web References

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.

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

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

Evaluation 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.

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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

Annexure-III

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech / (Honour / Minor)**						
Semester	**IV**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23ADX401**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PARALLEL PROGRAMMING AND HIGH PERFORMANCE COMPUTING**	**3**	**1**	**0**	**4**	**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: 12**	
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: 12**	
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: 12**	
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: 12**	
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: 12**	
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: 15**	**Practical Periods: -**	**Total Periods: 60**

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/

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

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

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech / (Honour / Minor)**						
Semester	**V**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23ADX502**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ADVANCED DEEP LEARNING**	**3**	**1**	**0**	**4**	**25**	**75**	**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	**K3**
	CO2	Apply generative models for image synthesis, style transfer, and data augmentation tasks.	**K3**
	CO3	Apply advanced sequence models for NLP tasks like text generation, summarization, and multimodal learning.	**K3**
	CO4	Apply reinforcement learning concepts in AI, robotics, and autonomous systems.	**K3**
	CO5	Apply techniques such as neural architecture search and meta-learning to optimize models for edge devices and energy-efficient AI systems.	**K3**

UNIT – I	**Advanced Convolutional Networks and Visual Recognition**	**Periods:12**	
Deep Convolutional Networks: ResNet, DenseNet, Inception, and their architectures. Transfer Learning: Pre-trained models (VGG, EfficientNet), fine-tuning, domain adaptation. Attention in Vision: Vision transformers (ViT), attention mechanisms in CNNs. Object Detection and Segmentation: R-CNN, Fast R-CNN, YOLO, Mask R-CNN. Applications: Image classification, detection, segmentation, and enhancement tasks.			**CO1**
UNIT – II	**Generative Models**	**Periods:12**	
Generative Adversarial Networks (GANs): Architecture, loss functions, training instability, and improvements (DCGAN, WGAN, StyleGAN). Variational Autoencoders (VAEs): Probabilistic interpretation, KL divergence, reconstruction. Diffusion Models: Overview of diffusion probabilistic models for image generation. Applications: Image synthesis, style transfer, super-resolution, and data augmentation.			**CO2**
UNIT – III	**Sequence Models and Natural Language Processing (NLP)**	**Periods:12**	
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. Applications: Text generation, translation, summarization, sentiment analysis.			**CO3**
UNIT – IV	**Reinforcement Learning and Deep RL**	**Periods:12**	
Foundations of Reinforcement Learning: Markov decision processes (MDPs), policy, value functions. Deep Q-Networks (DQN): Q-learning with deep networks, experience replay. Policy Gradient Methods: REINFORCE, actor-critic methods, Proximal Policy Optimization (PPO). Deep RL Applications: Game AI, robotics, autonomous systems, recommendation systems.			**CO4**
UNIT – V	**Neural Architecture Search and Model Optimization**	**Periods:12**	
Neural Architecture Search (NAS): Techniques for automating architecture discovery (e.g., ENAS, AutoML). Model Pruning and Quantization. Knowledge Distillation: Transfer of knowledge from large models to smaller, Meta-Learning: Few-shot learning, model adaptation to new tasks with limited data. Applications: Optimizing models for edge devices, mobile AI, energy-efficient deep learning.			**CO5**

Lecture Periods:45	**Tutorial Periods: 15**	**Practical Periods: -**	**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)					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 / **(Honour / Minor)**						
Semester	**VI**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23ADX603**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**REINFORCEMENT LEARNING**	**3**	**1**	**0**	**4**	**25**	**75**	**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 Interpret the concepts of Reinforcement Learning to solve real world problems.	**K2**
	CO2 Apply Markov Decision Process, Monte Carlo, Temporal Difference methods for policy evaluation and prediction	**K3**
	CO3 Apply the Tabular Methods and On-policy Prediction with Approximation.	**K3**
	CO4 Apply suitable Reinforcement Techniques for a given problem	**K3**
	CO5 Implement eligibility traces, REINFORCE, tabular methods, Dyna, prioritized sweeping, and Monte Carlo tree search in reinforcement learning applications.	**K3**

UNIT-I	**Reinforcement Learning Primitives**	**Periods: 12**
Introduction and Basics of RL, Defining RL Framework, Probability Basics: Probability Axioms, Random Variables, Probability Mass Function, Probability Density Function, Introduction to Agents, Intelligent Agents – Problem Solving – Searching, Logical Agents.		**CO1**
UNIT-II	**Finite Markov Decision Process**	**Periods: 12**
Basics, The Agent-Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notation for Episodic and Continuing Tasks, Policies and Value Functions, Optimal Policies and optimal Value Functions.		**CO2**
UNIT-III	**Dynamic Programming**	**Periods: 12**
Definition, Policy Evaluation (Prediction), Policy Improvement, Policy Iteration, Value Iteration, Asynchronous dynamic programming, Generalized Policy Iteration, Efficiency of dynamic programming. Monte Carlo Methods: Definition, Monte Carlo Prediction, Monte Carlo Estimation of Action values, Monte Carlo Control, Monte Carlo Control without Exploring Starts.		**CO3**
UNIT-IV	**Monte Carlo methods for model free prediction and control and TD methods**	**Periods: 12**
Temporal-Difference Learning: TD Prediction, Advantages of TD Prediction Methods, Optimality of TD (0), Sarsa: On-policy TD control, Q-learning Off-policy TD control.		**CO4**
UNIT-V	**Eligibility Traces and Reinforce**	**Periods: 12**
Planning and Learning with Tabular Methods: Models and Planning**, Dyna**: Integrated Planning, acting and learning, Prioritized Sweeping- Real-time dynamic programming, Planning at decision time, Heuristic search, Rollout algorithms, Monte Carlo tree search.		**CO5**

LecturePeriods:45	**TutorialPeriods: 15**	**PracticalPeriods: -**	**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, ISBN 1119387558, 9781119387558

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)					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 / (Honour / Minor)**						
Semester	**VII**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23ADX704**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**IMAGE AND VIDEO ANALYTICS**	**3**	**1**	**0**	**4**	**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: 12**
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, Arithmetic Operations between Images - Geometric Image Operations. Binary Image Processing, Binary Image Morphology.		**CO1**

UNIT-II	**Image and Video Enhancement and Restoration**	**Periods: 12**
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 - Wavelet based image denoising - Basic methods for image restoration using deconvolution filters.		**CO2**

UNIT-III	**Image and Video Analysis**	**Periods: 12**
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: 12**
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: 12**
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: 15**	**PracticalPeriods: -**	**Total Periods:60**

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		
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 / (Honour / Minor)**						
Semester	**VIII**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23ADX805**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROMPT ENGINEERING**	**3**	**1**	**0**	**4**	**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: 12**
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: 12**
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: 12**
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: 12**
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: 12**
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: 15**	**PracticalPeriods: -**	**Total Periods:60**

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	10		5	5	5	75	100

*

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

Annexure-IV

COLLEGE VISION AND MISSION

VISION

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

MISSION

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

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

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

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

DEPARTMENT VISION AND MISSION

VISION

Vision

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

Mission

M1: Understand Data Science:

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

M2: Applying the Acquired Knowledge:

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

M3: Capstone Project:

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

M4: Be socially beneficial and other moral concerns:

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

M5: Continuous Learning for keen Initiative:

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

PROGRAMME OUTCOMES (POs)

PO1: Exploration of Research: An ability to independently carry out research/investigation and development work to solve practical problems.

PO2: Technical Skill: An ability to write and present a substantial technical report/document.

PO3: Expertise in Academics: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO4: Scholarship of Knowledge: Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.

PO5: Usage of Modern Tools: Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations.

PO6: Ethical Practices and Social Responsibility: Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Competitive Platform: To create a competitive platform for solving critical problems in a wide variety of fields.

PEO2: Exploration: Enthusiastic participation in learning, understanding, designing and applying new innovative research ideas as the field evolves.

PEO3: Career: Applying cutting-edge technology that improves knowledge and to commit students for life-long learning to reach the leading positions in the career.

PEO4: Professional Values: Simulate the graduates to hold the responsibilities in the context of technology, ethics, society and humanity.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Computational Skills: Graduates with the ability to apply basic knowledge of Computer Science in solving critical problems.

PSO2: Studious Research: Ability to convert innovative ideas into research or society-oriented projects through current trending technologies.

PSO3: Employability: Acquire placement in highly reputed industries or accomplish new technical business skills with the contemporary trends in the industry.

STRUCTURE FOR POSTGRADUATE ENGINEERING PROGRAM

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

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl.No	Course Category	Credits per Semester				Total Credits
		I	II	III	IV	
1	Humanities and Social Sciences (HS)	4	2	-	-	6
2	Basic Sciences (BS)	3	-	-	-	3
3	Engineering Sciences (ES)	-	-	-	-	-
4	Professional Core (PC)	11	14	-	-	25
5	Professional Electives (PE)	3	6	9	-	18
6	Open Electives (OE)	-	-	-	-	-
7	Professional Activities (PA)			8	12	20
8	Ability Enhancement Courses (AEC)*	-	-	-	-	-
9	Mandatory Courses (MC)*	-	-	-	-	-
Total		**21**	**22**	**17**	**12**	**72**

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

CURRICULUM

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

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

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

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

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

BS- Basic Sciences

PC – Professional Core

PE – Professional Elective

HS - Humanities and Social Sciences

PA - Professional Activity

CC- Common Course

AC- Audit Course

AEC - Ability Enhancement Course

CREDIT DISTRIBUTION

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

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

ANNEXURE- I
PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course Code	Course Title
Professional Elective-I		
1	P23ADEC01	Agile and Software Project Management
2	P23ADE101	Python for Data Science
3	P23ADE102	Data Science Essentials
4	P23ADE103	Big Data Mining and Analytics
5	P23ADE104	Artificial Intelligence for Decision Making
Professional Elective-II		
1	P23BDEC02	Web Analytics and Development
2	P23ADE205	Data Visualization using Tableau and Power BI
3	P23ADE206	Predictive Modelling
4	P23ADE207	Next Generation Database Systems
5	P23ADE208	Advanced Algorithms
Professional Elective-III		
1	P23ADE209	AI and Robotics
2	P23ADE210	Explainable Artificial Intelligence
3	P23ADE211	Introduction to Real-time Data Analytics
4	P23ADE212	Data Engineering in the Cloud
5	P23ADE213	Machine learning on Cloud platform
Professional Elective-IV		
1	P23ADE314	Generative Adversarial Networks
2	P23ADE315	Introduction to Large Language Models (LLMs)
3	P23ADE316	Transfer Learning
4	P23ADE317	Information Retrieval and Text Mining
5	P23ADE318	Statistical Natural Language Processing (NLP)
Professional Elective-V		
1	P23ADE319	Predictive Analytics
2	P23ADE320	Prescriptive Analytics
3	P23ADE321	Descriptive analytics
4	P23ADE322	Internet of Things (IoT) Data Analytics
5	P23ADE323	Social Media Analytics
Professional Elective-VI		
1	P23ADE324	Machine Learning Model Deployment and Management
2	P23ADE325	AI for Sustainability
3	P23ADE326	AI in Natural Language Processing
4	P23ADE327	AI Applications in Cloud Computing
5	P23ADE328	Ethics in AI and Data Science

ANNEXURE- II

ABILITY ENHANCEMENT COURSES

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

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

67	P23XXCX67	Artificial Intelligence
68	P23XXCX68	Cloud Computing
69	P23XXCX69	Computational Thinking
70	P23XXCX70	Cyber Security
71	P23XXCX71	Data Analytics
72	P23XXCX72	Databases
73	P23XXCX73	Java Programming
74	P23XXCX74	Networking
75	P23XXCX75	Python Programming
76	P23XXCX76	Web Application Development (HTML, CSS, JS)
77	P23XXCX77	Network Security
78	P23XXCX78	MATLAB
79	P23XXCX79	Azure Fundamentals
80	P23XXCX80	Azure AI (AI-900)
81	P23XXCX81	Azure Data (DP -900)
82	P23XXCX82	Microsoft 365 Fundamentals (SS-900)
83	P23XXCX83	Microsoft Security, Compliance and Identity (SC-900)
84	P23XXCX84	Microsoft Power Platform (Pl-900)
85	P23XXCX85	Microsoft Dynamics Fundamentals 365 – CRM
86	P23XXCX86	Microsoft Excel
87	P23XXCX87	Microsoft Excel Expert
88	P23XXCX88	Securities Market Foundation
89	P23XXCX89	Derivatives Equinity
90	P23XXCX90	Research Analyst
91	P23XXCX91	Portfolio Management Services
92	P23XXCX92	Cyber Security
93	P23XXCX93	Cloud Security
94	P23XXCX94	PMI – Ready
95	P23XXCX95	Tally – GST & TDS
96	P23XXCX96	Advance Tally
97	P23XXCX97	Associate Artist
98	P23XXCX98	Certified Unity Programming
99	P23XXCX99	VR Development

ANNEXURE-III

AUDIT COURSES
(Common to all M.Tech Programme)

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

Annexure-V

Department	**Mathematics**		Programme : **M.Tech.**					
Semester	**I**		Course Category: **BS**			*End SemesterExamType:**TE**		
Course Code	**P23MAT105**		Periods/Week			Credit	MaximumMarks	
			L	T	P	C	CAM	ESE	TM
Course Name	**PROBABILITY AND STATISTICS**		**2**	**1**	**0**	**3**	**40**	**60**	**100**
	(AI&DS)								
Prerequisite	Basic Mathematics								
Course Outcome	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)	
	CO1	Apply the concept of probability in random variables.						**K3**	
	CO2	Apply the basic rules of continuous random variables.						**K3**	
	CO3	Apply the concept of testing of hypothesis for small and large samples in real life problems.						**K2**	
	CO4	Apply Concept of linear regression, correlation, and its applications						**K3**	
	CO5	List the guidelines for designing experiments and recognize the key historical figures in Design of Experiments.						**K2**	

UNIT – I	**DISCRETE RANDOM VARIABLES**	**Periods:12**
Random Variables and their event spaces – The probability mass function – Distribution functions – Binomial – Geometric – Negative Binomial and Poisson.		**CO1**
UNIT – II	**CONTINUOUS RANDOM VARIABLES**	**Periods:12**
Some important distributions – Exponential distribution –Gamma – Weibull – Gaussian distributions. Application of distribution – Reliability – Failure density and Hazard function.		**CO2**
UNIT – III	**TESTING OF HYPOTHESIS**	**Periods:12**
Sampling distributions – Small and large samples –Tests based on Normal, t test, Chi square test, and F test distributions for testing of means, variance and proportions —- Contingency table (test for independent) Goodness of fit.		**CO3**
UNIT – IV	**CORRELATION AND REGRESSION**	**Periods:12**
Correlation –Rank correlation– Regression –Multiple and partial correlation – Method of least squares – Plane of regression – Coefficient of multiple correlation – Coefficient of partial correlation.		**CO4**
UNIT – V	**DESIGN OF EXPERIMENTS**	**Periods:12**
Analysis of variance – One way and two-way classifications – Completely randomized design – Randomized block design – Latin square design - 2^2 Factorial design.		**CO5**

LecturePeriods:45	**TutorialPeriods:15**	**PracticalPeriods: -**	**TotalPeriods:60**

Text Books

1. B.S.Grewal, “Higher Engineering Mathematics”, Khanna publishers - Paperback – 3rd Edition - 2017.
2. T. Veerarajan, “Probability, Statistics and Random Processes”, Tata McGraw-Hill Education, 2008.
3. Gupta. S. C., and Kapoor, V.K., “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons, 12th Edition, 2023.

Reference Books

1. Ravish R. Singh, Mukul Bhatt “Engineering Mathematics”, McGraw-Hill, 1stEdition, 2017.
2. William Mendenhall, Robert J. Beaver, 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. EhsanesSaleh, “An Introduction to Probability and Statistics”, Wiley – 2008.
5. E. Rukmangadachari, “Probability and Statistics”, Pearson Education India, 2012.

Web References

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

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

******Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme : **M.Tech.**						
Semester	**I**	Course Category: **PC**			*End SemesterExamType:**TE**			
Course Code	**P23ADT101**	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MACHINE LEARNING ALGORITHMS** (AI&DS)	**3**	**0**	**0**	**3**	**40**	**60**	**100**

Prerequisite	NIL		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Interpret the concepts of machine learning algorithms and use knowledge on regression models	**K2**
	CO2	Apply the classification and the clustering algorithms for their models	**K3**
	CO3	Apply the dimensionality reduction techniques in their models	**K3**
	CO4	Apply Decision learning algorithm and rule-based learning in their models	**K3**
	CO5	Identify the use of ensemble learning and apply them to improve the efficiency of their models	**K2, K3**

UNIT – I	**Introduction to Machine Learning**	**Periods:9**	
Basics of Machine Learning - Types of Machine Learning Algorithms - Data Preprocessing - Introduction of Regression Algorithms – Linear Regression – Multivariate Linear Regression – Logistic Regression.			**CO1**
UNIT – II	**Classification and Clustering Models**	**Periods:9**	
Basics of Classification Algorithms – Support Vector Machine – Naive Bayes – classifying with conditional probabilities – K-Nearest Neighbor – Basics of Clustering Algorithms - K-Means clustering - K-Medians – Hierarchical Clustering – Applications.			**CO2**
UNIT – III	**Dimensionality Reduction Techniques**	**Periods:9**	
Introduction– Subset Selection - Principal Component Analysis (PCA) – Factor analysis – Multidimensional Scaling - Linear Discriminant Analysis (LDA) Case Study.			**CO3**
UNIT – IV	**Decision Trees and Rule Based Learning**	**Periods:9**	
Decision tree representation – ID3 – CART – Hidden Morkov Model - Association rule mining – Association rules - Case studies with Apriori and Equivalence Class Transformation Algorithm			**CO4**
UNIT – V	**Ensemble Learning**	**Periods:9**	
Introduction – Bagging: Random Forest – Boosting: Adaboost and XGBoost Algorithms Light GBM – Stacking.			**CO5**

LecturePeriods:45	**TutorialPeriods:0**	**PracticalPeriods: -**	**TotalPeriods: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. Timothy Howard Jackson “AI and Machine Learning for Coders: A Programmer's Guide to Artificial Intelligence”, 2022.
4. 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.

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/
4. https://www.coursera.org/learn/machine-learning.
5. https://www.youtube.com/watch?v=GwIo3gDZCVQ

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	3	2	3	2	-	3	2	-
2	3	1	2	2	3	-	3	1	-
3	2	1	2	3	3	-	3	1	-
4	2	1	2	2	3	-	3	1	-
5	3	1	2	2	3	-	3	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		15	10	5	60	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus
****** Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**I**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**P23ADT102**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**COMPUTING SYSTEMS FOR DATA SCIENCE**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
(AI & DS)								
Prerequisite	Computer Organization and Architecture/Operating System/Database Management Systems							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret the issues related to the design and analysis of systems with real-time constraints and to identify the features of Real time OS	**K2**
	CO2 Classify and Compare various Uniprocessor and Multiprocessor scheduling mechanisms	**K3**
	CO3 Categorize the difference between traditional and real time databases.	**K2**
	CO4 Identify Data Storage and Management Technologies	**K2**
	CO5 Interpret information about Storage Area Networks characteristics and components.	**K2**

UNIT-I	**Introduction**	**Periods: 9**	
Introduction to real time computing - Concepts; Example of real-time applications – Structure of a real time system – Characterization of real time systems and tasks - Hard and Soft timing constraints - Design Challenges - Performance metrics - Prediction of Execution Time : Source code analysis, Microarchitecture level analysis, Cache and pipeline issues- Programming Languages for Real-Time Systems			**CO1**
UNIT-II	**Real-time OS**	**Periods: 9**	
Real time OS – Threads and Tasks – Structure of Microkernel – Time services – Scheduling mechanisms Communication and Synchronization – Event Notification and Software interrupt Task assignment and Scheduling - Task allocation algorithms - Single-processor and Multiprocessor task scheduling - Clock-driven and priority-based scheduling algorithms Fault tolerant scheduling.			**CO2**
UNIT-III	**Real time Databases**	**Periods: 9**	
Real time Databases – Transaction priorities – Concurrency control issues – Disk scheduling algorithms – Two phase approach to improve predictability			**CO3**
UNIT-IV	**Large Data Storage**	**Periods: 9**	
Hard Disks- Networked Attached Storage-Scalability issues- Networking issues. Storage Architecture - Storage Partitioning- Storage System Design- Caching-Legacy Systems.			**CO4**
UNIT-V	**Storage Area Networks**	**Periods: 9**	
Storage Area Networks – Hardware and Software Components, Storage-Clusters/Grids. Storage QoS– Performance, Reliability, and Security issues. Recent Trends related to Copy data management Erasure coding-and Software defined storage appliances.			**CO5**

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

Text Books

1. C.M. Krishna, Kang G. Shin – Real Time Systems, McGraw Hill Education; 1st Edition, 2017.
2. Jane W.S. Liu, Real-Time Systems", Pearson Education India, 2002.
3. Sanjoy Baruah, Marko Bertogna, Giorgio Buttazzo, Multiprocessor Scheduling for Real-Time Systems, Springer International Publishing, 2015.

Reference Books

1. Hermann Kopetz, Real-Time Systems: Design Principles for Distributed Embedded Applications, 4th Edition, 2011.
2. Robert Spalding and Daniel J. Worden, Storage Networks: The Complete Reference, 1st edition, 2003.
3. Phillip A. Laplante, Real-Time Systems Design and Analysis: Tools for the Practitioner, 3rd edition, 2004.
4. Qing Li, Caroline Yao, Real-Time Concepts for Embedded Systems, 1st edition, 2003.
5. Christopher Poelker, Alex Nikitin, Storage Area Networks for Dummies, 2nd edition, 2009.

Web References

1. https://datascience.columbia.edu/research/centers/computing-systems-for-data-driven-science/https://www.guru99.com/what-is-tableau.html
2. https://www.geeksforgeeks.org/real-time-operating-system-rtos/
3. https://hazelcast.com/glossary/real-time-database/
4. https://www.simplilearn.com/big-data-storage-article
5. https://www.techtarget.com/searchstorage/definition/big-data-storage

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

******Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**I**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**P23ADT103**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ARTIFICIAL INTELLIGENCE AND INTELLIGENT SYSTEMS**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
(AI & DS)								
Prerequisite	-							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Apply different search techniques to solve real world problems	**K3**
	CO2	Interpret different approaches of knowledge representation and reasoning	**K2**
	CO3	Apply the planning and learning approaches to formulate solutions for real world problems.	**K3**
	CO4	Interpret intelligent computing models and explore the ways in which real-world problems can be solved	**K3**
	CO5	Apply the benefits of hybridization and propose new hybrid algorithms	**K3**

UNIT-I	**Introduction and Search Techniques**	**Periods: 9**	
History of AI, Problem-solving through search, state-space, blind search techniques: BFS, DFS, UCS, Heuristic search techniques - Best-first search, Greedy search, A* search, AO* search, Adversarial search: Mini-max search, alpha-beta cut off, Problem reduction – AND/OR Graphs, Constraint satisfaction problem, Means Ends Analysis.			**CO1**
UNIT-II	**Knowledge Representation Techniques and Reasoning under uncertainty**	**Periods: 9**	
Approaches for knowledge representation, Propositional Logic, Predicate Logic, Rule based knowledge representation, Conflict Resolution, Semantic networks, Forward Chaining, Backward Chaining, Unification an, Resolution, Managing Uncertainty–Probability Theory, Bayes Rule, Bayesian Belief Networks.			**CO2**
UNIT-III	**Planning and Learning**	**Periods: 9**	
State space planning, partial order planning, Planning graphs, Planning under uncertainty, Learning Types- Rote Learning, Learning by taking advice, Explanation based learning, Supervised and Unsupervised learning, Decision trees based learning, Reinforcement Learning.			**CO3**
UNIT-IV	**Intelligent Computing Models**	**Periods: 9**	
Introduction to Intelligent Systems, knowing when to use Intelligent Systems, Modes of intelligent interaction, Artificial Neural Networks- Types, Activation functions, Learning algorithms, Fuzzy Logic Fuzzy sets and operations, Fuzzy Rules, Fuzzy Inference, Evolutionary Algorithms- Genetic Algorithm, Swarm intelligence- Particle Swarm Optimization Algorithm.			**CO4**
UNIT-V	**Hybrid Intelligent Systems**	**Periods: 9**	
Need for hybridization, Types of hybrid intelligent systems – Neuro-Fuzzy Systems, Evolutionary Fuzzy Systems, Evolutionary Neural Networks, Case studies on the applications of hybrid Intelligence techniques			**CO5**

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

Text Books

1. N.P.Padhy, Artificial Intelligence and Intelligent systems,1st edition,Oxford,2005.
2. Adrian A.Hopgood,Intelligent Systems for Engineers and Scientists,4th edition,2021.
3. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th edition, 2021.

Reference Books

1. Stuart J Russell, Peter Norvig, Artificial Intelligence- A Modern Approach, 4th Edition, Pearson Education, 2020.
2. Geoff Hulten, Building Intelligent Systems - A Guide to Machine Learning Engineering, Apress, 1st edition, 2018.
3. Crina Grosan and Ajith Abraham, Intelligent Systems- A Modern Approach, Springer Intelligent Systems Reference Library Book 17, 2011.
4. Michael Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems, 3rd edition, 2011.
5. Christopher M. Bishop, Pattern Recognition and Machine Learning, 1st Edition, 2006.

Web References

1. https://www.ibm.com/topics/data-science
2. https://www.oracle.com/in/what-is-data-science/
3. https://u-next.com/blogs/data-science/importance-of-data-science/
4. https://monkeylearn.com/text-analysis/
5. https://www.toptal.com/designers/data-visualization/data-visualization-tools

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	3	2	3	2	-	3	2	-
2	3	1	2	2	3	-	3	1	-
3	2	1	2	3	3	-	3	1	-
4	2	1	2	2	3	-	3	1	-
5	3	1	2	2	3	-	3	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		15	10	5	60	100

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

**Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**		Programme: **M.Tech.**					
Semester	**I**		Course Category Code: **HS**			*End Semester Exam Type: **TE**		
Course Code	**P23HSTC01**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**RESEARCH METHODOLOGY AND IPR**		**2**	**0**	**0**	**2**	**40**	**60**	**100**
Prerequisite	No prerequisite needed								
Course Outcomes	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)		
	CO1	Interpret and formulate the research problem.					**K2**		
	CO2	Identify the concepts to carry out the literature review, ethics and research analysis.					**K2**		
	CO3	Identify the way of writing technical paper and presentation methods.					**K2**		
	CO4	Interpret the use of intellectual property rights					**K2**		
	CO5	File patents through Research and Development cell					**K3**		
UNIT-I	**Research Problem Formulation**					**Periods: 6**			
Meaning of research problem- Sources of research problem - criteria characteristics of a good research problem - errors in selecting a research problem - scope and objectives of research problem. Approaches of investigation of solutions for research problem - data collection – analysis – interpretation - necessary instrumentations.									**CO1**
UNIT-II	**Literature Review**					**Periods: 6**			
Effective literature studies approaches – analysis – plagiarism and research ethics									**CO2**
UNIT-III	**Technical Writing /Presentation**					**Periods: 6**			
Effective technical writing - how to write report – paper - developing a research proposal - format of research proposal - Presentation and assessment by a review committee.									**CO3**
UNIT-IV	**Introduction To Intellectual Property Rights (IPR)**					**Periods: 6**			
Nature of intellectual property: patents – designs - trade and copyright. Process of patenting and development: technological research – innovation – patenting - development. International scenario: international cooperation on intellectual property - procedure for grants of patents - patenting under pct.									**CO4**
UNIT-V	**Intellectual Property Rights (IPR)**					**Periods: 6**			
Patent Rights: Scope of Patent Rights - Licensing and transfer of technology - Patent information and databases - Geographical Indications - New Developments in IPR - Administration of Patent System - IPR of Biological Systems - Computer Software etc. Traditional knowledge Case Studies - IPR and IITs.									**CO5**
Lecture Periods: 30		**Tutorial Periods: -**			**Practical Periods: -**			**Total Periods: 30**	

Text Books

1. Stuart Melville and Wayne Goddard, “Research methodology: An introduction for science & Engineering students’, Kenwyn Publisher, 1996.
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”, Lansdowne Publisher, Second Edition, 2001.
3. C.R. Kothari, Gaurav Garg, “Research Methodology: Methods and Techniques”, New Age International, Fourth Edition, 2018.

Reference Books

1. Halbert, “Resisting Intellectual Property”, Taylor & Francis Limited, 2007.
2. Ranjit Kumar, “Research Methodology: A Step by Step Guide for beginners”, Second Edition, 2010.
3. Trochim, “Research Methods: The concise knowledge base”, Atomic Dog Publishing, 2005.
4. Fink A, “Conducting Research Literature Reviews: From the Internet to Paper”, Sage Publications, 2009.

Web References

1. https://www.scribd.com/document/427419672/Research-Methodology-and-Ipr
2. https://www.isical.ac.in/~palash/research-methodology/RM-lec9.pdf
3. https://www.wipo.int/edocs/pubdocs/en/intproperty/958/wipo_pub_958_3.pdf
4. https://lecturenotes.in/m/21513-research-methodology
5. https://iare.ac.in/sites/default/files/MTECH-CAD.CAM-R18-RM-IP-NOTES.pd

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

* TE – Theory Exam, LE – Lab Exam

Evaluation Method

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

**Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech**						
Semester	**I**	Course Category: **PC**			*End Semester Exam Type: **LE**			
Course Code	**P23ADP101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MACHINE LEARNING ALGORITHMS LABORATORY**	**0**	**0**	**4**	**2**	**50**	**50**	**100**
(AI & DS)								
Prerequisite	Knowledge about Machine Learning Algorithms							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Build models by applying Supervised algorithms.	**K6**
	CO2 Build models by applying Unsupervised algorithms	**K6**
	CO3 Build models by applying Regression Techniques.	**K6**
	CO4 Build models by applying Dimensionality Reduction techniques.	**K6**
	CO5 Build models by applying hybrid ensemble algorithms	**K6**

List of Exercises

1. Support Vector Machine
2. Naive Bayes
3. K-Nearest Neighbor
4. Linear Regression and Logistic Regression
5. K-Means and K-Medians
6. Principal Component Analysis and Linear Discriminant Analysis
7. Decision Tree Algorithm
8. Naïve Bayes ensemble
9. Random forests
10. Adaboost and XGBoost

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

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, 2009.

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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: **M.Tech.**						
Semester	**First**	Course Category Code: **HS**			*End Semester Exam Type: **LE**			
Course Code	**P23HSPC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**TECHNICAL REPORT WRITING AND SEMINAR**	**0**	**0**	**4**	**2**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite								

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Select a subject, narrowing the subject into a topic.	**K2**
	CO2 State an objective and collecting the relevant bibliography (at least 15 journal papers).	**K2**
	CO3 Study the papers and understanding the author's contributions and critically analyzing each paper.	**K3**
	CO4 Prepare a working outline and linking the papers and preparing a draft of the paper.	**K2**
	CO5 Prepare a working outline and linking the papers and preparing a draft of the paper.	**K2**

List of Experiments:

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic	Select an area of interest, topic and state an objective	2nd week	3 % Based on clarity of thought, current relevance and clarity in writing
Stating an Objective			
Collecting Information about area & topic	1. List 1 Special Interest Groups or professional society 2. List 2 journals 3. List 2 conferences, symposia or workshops 4. List 1 thesis title 5. List 3 web presences (mailing lists, forums, news sites) 6. List 3 authors who publish regularly in your area 7. Attach a call for papers (CFP) from your area.	3rd week	3% (the selected information must be area specific and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filte	• provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar • When picking papers to read - try to: - Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them. - Favour papers from well-known journals and conferences, in the field (as indicated in other Favour more recent papers, - Pick a recent survey of the field so you can quickly gain an overview, Find relationships with respect to each other and to your topic area(classification scheme/categorization) - Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered	4th week	6% (the list of standard papers and reason for selection)
Reading and notes for first 5 papers	Reading Paper Process For each paper form a Table answering the following questions: • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future research?	6th week	8% (The table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

	• Conclude with limitations/issues not addressed by the paper (from the perspective of survey)		
Reading and notes for next 5 papers	Repeat Reading Paper Process	7 th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper
Draft outline 1 and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8 th week	8% (this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9 th week	6%(Clarity, purpose and conclusion) 6% Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	5% (clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11th week	10% (this component will be evaluated based on the linking and classification among the papers)
Conclusions	Write your conclusions and future work	12th week	5% (conclusions)
Final Draft	Complete the final draft of your paper	13th week	10% (formatting, English, Clarity and linking) 4% Plagiarism Check Repor
Seminar	A brief 15 slides on your paper	14th & 15th week	10% (based on presentation and Vivavoce)

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

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COs/POs/PSOs Mapping

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

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)				Attendance	End Semester Examination (ESE) Marks	Total Marks
	Weekly Progress	Seminar	Record work	Viva			
Marks	40	30	10	10	10	-	100

Department	**Artificial intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**First**	Course Category Code: **AEC**			*End Semester Exam Type: **-**			
Course Code	**P23ADC1XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ABILITY ENHANCEMENT COURSE - I**	**0**	**0**	**4**	**-**	**100**	**-**	**100**

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

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

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**I**	Course Category: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADEC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**AGILE AND SOFTWARE PROJECT MANAGEMENT**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
(AI & DS)								
Prerequisite	-							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Interpret the steps involved in software development	**K2**
	CO2	Identify an exclusive and appropriate design for a software project	**K2**
	CO3	Apply different software testing strategies for ensuring the quality of software	**K3**
	CO4	Identify the different agile methodologies applied in the industry	**K2**
	CO5	Apply different agile process used in software development	**K3**

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: 30	**Tutorial Periods: 15**	**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.

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

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

******Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**I**	Course Category: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PYTHON FOR DATA SCIENCE**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite	**Python Basics**							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Identify the roles and stages of data science projects	**K2**
	CO2 Interpret data structures provided by pandas and numpy library for data analysis	**K2**
	CO3 Perform data wrangling, cleaning and transformation using python	**K2**
	CO4 Apply matplotlib for plotting and visualizing the datasets	**K3**
	CO5 Apply data aggregation and time series analysis using python programming	**K3**

UNIT-I	**Introduction to Data Science**	**Periods: 9**	
Data science process – Roles, Stages in data science project – Working with data from files – Working with relational databases – Exploring data – Managing data – Cleaning and sampling for modeling and validation.			**CO1**
UNIT-II	**Basics of Numpy, Pandas, and Vectorized Computation**	**Periods: 9**	
The Numpy ndarray: A Multidimensional Array Object – Universal Functions: Fast Element-wise Array Functions – Data Processing Using Arrays - File Input and Output with Arrays – Linear Algebra – Random Number Generation – Random Walks. Introduction to pandas Data Structures – Essential Functionality – Summarizing and Computing Descriptive Statistics – Handling Missing Data – Hierarchical Indexing.			**CO2**
UNIT-III	**Data Preprocessing, Wrangling, and Transformation**	**Periods: 9**	
Data preprocessing**:** Reading and Writing Data in Text Format – Binary Data Formats – Interacting with HTML and Web APIs – Interacting with Databases. Data wrangling and transformation: Combining and Merging Data Sets – Reshaping and Pivoting – Data Transformation – String Manipulation – USDA Food Database			**CO3**
UNIT-IV	**Plotting and Visualization**	**Periods: 9**	
A Brief matplot lib API Primer – Plotting Functions in pandas – Plotting Maps: Visualizing Haiti Earthquake Crisis Data – Python Visualization Tool Ecosystem.			**CO4**
UNIT-V	**Data Aggregation, Group Operations and Time Series**	**Periods: 9**	
Data aggregation and group operations**:** GroupBy Mechanics – Data Aggregation – Group-wise Operations and Transformations – Pivot Tables and Cross-Tabulation. Time series: Date and Time Data Types and Tools – Time Series Basics – Date Ranges, Frequencies, and Shifting – Time Zone Handling – Periods and Period Arithmetic – Resampling and Frequency Conversion – Time Series Plotting – Moving Window Functions – Performance and Memory Usage Notes.			**CO5**

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

Text Books

1. William McKinney, “Python for Data Analysis – Data Wrangling with Pandas, NumPy and IPython”, O’Reilly, 2nd edition, 2017.
2. Jake VanderPlas, “Python Data Science Handbook – Essential tools for working with data”, O’Reilly, 1st edition, 2016.
3. Fabio Nelli, “Python Data Analytics with Pandas, NumPy, and Matplotlib”, 2nd edition, 2018.

Reference Books

1. John Paul Mueller, Luca Massaron, “Python for Data Science for Dummies”, John Wiley& Sons, 2nd edition, 2019.
2. Jesus Rogel-Salazar, “Data Science and Analytics with Python”, CRC Press Taylor and Francis Group, 1st edition, 2017.
3. Mark Lutz, Laura Lewin, Frank Willison, “Programming Python”, O'Reilly Media, 3rd edition, 2006.
4. Eric Matthes, “Python Crash Course: A Hands-on, Project-based Introduction to Programming”, 2nd edition, 2019
5. Al Sweigart, “Automate the Boring Stuff with Python: Practical Programming for Total Beginners”, 1st edition, 2015

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.datacamp.com/courses/statistical-thinking-in-python-part-1

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COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus
****** Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**I**	Course Category: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE102**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DATA SCIENCE ESSENTIALS**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
(AI & DS)								
Prerequisite	-							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Interpret the data science process and how its components interact	**K2**
	CO2	Classify, formulate the data science problems and manage large dataset	**K2**
	CO3	Implement modeling, apply basic machine learning algorithms and evaluate the model.	**K3**
	CO4	Apply effective visualization and text analysis for data science projects	**K3**
	CO5	Apply data science toolkit and develop awareness of ethical dimensions of data science	**K3**

UNIT-I	**Introduction**	**Periods: 9**	
Introduction: Data Science - Key Features - Motivations - Relationship between Artificial Intelligence, Machine Learning, and Data Science - History and Current Landscape - Data science in a big data world: Big Data and Data Science hype - Datafication - Benefits and uses of data science and big data - Facets of data - Data Science Process: A Data Scientist's Role - Overview of the data science process - Data Science Classification - Data Science Applications.			**CO1**
UNIT-II	**Data Management**	**Periods: 9**	
Data Exploration: Objectives - Datasets - Descriptive Statistics - Data Visualization – Data Collection: Data Sources - Reading Files - Scraping the Web - Using APIs – Working with Data: Exploring Your Data - Cleaning and Munging - Manipulating Data – Rescaling - Dimensionality Reduction – Data Handling: The problems of handling large data – Techniques and Programming tips for handling large volumes of data - Distributing data storage and processing with frameworks.			**CO2**
UNIT-III	**Data Modeling and Algorithms**	**Periods: 9**	
The Modeling Process - Machine learning in Data Science - Overfitting and Underfitting - Correctness – Basic Machine Learning Algorithms: Classification: k-Nearest Neighbors - Naïve Bayes - Support Vector Machines– Regression Methods: Linear Regression - Logistic Regression – Clustering: Kmeans Clustering – Model Evaluation: Confusion matrix - ROC/AUC- and lift Curves			**CO3**
UNIT-IV	**Data Visualization and Text Analysis**	**Periods: 9**	
Define: Data Visualization - Data Visualization History - Types of Data Visualization: Exploratory - Explanatory - Data for Visualization - Data Types - Data Encodings - Retinal variables - Mapping variables to Encodings - Visual encodings - Technologies for Visualization - Bokeh (Python) – Text mining and Text Analytics: Text mining in the real world -Text mining techniques - Case study: Classifying Reddit posts			**CO4**
UNIT-V	**Data Science Tools and Ethics**	**Periods: 9**	
Data Engineering: MapReduce, Pregel, and Hadoop – RapidMiner: User Interface and Terminology - Data Importing and Exporting Tools - Data Visualization Tools - Data Transformation Tools - Sampling and Missing Value Tools - Optimization Tools - Integration with R – Next-Generation Data Scientists, Hubris, and Ethics.			**CO5**

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

Text Books

1. Vijay Kotu and Bala Deshpande, Data Science, Concepts and Practice, Second Edition, Morgan Kaufmann, 2019.
2. Davy Cielen, Arno D. B. Meysman and Mohamed Ali, Introducing Data Science: Big Data, Machine Learning, and more, using Python Tools, Manning, 2016.
3. Cathy O"Neil and Rachel Schutt, Doing Data Science, Straight Talk from The Frontline, O"Reilly, 2013

Reference Books

1. Joel Grus, Data Science from Scratch, Second Edition, O"Reilly, 2019.
2. Skiena, Steven S.. The Data Science Design Manual. , Springer, 2017.
3. Foster Provost and Tom Fawcett, Data Science for Business: What You Need to Know About Data Mining and Data-Analytic Thinking, 1st edition, 2013.
4. John Paul Mueller and Luca Massaron, Python for Data Science for Dummies, 1st edition, 2015.
5. Christopher M. Bishop, Pattern Recognition and Machine Learning, 1st edition, 2006.

Web References

1. https://www.ibm.com/topics/data-science
2. https://www.oracle.com/in/what-is-data-science/
3. https://u-next.com/blogs/data-science/importance-of-data-science/
4. https://monkeylearn.com/text-analysis/
5. https://www.toptal.com/designers/data-visualization/data-visualization-tools

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

** Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**I**	Course Category: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE103**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**BIG DATA MINING AND ANALYTICS**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
(AI & DS)								
Prerequisite	-							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Interpret the fundamental concepts of big data and analytics.	**K2**
	CO2	Apply Hadoop and map-reduce techniques for big data applications	**K3**
	CO3	Apply algorithms for handling petabytes of datasets	**K2**
	CO4	Apply algorithms and propose solutions for Big Data by optimizing main memory consumption	**K3**
	CO5	Apply predictive analysis in real time applications	**K3**

UNIT-I	**Introduction To Big Data and Analytics**	**Periods: 9**
Introduction to Big Data Platform – Importance of Big data – Big data sources – Acquisition, Big data Business Analytics - State of the practice in analytics role of data scientists - Key roles for successful analytic project - Main phases of life cycle - Best Practices for Big data Analytics- Big Data Analytics applications		**CO1**
UNIT-II	**HADOOP**	**Periods: 9**
History of Hadoop - Hadoop Distributed File System – Components of Hadoop - Analyzing the Data with Hadoop - Scaling Out - Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics - Developing a Map Reduce Application- How Map Reduce Works-Anatomy of a Map Reduce Job runFailures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features- Hadoop environment.		**CO2**
UNIT-III	**Similar Items Search**	**Periods: 9**
Nearest Neighbor Search – Shingling of Documents – Similarity preserving summaries – Locality sensitive hashing for documents – Distance Measures – Theory of Locality Sensitive Functions – LSH Families – Methods for High Degree of Similarities		**CO3**
UNIT-IV	**Mining Data Streams**	**Periods: 9**
Stream Data Model – Sampling Data in the Stream – Filtering Streams – Counting Distance Elements in a Stream – Estimating Moments – Counting Ones in Window – Decaying Windows		**CO4**
UNIT-V	**Predictive Analytics**	**Periods: 9**
Predictive Analytics- Simple linear regression- Multiple linear regressions - Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications		**CO5**

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

Text Books

1. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw-Hill Publishing, 2012.
2. ure Leskovec, Anand Rajaraman, Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2nd Edition, 2014.
3. Jiawei Han, Micheline amber, Jian Pei, “Data Mining Concepts and Techniques”, Morgan Kaufman Publications, 3rd Edition, 2011.

Reference Books

1. Ian H.Witten, Eibe Frank “Data Mining – Practical Machine Learning Tools and Techniques”, Morgan Kaufman Publications, 4th Edition, 2016.
2. Arshdeep Bahga, Vijay Madisetti, “Big Data Science & Analytics: A Hands-On Approach “, VPT, 1st Edition, 2018.
3. Michael Minelli, Michehe Chambers, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Business”, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
4. Viktor Mayer-Schönberger and Kenneth Cukier, Big Data: A Revolution That Will Transform How We Live, Work, and Think, 1st edition, 2013.
5. Tom White, Hadoop: The Definitive Guide, 4th edition, 2015.

Web References

1. https://encyclopedia.pub/entry/12788#:~:text=Big%20data%20mining%20(BDM)%20is,data%20of%20an%20immense%20volume.
2. https://www.techopedia.com/definition/30215/big-data-mining
3. https://www.techtarget.com/searchbusinessanalytics/definition/data-mining
4. https://www.javatpoint.com/types-of-sources-of-data-in-data-mining-in-dbms
5. https://www.ibm.com/topics/predictive-analytics

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COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

**Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**I**	Course Category: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE104**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ARTIFICIAL INTELLIGENCE FOR DECISION MAKING**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
(AI & DS)								
Prerequisite	-							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Interpret the concepts behind the expert systems and apply it in creating rule-based systems.	**K2**
	CO2	Identify different knowledge representation techniques.	**K2**
	CO3	Apply various Inference methods for reasoning	**K3**
	CO4	Apply probabilistic methods for performing reasoning under uncertainty.	**K3**
	CO5	Apply the concepts for creating expert system in real time	**K3**

UNIT-I	**Introduction to Expert Systems**	**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.			**CO1**
UNIT-II	**The Representation of Knowledge**	**Periods: 9**	
The study of logic - difference between formal logic and informal logic - meaning of Knowledge - how knowledge can be represented - semantic nets - how to translate semantic nets into PROLOG - limitations of semantic nets – schemas - frames and their limitations - how to use logic and set symbols to represent knowledge - the meaning of propositional and first order predicate logic – quantifiers - imitations of propositional and predicate logic.			**CO2**
UNIT-III	**Methods of Inference**	**Periods: 9**	
Trees – lattices - and graphs - state and problem spaces - AND-OR trees and goals - methods of inference - rules of inference - limitations of propositional logic - logic systems - resolution rule of inference - resolution systems - and deduction - shallow and causal reasoning - applying resolution to first-order predicate logic - forward and backward chaining - 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.			**CO3**
UNIT-IV	**Reasoning Under Uncertainty**	**Periods: 9**	
The meaning of uncertainty and theories devised to deal with it - types of errors attributed to uncertainty - errors associate - with induction - features of classical probability - experimental and subjective probabilities - compound and conditional probabilities - hypothetical reasoning and backward induction - temporal reasoning - Markov chains - odds of belief - sufficiency and necessity - role of uncertainty in inference chains - implications of combining evidence - role of inference nets in expert systems - how probabilities are propagated.			**CO4**
UNIT-V	**Design of Expert Systems**	**Periods: 9**	
How to select an appropriate problem - the stages in the development of an expert system - types of errors to expect in the development stages - the role of the knowledge engineer in the building of expert systems - the expected life cycle of an expert system - how to do a life cycle model.			**CO5**

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

Text Books

1. Durkin, J., “Expert systems Design and Development”, Macmillan, 1994.
2. Elias M. Awad, “Building Expert Systems”, West Publishing Company, 1996.
3. Peter Jackson, “Introduction to Expert Systems”, Addison Wesley Longman, 1999.

Reference Books

1. Gonzalez and D. Dankel, "The Engineering of Knowledge-Based Systems", Prentice Hall, 1994.
2. Nikolopoulos, "Expert Systems", Marcel Dekker Inc. 1997.
3. H. B. Verbruggen, Spyros G. Tzafestas, “Artificial Intelligence in Industrial Decision Making, Control and Automation”, Springer, 2012.
4. Lakhmi C. Jain, Gloria Phillips-Wren, “Intelligent Decision Support Systems in Agent-mediated Environments”, IOS Press, 2005.
5. Nilanjan Dey, Jitendra Kumar Rout, Himansu Das, Suresh Chandra Moharana “Applied Intelligent Decision Making in Machine Learning”, CRC Press; 1st Edition, 2020.

Web References

1. 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/
2. http://www.umsl.edu/~joshik/msis480/chapt11.htm
3. https://www.coursera.org/courses?query=decision%20making
4. https://www.slideshare.net/akhilrocker143/572-11293384
5. https://www.sciencedirect.com/science/article/abs/pii/0378720693900696

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COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

******Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**		Programme: **M.Tech.**					
Semester	**II**		Course Category: **PC**			*End Semester Exam Type:**TE**		
Course Code	**P23ADT204**		Periods/Week			Credit	Maximum Marks		
			L	T	P	C	CAM	ESE	TM
Course Name	**PARALLEL PROGRAMMING PARADIGMS** (AI&DS)		**3**	**0**	**0**	**3**	**40**	**60**	**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	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 completion	**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/

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COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

**Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**II**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**P23ADT205**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**NATURAL LANGUAGE PROCESSING**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
(AI & DS)								
Prerequisite	Machine Learning							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Interpret the basics of NLP for processing word, paragraph and sentence	**K3**
	CO2	Identify and apply the basic ML and DL techniques for NLP	**K2, K3**
	CO3	Interpret and realize the advanced deep learning paradigms along NLP Techniques.	**K2, K3**
	CO4	Identify the concept of NLU, NLG and apply the concept of Information Retrieval	**K2,K3**
	CO5	Apply ethics and NLP Libraries to be followed while building NLP Applications	**K3**

UNIT – I	**Introduction**	**Periods:9**	
Phases of NLP, Text Preprocessing: Tokenization, Stemming and Lemmatization, Pos Tagging, Named Entity Recognition. NLP Feature Engineering, Word Count Vector, Word Sense Disambiguation			**CO1**
UNIT – II	**Language Modelling**	**Periods:9**	
N -gram Models, Hidden Markov Models, Maximum Likelihood Estimation. Supervised, Unsupervised and Semi Supervised Learning. Text Classification and Sentiment Analysis, Topic Modelling and Clustering, Word Embeddings, RNN & LSTMs for NLP, CNN for NLP.			**CO2**
UNIT – III	**Advanced NLP Techniques**	**Periods:9**	
Sequence- to -Sequence Models, Attention Mechanisms, Transformer Architecture: BERT, GPT			**CO3**
UNIT – IV	**Language Understanding and Generation, Information Retrieval**	**Periods:9**	
Text Generation, Question Answering, Dialogue Systems and Chatbots. Machine Translation, Cross Lingual Transfer Learning. Text Indexing and Search, Text Summarization.			**CO4**
UNIT – V	**NLP Tools, Libraries, Applications, Ethics**	**Periods:9**	
Bias and Fairness in NLP, Privacy Concerns in NLP Applications. NP libraries: NLTK, Spacy, Tensor Flow, Pytorch. NLP Applications: Sentiment Analysis, Named Entity Recognition in Real World Data Sets, Text Classification for Various Domains.			**CO5**

LecturePeriods:45	**TutorialPeriods:0**	**PracticalPeriods:0**	**LecturePeriods:45**

Textbooks

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things: A Hands-on Approach", VPT, 1st edition,2014.
2. James Allen, "Natural Language Understanding", 2nd Edition, Pearson Education, 2003.
3. Jurafsky, Dan and Martin, James, "Speech and Language Processing", 2nd Edition, Prentice Hall, 2008.
4. Srini Janarthanam, "Hands-On Chatbots and Conversational UI Development: Build chatbots", Published by Packet Publishing Ltd., 1st Edition, 2017.
5. Matt Richardson & Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), Third Edition,2016

References

1. Cathy Pearl, "Designing Voice User Interfaces: Principles of Conversational Experiences", Shroff/O'Reilly, 1st Edition, 2017..
2. Daniel M.Bikel and Imed Zitouni, "Multilingual Natural Language Processing Applications: From Theory To Practice", Pearson Publications,2019
3. Abhishek Singh, Karthik Ramasubramanian, Shrey Shivam, "Building an Enterprise Chatbot: Work with Protected Enterprise Data using Open Source Frameworks", Apress, 2019.
4. Michael McTear, Zoraida Callejas, David Griol, "The Conversational Interface: Talking to Smart Devices", Springer, First Edition 2016.
5. Akshar Bharathi, Vineet chaitanya, "Natural Language Processing, A paninian perspective", Prentice – Hall of India,2018

Web References

1. https://www.udemy.com/course/chatbot/
2. https://gtuematerial.in/natural-language-processing-3170723/
3. https://chatbotsmagazine.com/understanding-the-need-for-nlp-in-your-chatbot-78ef2651de84?gi=ecca664b642a
4. https://www.ultimate.ai/blog/ai-automation/how-nlp-text-based-chatbots-work

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

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

Evaluation Method

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

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

******Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**II**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**P23ADT206**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ADVANCED DEEP LEARNING**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
(AI & DS)								
Prerequisite	Machine Learning Algorithms							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify various neural network and activation function to calculate the loss and improve the accuracy	**K2**
	CO2 Apply different Convolutional Neural Network for processing images effectively	**K3**
	CO3 Interpret and apply deep learning regularization and optimization methods.	**K2, K3**
	CO4 Apply different Neural Network Models for predicting next word, spelling correction etc	**K3**
	CO5 Apply Neural Style transfer and autoencoding process for finding duplicates in images and content	**K3**

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	**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 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**

LecturePeriods:45	**TutorialPeriods:0**	**PracticalPeriods:-0**	**LecturePeriods: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://www.guru99.com/deep-learning-tutorial.html
4. https://www.coursera.org/specializations/deep-learning
5. http://neuralnetworksanddeeplearning.com/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

******Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**II**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**P23ADT207**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**AI AND ROBOTIC PROCESS AUTOMATION**	**3**	**0**	**0**	**3**	**40**	**60**	**100**

(AI & DS)

Prerequisite: -

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	Apply techniques to deploy and maintain a bot	**K3**

UNIT – I	**Introduction to Robotic Process Automation**	**Periods:9**
What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - 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.		**CO1**
UNIT – II	**RPA Tool Introduction and Basics**	**Periods:9**
Introduction to RPA Tool - The User Interface - Variables - Control Flow - If Else Statements - Loops - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity-The Switch Activity - The While Activity - The for Each Activity - The Break Activity - Data Manipulation- Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data		**CO2**
UNIT – III	**Advanced Automation Concepts & Techniques**	**Periods:9**
Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization -Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation Introduction to Image & Text Automation - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel – Extracting Data from PDF		**CO3**
UNIT – IV	**Handling User Events & Assistant Bots, Exception Handling**	**Periods:9**
What are assistant bots - Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger -Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event. Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.		**CO4**
UNIT – V	**Deploying and Maintaining the Bot**	**Periods:9**
Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates -Managing packages - Uploading packages - Deleting packages		**CO5**

LecturePeriods:45	**TutorialPeriods:0**	**PracticalPeriods:-0**	**LecturePeriods:45**

Textbooks

1. Tom Taulli, The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems, 2020.
2. Alok Mani Tripathi, “Learning Robotic Process Automation”, Packt Publishing, 2018.

Reference Books

1. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, “Introduction to Robotic Process Automation: a Primer”, Institute of Robotic Process Automation,1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & become an RPA Consultant”, Independently Published, 1st Edition 2018.
3. Srikanth Merianda,” Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation”, Consulting Opportunity Holdings LLC, 1st Edition 2018.
4. Lim Mei Ying, “Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes”, Packt Publishing, 1st Edition 2018.

Web References

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com
3. https://www.guru99.com/deep-learning-tutorial.html
4. https://www.coursera.org/specializations/deep-learning
5. http://neuralnetworksanddeeplearning.com/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

**Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme:**M.Tech.**					
Semester	**II**	Course Category Code: PC			*End Semester Exam Type: **LE**		
Course Code	**P23ADP202**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**ADVANCED DEEP LEARNING LABORATORY**	**0**	**0**	**4**	**2**	**50**	**50**	**100**
(AI & DS)								
Prerequisite	NIL							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Design a simple neural network.	**K6**
	CO2 Create applications using CNN.	**K6**
	CO3 Create applications using RNN and LSTM.	**K6**
	CO4 Create applications using GRU.	**K6**
	CO5 Create a recommendation system.	**K6**

List of Exercises

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, 2017.
5. Nikhil Buduma, “Fundamentals of Deep Learning”, O’Reilly, 2017.

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

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **HS**			*End Semester Exam Type: **LE**			
Course Code	**P23HSPC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SEMINAR ON ICT: A HANDS-ON APPROACH**	**0**	**0**	**4**	**2**	**100**	**-**	**100**
(Common to all M.Tech Programmes)								
Prerequisite	No Prerequisite needed							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Select a topic, narrowing the topic into presentation.	**K2**
	CO2 State an objective and use the relevant ICT tools to make the presentation effective.	**K3**
	CO3 Study the topic and understanding the contributions and prepare report.	**K2**
	CO4 Prepare a working demo.	**K3**
	CO5 Prepare conclusions based on the reading of the topic and giving final Presentation.	**K4**

List of Experiments:

The methodology used is “learning by doing”, a hands-on approach, enabling the students to follow their own pace. The teacher, after explaining the project, became a tutor, answering questions and helping students on their learning experience.

ICT skills
- Understand ICT workflow in the respective domain choosed.
- Manage multitasking.
- Deal with main issues using tech in class.
- Record, edit and deliver audio and video.
- Automate assessments and results.

Scope
- Perspective in order to design activities in class.
- Understand the process of creating audiovisuals.

Teaching tools
- Different ways to create audiovisual activities.
- Handle audiovisual editors.
- Collaborative working.
- Individualize learning experience.
- Get instant feedback from students.

Each one of the students will be assigned an ICT Topic and the student has to conduct a detailed study on the assigned topic and prepare a report, running to 30 or 40 pages for which a demo to be performed followed by a brief question and answer session. The demo will be evaluated by the internal assessment committee (comprising of the Head of the Department and two faculty members) for a total of 100 marks.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 4 5**	**Total Periods: 45**

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	-	3	1	1	3	3	3	2	1
2	-	3	1	1	3	2	3	2	1
3	-	3	1	1	3	2	3	2	1
4	-	3	1	1	3	2	3	2	1
5	-	3	1	1	3	2	3	2	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			Attendance		
	Presention using ICT	Report	viva			
Marks	30	30	30	10	-	100

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

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**Second**	Course Category Code: **AEC**			*End Semester Exam Type: **-**			
Course Code	**P23ADC2XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ABILITY ENHANCEMENT COURSE - II**	**0**	**0**	**4**	**-**	**100**	**-**	**100**

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

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

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PE**			End Semester Exam Type: **TE**			
Course Code	**P23BDEC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Web Analytics and Development**	**3**	**0**	**0**	**3**	**40**	**60**	**100**

(Common to M.Tech CSE(BDA) and AI & DS)

Prerequisite	**Internet Programming**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret various web analytics platform, and their evolution	**K2**
	CO2 Apply various Data collection techniques to gather and organize data streams.	**K3**
	CO3 Interpret the benefits of qualitative analytics	**K2**
	CO4 Interpret and apply various metrics to evaluate the performance of web data	**K2, K3**
	CO5 Apply various Web analytics versions in real world scenarios	**K3**

UNIT – I	**Introduction**	**Periods:9**	
Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, on site web; Web analytics platform, Web analytics evolution, Need for web analytics, Advantages, Limitations			**CO1**
UNIT – II	**Data Collection**	**Periods:9**	
Click stream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: Ecommerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing; Competitive Data: Panel-Based measurement, ISP-based measurement, Search Engine data.			**CO2**
UNIT – III	**Qualitative Analysis**	**Periods:9**	
Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic evaluations; Site Visits: Conducting a site visit, Benefits of site visits; Surveys: Website surveys, post-visit surveys, creating and running a survey, Benefits of surveys. Capturing data: Web logs or JavaScript's tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, selecting optimal web analytic tool, Understanding click stream data quality, identifying unique page definition, Using cookies, Link coding issues.			**CO3**
UNIT – IV	**Web Metrics**	**Periods:9**	
Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, new visits; Optimization (e-commerce, non-e- commerce sites): Improving bounce rates, Optimizing Ad Words campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI. Relevant Technologies: Internet & TCP/IP, Client / Server Computing, HTTP (Hypertext Transfer Protocol), Server Log Files & Cookies, Web Bugs.			**CO4**
UNIT – V	**Web Analytics 2.0**	**Periods:9**	
Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0, Competitive intelligence analysis: CI data sources Toolbar data, Panel data, ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends Analyzing competitive site overlap and opportunities. Google Analytics: Brie introduction and working, Ad Words, Benchmarking Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues.			**CO5**

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

Text Books

1. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc.2nd ed, 2012.
2. Jure Leskovec, Anand Rajaraman, and Jeffrey D. Ullman , "Mining of Massive Datasets" 2nd edition, Cambridge University Press, 2014
3. Kaushik A., Web Analytics 2.0, The Art of Online Accountability and Science of Customer Centricity, WileyPublishing, Inc. 1st ed, 2010

References Books

1. Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons,2002
2. Brian Clifton , "Advanced Web Metrics with Google Analytics" , Sybex, Third Edition, 2012
3. Jerri L. Ledford and Joe Teixeira , "Learning Web Analytics: A Beginner's Guide to Google Analytics", O'Reilly Media, 2010
Pedro Sostre ,"Web Analytics For Dummies" , For Dummies, Second Edition , 2012
4. Avinash Kaushik ,"Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity" , Sybex, 2nd Edition, 2009

Web References

1. https://www.mygreatlearning.com/courses/big-data-analytics-dse
2. https://intellipaat.com/big-data-hadoop-training/
3. https://www.edureka.co/comprehensive-hive

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

******Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**II**	Course Category: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23ADE205**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DATA VISUALIZATION USING TABLEAU AND POWER BI**	**3**	**0**	**0**	**3**	**40**	**60**	**100**

Prerequisite	Python for Data Science		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Interpret how the data can be visualized using Tableau	**K2**
	CO2	Customize and fine tune map aesthetics using Tableau	**K3**
	CO3	Apply Power BI basics for generating interactive reports effectively	**K3**
	CO4	Interpret and apply power query and M language for handling tables	**K2, K3**
	CO5	Apply Power BI concepts for data modeling	**K3**

UNIT-I	**Introduction in Tableau**	**Periods: 9**	
Data Visualization-Tableau Products- 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.			**CO1**
UNIT-II	**Maps and Statistics using Tableau**	**Periods: 9**	
Setting Geographic Roles – Placing marks on a Map – Overlaying Demographic data – Creating choropleth Maps – Using polygon shapes – Customizing Maps – Statistics: Add Reference Lines Bands and Distribution- Adding Reference Lines -Adding Reference Bands -Adding Reference Distribution-Working Reference Lines Bands and Forecasting -Trend lines and Trend Models- Creating Dashboards – Creating Storyboard			**CO2**
UNIT-III	**Introduction to Power BI**	**Periods: 9**	
Connection of Data Source- Reporting Business Intelligence (BI), Traditional BI, Self-Serviced BI-Power BI Products-Power BI Desktop-Flow of Work in Power BI Desktop-Power BI Architecture-A Brief History of Power BI.			**CO3**
UNIT-IV	**Power Query And M Language**	**Periods: 9**	
Data Transformation, Benefits of Data Transformation-Shape or Transform Data using Power Query-Overview of Power Query / Query Editor, Query Editor User Interface- The Ribbon (Home, Transform, Add Column, View Tabs)-Basic Functions-M Language-IF..ELSE Conditions, Transform Column () Types-Remove Columns (), Split Columns (),Replace Value() -Table. Distinct Options and GROUP BY Options Table. -Group () Table. Sort () with Type Conversions PIVOT -Operation and Table. Pivot()-List Functions Using Parameters with M Language			**CO4**
UNIT-V	**Data Modeling**	**Periods: 9**	
Data Modeling Introduction -Relationship, Need of Relationship -Relationship Types , Cardinality in General ϖ One-to-One, One-to-Many (or Many-to-One), Many-to-Many - AutoDetect the relationship, Create a new relationship, Edit existing relationships -Make Relationship Active or Inactive -Delete a relationship – Power BI service- Creating Dashboards.			**CO5**

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

Text Books

1. Ashutosh Nandeshwar, "Tableau Data Visualization Cookbook", Packt Publishing Ltd., 2013.
2. Brett Powell, Mastering Microsoft Power BI: Expert techniques for effective data analytics and business intelligence, 1st edition, 2018.
3. Alberto Ferrari and Marco Russo, Analyzing Data with Power BI and Power Pivot for Excel, 1st edition, 2017.

Reference Books

1. Scott Murray, Interactive Data Visualization for the Web: An Introduction to Designing with D3, 2nd edition, 2017.
2. Cole Nussbaumer Knaflic, Storytelling with Data: A Data Visualization Guide for Business Professionals, 1st edition, 2015.
3. Stephen Few, Information Dashboard Design: Displaying Data for At-a-Glance Monitoring, 2nd edition, 2013.
4. Nathan Yau, Data Points: Visualization That Means Something, 1st edition, 2013.
5. Edward R. Tufte, The Visual Display of Quantitative Information, 2nd edition, 2001

Web References

1. https://www.tableau.com/
2. https://www.guru99.com/what-is-tableau.html
3. https://www.datacamp.com/tutorial/data-visualisation-powerbi
4. https://learn.microsoft.com/en-us/power-query/power-query-ui
5. https://www.tutorialspoint.com/power_bi/power_bi_data_modeling.html

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

******Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme: M.Tech						
Semester	**II**	Course Category: PE			*End Semester Exam Type: **TE**			
Course Code	**P23ADE206**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PREDICTIVE MODELLING**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
(AI & DS)								
Prerequisite	NIL							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret the steps for predictive modeling and realize it in real world	**K2**
	CO2 Interpret various terminologies and steps for predictive modeling	**K2**
	CO3 Apply and improvise machine learning techniques for predictive modeling.	**K3**
	CO4 Apply Predictive Modeling Markup Language for making predictive modeling easier	**K3**
	CO5 Apply predictive modeling techniques in real world case studies	**K3**

UNIT-I	**Introduction**	**Periods: 9**	
Core ideas in data mining - Supervised and unsupervised learning - Classification vs. Prediction - Steps in data mining- SEMMA Approach - Sampling -Pre-processing - Data cleaning - Data Partitioning - Building a model - Statistical models - Statistical models for predictive analytics.			**CO1**
UNIT-II	**Predictive Modeling**	**Periods: 9**	
Data splitting – Balancing- Over fitting –Oversampling –Multiple Regression Artificial neural networks (MLP) - Variable importance- Profit/loss/prior probabilities - Model specification - Model selection - Multivariate Analysis			**CO2**
UNIT-III	**Predictive Models**	**Periods: 9**	
Association Rules-Clustering Models –Decision Trees- Ruleset Models- KNearest Neighbors – Naive Bayes - Neural Network Model – Regression Models – Regression Trees – Classification & Regression Trees (CART) – Logistic Regression – Multiple Linear Regression Scorecards – Support Vector Machines – Time Series Models - Comparison between models - Lift chart Assessment of a single model.			**CO3**
UNIT-IV	**Predictive Modeling Markup Language**	**Periods: 9**	
Introduction to PMML – PMML Converter - PMML Structure – Data Manipulation in PMML – PMML Modeling Techniques - Multiple Model Support – Model Verification.			**CO4**
UNIT-V	**Technologies And Case Studies**	**Periods: 9**	
Weka – RapidMiner – IBM SPSS Statistics- IBM SPSS Modeler – SAS Enterprise Miner – Apache Mahout – R Programming Language.-Real time case study with modeling and analysis.			**CO5**

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

Text Books

1. Statistical and Machine-Learning Data Mining Techniques for Better Predictive Modeling and Analysis of Big Data, Second Edition,2011
2. Predictive Modeling with SAS Enterprise Miner Practical Solutions for Business Applications, Third Edition,2017
3 Mastering Predictive Analytics with R,Second Edition: Machine learning techniques for advanced models,2017

Reference Books

1. Kattamuri S. Sarma, “Predictive Modeling with SAS Enterprise Miner: Practical Solutions for Business Applications”, 3rd Edition, SAS Publishing, 2017.
2. Alex Guazzelli, Wen-Ching Lin, Tridivesh Jena, James Taylor, “PMML in Action Unleashing the Power of Open Standards for Data Mining and Predictive Analytics”, 2nd Edition, Create Space Independent Publishing Platform,2012
3. Ian H. Witten, Eibe Frank , “Data Mining: Practical Machine Learning Tools and Techniques”, Morgan Kaufmann Series in Data Management Systems, Morgan Kaufmann, 3rd Edition, 2011
4. Eric Siegel , “Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die”, 2nd Edition, Wiley, 2016.
5. Conrad Carlberg, “Predictive Analytics: Microsoft Excel”, 1st Edition, Que Publishing, 2012.

Web References

1.https://nptel.ac.in/courses/108108111/
2.https://www.coursera.org/learn/predictive-modeling-analytics
3.https://bookdown.org/egarpor/PM-UC3M/
4.https://cics.nd.edu/research/applications/materia
5.https://www.netsuite.com/portal/resource/articles/financial-management/predictive-modeling.shtml

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

Department	**Artificial Intelligence and Data Science**	Programme: M.Tech						
Semester	**II**	Course Category:PE			*End Semester Exam Type: **TE**			
Course Code	**P23ADE207**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**NEXT GENERATION DATABASE SYSTEMS**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
(AI & DS)								
Prerequisite	NIL							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Interpret market and technology leading to today's next generation databases.	**K2**
	CO2	Apply Hadoop architecture with querying in various Hadoop components	**K3**
	CO3	Identify XML and JSON Document Databases	**K2**
	CO4	Identify database applications oriented to Graph and Column databases	**K2**
	CO5	Apply the Distributed Database patterns and consistency models in MongoDB, HBase and Cassandra	**K3**

UNIT-I	**Database Revolution**	**Periods: 9**	
First Database Revolution – Second Database Revolution: Relational Theory – Transaction Models – First Relational Databases – Database Wars - Client-server Computing – Object Oriented Programming and OODBMS – Third Database Revolution: Google and Hadoop – Cloud Computing – Document Databases – NEWSQL.			**CO1**
UNIT-II	**Hadoop: Open-Source Google Stack**	**Periods: 9**	
Hadoop's Origin – Power of Hadoop – Hadoop's Architecture – Working with Hadoop: Loading Data – Handling Files – Getting Data. Hadoop's Ecosystem – MapReduce – Hbase – Pig - Hive: Querying Big Data with Hive – Using Hive to query Hadoop files.			**CO2**
UNIT-III	**Document Databases**	**Periods: 9**	
XML Databases: XML Tools and Standards – XML support in Relational Systems – JSON Document Databases – JSON and AJAX – Data Models in Document Databases – Early JSON Databases – MemBase and CouchBase – MongoDB			**CO3**
UNIT-IV	**Graph and Column Databases**	**Periods: 9**	
Graph Database: RDBMS Pattern for Graphs – RDF and SPARQL – Property Graphs and Neo4j – Gremlin – Graph Database Internals – Graph Compute Engines. Column Databases: Data Warehouse Schema – Columnar Alternative (Columnar Compression, Columnar Write Penalty) – Sybase IQ, C-Store and Vertica – Column Database Architectures.			**CO4**
UNIT-V	**Distributed Database Patterns and Consistency Models**	**Periods: 9**	
Distributed Database Patterns: Distributed Relational Databases – Non-relational Distributed Databases – MongoDB Sharding and Replication - HBase – Cassandra. Consistency Models: Types of Consistency – Consistency in MongoDB – Hbase Consistency – Cassandra Consistency			**CO5**

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

Text Books

1. Enhancing Availability for NoSQL Database Systems using Failover Techniques,Priyanka Gotter, Kiranbir Kaur, Tanveer Kaur
2. NoSQL A complete guide,2021 edition

Reference Books

1. Guy Harrison, "Next Generation Databases: NoSQL, NewSQL, and Big Data", Apress Publisher, 2016
2. Chanchal Singh and Manish Kumar, "Mastering Hadoop 3: Big data processing at scale to unlock unique business insights", Packt Publishing, 2019.
3. Subhashini Chellappan, Dharanitharan Ganesan, "MongoDB Recipes: With Data Modeling and Query Building Strategies", Apress Publisher, 2019
4. Jeff Friesen, "Java XML and JSON: Document Processing for Java SE", Apress Publisher, 2019

Web References

1. https://www.researchgate.net/publication/221214756_The_Next_Database_Revolution
2. https://cloudxlab.com/blog/big-data-solution-apache-hadoop-and-spark/
3. https://www.mongodb.com/document-databases
4. https://www.geeksforgeeks.org/document-databases-in-nosql/
5. https://towardsdatascience.com/cap-theorem-and-distributed-database-management-systems-5c2be977950e

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

** Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**	Programme: M.Tech						
Semester	**II**	Course Category: PE			*End Semester Exam Type: **TE**			
Course Code	**P23ADE208**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ADVANCED ALGORITHMS**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
(AI & DS)								
Prerequisite	-							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Interpret algorithm evaluation techniques and ensure algorithm correctness	**K2**
	CO2 Apply greedy algorithms to solve problems	**K3**
	CO3 Apply divide and conquer algorithm to solve real word problems	**K3**
	CO4 Apply network flow algorithms to handle graph related real world problems	**K3**
	CO5 Interpret NP-complete problems and apply them in real world scenarios	**K2, K3**

UNIT-I	**Basics of Algorithm Analysis**	**Periods: 9**
Computational Tractability – Asymptotic Order of Growth – Implementing the Stable Matching Algorithm Using Lists and Arrays – A survey of common running times – A more Complex Data Structure: Priority Queues.		**CO1**
UNIT-II	**Graphs and Greedy Algorithms**	**Periods: 9**
Graphs: Basic Definitions and Applications – Graph connectivity and Graph traversal – Implementing Graph Traversal using Queues and Stacks – Testing Bipartiteness: An application of Breadth First search. **Greedy Algorithms**: Interval Scheduling: The Greedy Algorithm Stays Ahead – Optimal Caching: A More Complex Exchange Argument – The Minimum Spanning Tree Problem – Implementing Kruskal's Algorithm: The Union-Find Data Structure – Clustering – Huffman Codes and Data Compression		**CO2**
UNIT-III	**Divide and Conquer**	**Periods: 9**
A First Recurrence: The Merge sort Algorithm – Further Recurrence Relations – Counting Inversions – Finding the Closest Pair of Points – Integer Multiplication **Dynamic Programming:** Weighted Interval Scheduling: A Recursive Procedure – Principles of Dynamic Programming: Memoization or Iteration over Subproblems – **Segmented Least Squares**: Multi-way Choices – Subset Sums and Knapsacks: Adding a variable – Shortest Paths in a Graph – Shortest Paths and Distance Vector Protocols – Negative Cycles in a Graph		**CO3**
UNIT-IV	**Network Flow**	**Periods: 9**
The Maximum-Flow Problem and the Ford-Fulkerson Algorithm – Maximum Flows and Minimum Cuts in a Network – Choosing Good Augmenting Paths – A First Application: The Bipartite Matching Problem – Disjoint Paths in Directed and Undirected Graphs.		**CO4**
UNIT-V	**NP and Computational Intractability**	**Periods: 9**
Polynomial-Time Reductions – Efficient Certification and the Definition of NP – NP-Complete Problems – Sequencing Problems – Partitioning Problems – Graph Coloring – Co-NP and the Asymmetry of NP.		**CO5**

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

Text Books

1. Advanced Data Structures And Algorithms ,1st edition 2015
2. Algorithms,Robert Sedgewick and Kavin Wayne,4th edition

Reference Books

1. Jon Kleinberg, ÉvaTardos, "Algorithm Design",Pearson Education Limited 2014.
2.Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, 2009.
3. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, Hyderabad, 2008.
4. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education Asia, 2008.

Web References

1. https://www.scaler.com/topics/analysis-of-algorithm/
2. https://www.codingninjas.com/studio/library/greedy-algorithm-in-graph-theory
3. https://www.tutorialspoint.com/data_structures_algorithms/divide_and_conquer.htm
4. https://www.cs.cmu.edu/~avrim/451f11/lectures/lect1025.pdf
5. https://cseweb.ucsd.edu//classes/sp05/cse101/Day19NP.pdf

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

**Assignment to be given from Unit-5

Department	**Artificial Intelligence and Data Science**			Programme: **M.Tech.**				
Semester	**I/II**			Course Category : **AEC**			*End Semester Exam Type: **-**	
Course Code	**P23ACTX01**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**ENGLISH FOR RESEARCH PAPER WRITING**			**2**	**0**	**0**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)										
Prerequisite	No Prerequisite needed									
Course Outcomes	**On completion of the course, the students will be able to**									BT Mapping (Highest Level)
	CO1	Understand that how to improve your writing skills and level of readability.								**K2**
	CO2	Learn about what to write in each section.								**K1**
	CO3	Understand the skills needed when writing a Title.								**K2**
	CO4	Understand the skills needed when writing the Conclusion.								**K2**
	CO5	Ensure the good quality of paper at very first-time submission.								**K3**
UNIT- I	**Introduction to Research Paper Writing**						**Periods: 6**			
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.										**CO1**
UNIT- II	**Presentation Skills**						**Periods: 6**			
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.										**CO2**
UNIT- III	**Title Writing Skills**						**Periods: 6**			
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.										**CO3**
UNIT- IV	**Result Writing Skills**						**Periods: 6**			
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.										**CO4**
UNIT- V	**Verification Skills**						**Periods: 6**			
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission.										**CO5**
Lecture Periods: 30		**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 30**			
Reference Books										
1. Adrian Wallwork, “English for Writing Research Papers”, Springer, New York, Dordrecht Heidelberg London, 2011. 2. Day R, “How to Write and Publish a Scientific Paper”, Cambridge University Press, 2006. 3. Goldbort R, “Writing for Science”, Yale University Press (Available on Google Books), 2006. 4. Highman N, “Handbook of Writing for the Mathematical Sciences”, SIAM. Highman’s book, 1998.										

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category : **AEC**			*End Semester Exam Type: **-**			
Course Code	**P23ACTX02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DISASTER MANAGEMENT**	**0**	**0**	**2**	**-**	**100**	**-**	**100**

(Common to all M.Tech Programme)

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Ability to summarize basics of disaster.	**K1**
	CO2 Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	**K2**
	CO3 Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	**K3**
	CO4 Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	**K3**
	CO5 Ability to develop the strengths and weaknesses of disaster management approaches.	**K3**

UNIT- I	**Introduction**	**Periods: 6**
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.		**CO1**
UNIT- II	**Repercussions of Disasters and Hazards**	**Periods: 6**
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.		**CO2**
UNIT- III	**Disaster Prone Areas in India**	**Periods: 6**
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics.		**CO3**
UNIT- IV	**Disaster Preparedness and Management**	**Periods: 6**
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.		**CO4**
UNIT- V	**Risk Assessment**	**Periods: 6**
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival		**CO5**

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

Reference Books

1. Goel S. L., "Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company, 2007.
3. Sahni, Pardeep Et.Al. , "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Artificial Intelligence and Data Science**			Programme: **M.Tech.**				
Semester	**I/II**			Course Category : **AEC**		*End Semester Exam Type: **-**		
Course Code	**P23ACTX03**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**SANSKRIT FOR TECHNICAL KNOWLEDGE**			**0**	**0**	**2**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)										
Prerequisite	No Prerequisite needed									
Course Outcomes	**On completion of the course, the students will be able to**									BT Mapping (Highest Level)
	CO1	Understanding basic Sanskrit language.								**K2**
	CO2	Write sentences								**K2**
	CO3	Know the order and roots of Sanskrit.								**K3**
	CO4	Know about technical information about Sanskrit literature								**K3**
	CO5	Understand the technical concepts of Engineering.								**K2**
UNIT- I	**Alphabets**						**Periods: 6**			
Alphabets in Sanskrit.										**CO1**
UNIT- II	**Tenses and Sentences**						**Periods: 6**			
Past/Present/Future Tense - Simple Sentences.										**CO2**
UNIT- III	**Order and Roots**						**Periods: 6**			
Order - Introduction of roots of Engineering-Electrical, Mechanical, Architecture, Mathematics.										**CO3**
UNIT- IV	**Sanskrit Literature**						**Periods: 6**			
Technical information about Sanskrit Literature.										**CO4**
UNIT- V	**Technical Concepts of Engineering**						**Periods: 6**			
Technical concepts										**CO5**
Lecture Periods: 30		**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 30**			

Reference Books

1. Dr. Vishwas, “Abhyaspustakam”, Samskrita-Bharti Publication, New Delhi.
2. Prathama Deeksha, Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, “Teach Yourself Sanskrit”, New Delhi Publication.
3. Suresh Soni, “India’s Glorious Scientific Tradition”, Ocean books (P) Ltd., New Delhi, 2017

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Artificial Intelligence and Data Science**		Programme: **M.Tech.**					
Semester	**I/II**		Course Category : **AEC**			*End Semester Exam Type: **-**		
Course Code	**P23ACTX04**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**VALUE EDUCATION**		**0**	**0**	**2**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							
Course Outcomes	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)
	CO1	Knowledge of self-development.						**K2**
	CO2	Learn the importance of Human values.						**K1**
	CO3	Developing the overall personality.						**K3**
	CO4	Developing Character and Competence						**K3**
UNIT- I	**Values and Self Development**					**Periods: 6**		
Values and self-development–Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgments of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.								**CO1**
UNIT- II	**Cultivation of Values**					**Periods: 6**		
Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline								CO2
UNIT- III	**Personality Development**					**Periods: 6**		
Personality and Behavior Development-Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brother hood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.								**CO3**
UNIT- IV	**Character Development**					**Periods: 6**		
Character and Competence–Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role.								**CO4**
Lecture Periods: 30	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 30**		
Reference Books								
1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.								

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Artificial Intelligence and Data Science**			Programme: **M.Tech.**				
Semester	**I/II**			Course Category : **AEC**		*End Semester Exam Type: **-**		
Course Code	**P23ACTX05**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**CONSTITUTION OF INDIA**			**0**	**0**	**2**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)										
Prerequisite	No Prerequisite needed									
Course Outcomes	**On completion of the course, the students will be able to**									BT Mapping (Highest Level)
	CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.								**K3**
	CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.								**K3**
	CO3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections.								**K3**
	CO4	Discuss the passage of the Hindu Code Bill of 1956.								**K3**
	CO5	Discuss the administration and Election commission								**K3**
UNIT- I	**History of Making of The Indian Constitution**						**Periods: 6**			
History, Drafting Committee, (Composition & Working).										**CO1**
UNIT- II	**Philosophy of The Indian Constitution**						**Periods: 6**			
Preamble, Salient Features.										**CO2**
UNIT- III	**Contours of Constitutional Rights and Duties**						**Periods: 6**			
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.										**CO3**
UNIT- IV	**Organs of Governance**						**Periods: 6**			
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.										**CO4**
UNIT- V	**Local Administration and Election Commission**						**Periods: 6**			
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy. Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners – Institute and Bodies for the welfare of SC/ST/OBC and women.										**CO5**
Lecture Periods: 30		**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 30**			

Reference Books

1. "The Constitution of India, 1950(Bare Act), Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution, 1 st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edition, Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.
5. Suresh Soni, "India's Glorious Scientific Tradition" Ocean books (P) Ltd., New Delhi, 2017.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Artificial Intelligence and Data Science**			Programme: **M.Tech.**				
Semester	**I/II**			Course Category : **AEC**		*End Semester Exam Type: **-**		
-Course Code	**P23ACTX06**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**PEDAGOGY STUDIES**			**0**	**0**	**2**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)										
Prerequisite	No Prerequisite needed									
Course Outcomes	**On completion of the course, the students will be able to**								BT Mapping (Highest Level)	
	CO1	What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?							**K2**	
	CO2	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?							**K2**	
	CO3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?							**K2**	
	CO4	Illustrate Professional development							**K3**	
	CO5	Identify Research gaps and Future Directions							**K3**	
UNIT- I	**Introduction and Methodology**						**Periods: 6**			
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions – Overview of methodology and Searching.										CO1
UNIT- II	**Thematic Overview**						**Periods: 6**			
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.										**CO2**
UNIT- III	**Evidence on The Effectiveness of Pedagogical Practices**						**Periods: 6**			
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies										**CO3**
UNIT- IV	**Professional Development**						**Periods: 6**			
Professional development: alignment with classroom practices and follows up support – Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes										**CO4**
UNIT- V	**Research Gaps and Future Directions**						**Periods: 6**			
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.										**CO5**
Lecture Periods: 30		**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 30**			

Reference Books

1. Ackers J, Hardman,F, "Classroom interaction in Kenyan primary schools, Compare", 31(2): 245- 261, 2001.
2. Agrawal M, "Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies", 36(3):361-379, 2004.
3. Akyeampong K, "Teacher training in Ghana-does it count? Multi-site teacher education research project (MUSTER) country report", London, DFID, 2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count?", International Journal Educational Development, 33(3): 272–282, 2013.
5. Alexander RJ, "Culture and pedagogy: International comparisons in primary education", Oxford and Boston: Blackwell, 2001.
6. Chavan M, "Read India: Amass scale, rapid, 'learning to read' campaign", 2003.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

Department	**Artificial Intelligence and Data Science**			Programme: **M.Tech.**				
Semester	**I/II**			Course Category : **AEC**		*End Semester Exam Type: **-**		
Course Code	**P23ACTX07**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**STRESS MANAGEMENT BY YOGA**			**0**	**0**	**2**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)										
Prerequisite	No Prerequisite needed									
Course Outcomes	**On completion of the course, the students will be able to**									BT Mapping (Highest Level)
	CO1	Develop healthy mind in a healthy body thus improving social health also								**K2**
	CO2	Improve efficiency.								**K2**
	CO3	Understand Asan and Pranayam								**K2**
	CO4	Apply Asanas								**K4**
	CO5	Apply Pranayam								**K4**
UNIT- I	**Introduction**						**Periods: 6**			
Definitions of Eight parts of yoga. (Ashtanga).										**CO1**
UNIT- II	**Do`s and Don't's in Life**						**Periods: 6**			
Yam and Niyam - Do`s and Don't's in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.										**CO2**
UNIT- III	**Asan and Pranayam**						**Periods: 6**			
Asan and Pranayam - Various yoga poses and their benefits for mind & body - Regularization of breathing techniques and its effects-Types of pranayam.										**CO3**
UNIT- IV	**Asan Practices**						**Periods: 6**			
Practice on Various yoga poses										**CO4**
UNIT- V	**Pranayam Practices**						**Periods: 6**			
Practice on various pranayam										**CO5**
Lecture Periods: 30		**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 30**			

Reference Books

1. Janardan Swami Yoga bhyasi Mandal, "Yogic Asanas for Group Tarining-Part-I", Nagpur.
2. Swami Vivekananda, "Rajayoga or conquering the Internal Nature", Advaita Ashrama Publication Department, Kolkata

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

Department	**Artificial Intelligence and Data Science**		Programme: **M.Tech.**					
Semester	**I/II**		Course Category : **AEC**			*End Semester Exam Type: **-**		
Course Code	**P23ACTX08**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS**		**0**	**0**	**2**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)									
Prerequisite	No Prerequisite needed								
Course Outcomes	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)	
	CO1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.						**K3**	
	CO2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity.						**K1**	
	CO3	Study of Neet is hatakam will help in developing versatile personality of students.						**K3**	
UNIT- I						**Periods: 6**			
Neetisatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's) 4-Verses 18, 38,39 Chapter18 – Verses37,38,63.									**CO1**
UNIT- II						**Periods: 12**			
Approach to day to day work and duties - Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3- Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.model – shrimad bhagwad geeta - Chapter2- Verses 17, Chapter 3-Verses 36,37,42 – Chapter.									**CO2**
UNIT- III						**Periods: 12**			
Statements of basic knowledge – Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter12 -Verses 13, 14, 15, 16,17, 18 - Personality of role.									**CO3**
Lecture Periods: 30	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 30**			

Reference Books

1. Gopinath, Rashtriya Sanskrit Sansthanam P, "Bhartrihari's Three Satakam, Niti-sringar- vairagya", New Delhi,2010.
2. Swami Swarupananda, Srimad Bhagavad Gita, Advaita Ashram, Publication Department, Kolkata, 2016

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category : **AEC**			*End Semester Exam Type: **-**			
Course Code	**P23ACTX09**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**UNNAT BHARATH ABHIYAN**	**0**	**0**	**2**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Gain an understanding of rural life, culture and social realities	**K3**
	CO2	Develop a sense of empathy and bonds of mutuality with local community	**K1**
	CO3	Appreciate significant contributions of local communities to Indian society and economy	**K3**
	CO4	Learn to value the local knowledge and wisdom of the community	**K3**
	CO5	Identify opportunities for contributing to community's socio-economic improvements.	**K3**

UNIT- I	**Appreciation of Rural Society**	**Periods: 6**	
Rural life style, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure.			**CO1**
UNIT- II	**Understanding Rural Economy and Livelihood**	**Periods: 6**	
Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets.			**CO2**
UNIT- III	**Rural Institutions**	**Periods: 6**	
Traditional rural organizations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration.			**CO3**
UNIT- IV	**Rural Development Programmes**	**Periods: 6**	
History of rural development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awaas Yojana, Skill India, Gram Panchayat Decentralized Planning, NRLM, MNREGA, etc.			**CO4**
UNIT- V	**Field Based Practical Activities**	**Periods: 6**	
Visit MGNREGS project sites. Swachh Bharat project sites, Conduct Mission Antyodaya surveys, Interactive community exercise with local leaders, Panchayat functionaries, Visit Rural Schools / mid-day meal centres, study Academic and infrastructural resources and gaps, Participate in Gram Sabha meetings, Visit local Anganwadi Centre, Conduct soil health test, drinking water analysis.			**CO5**
Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. Singh, Katar, "Rural Development : Principles, Policies and Management", Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, "Sustainable Development Goals", 2015.
4. M.P.Boraian, "Best Practices in Rural Development", Shanlax Publishers, 2016

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **PA**			*End Semester Exam Type: **LE**			
Course Code	**P23ADW301**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Project Phase - I**	**0**	**0**	**12**	**6**	**50**	**50**	**100**

Aim & Objective:

The project work aims to develop the work practice and to apply theoretical and practical tools/techniques for solving real life problems related to industry and current research. The objective of the project work is to improve the professional competency and research attitude by touching the areas which are not covered in theory or laboratory classes.

- The project work shall be a design project/experimental project and/or computer simulation project on any of the topic in manufacturing engineering or related field.
- The project work shall be allotted individually on different topics.
- The students shall be encouraged to do their project work in the parent institute itself. In exceptional cases the students shall be permitted to undertake continue their project outside the parent institute with appropriate permission from Head of the institution through the Project Coordinator.
- Department shall constitute an Evaluation Committee to review the project work.
- The Evaluation committee shall consist of at least three faculty members namely internal guide, project coordinator and another expert in the specified area of the project.

The student is required to undertake the project phase I during the third semester and the same shall be continued in the 4 th semester (Phase II). Phase I consist of preliminary thesis work, three reviews of the work and the submission of preliminary report. First review shall highlight the topic, objectives and origin of problem, second review shall highlight, Literature survey, methodology and expected results. Third review shall evaluate the progress of the work, preliminary report and scope of the work which shall be completed in the 4 th semester. Also the evaluation of project phase - I shall be done externally.

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **PA**				*End Semester Exam Type: -		
Course Code	**P23ADW302**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Internship**	**0**	**0**	**0**	**2**	**100**	**-**	**100**

Students should undergo training or internship during summer / winter vacation at Industry/ Research organization / University (after due approval from the Programme Academic Coordinator and Department Consultative Committee (DCC). In such cases, the internship/training should be undergone continuously (without break) in one organization. Normally no extension of time is allowed. However, DCC may provide relaxation based on the exceptional case. The students are allowed to undergo three to four weeks internship in established industry / Esteemed institution during vacation period. The student should give presentation and submit report to DCC. The Internship is assessed internally for 100 marks.

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **AEC**			*End Semester Exam Type: -			
Course Code	**P23ADC301**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**NPTEL/SWAYAM/MOOC**	**0**	**0**	**0**	**-**	**100**	**-**	**100**

Student should register online courses like MOOC / SWAYAM / NPTEL etc. approved by the Department committee comprising of HoD, Programme Academic Coordinator and Subject Experts. Students have to complete relevant online courses successfully. The list of online courses is to be approved by Academic Council on the recommendation of HoD at the beginning of the semester if necessary, subject to ratification in the next Academic council meeting. The Committee will monitor the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the marks secured in online examinations. The marks attained for this course is not considered for CGPA calculation.

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**IV**	Course Category : **PA**			*End Semester Exam Type: **LE**			
Course Code	**P23ADW403**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Project Phase - II**	**0**	**0**	**24**	**12**	**50**	**50**	**100**

Aim & Objective:

The project work aims to develop the work practice and to apply theoretical and practical tools/techniques for solving real life problems related to industry and current research. The objective of the project work is to improve the professional competency and research attitude by touching the areas which are not covered in theory or laboratory classes.

- The project work shall be a design project/experimental project and/or computer simulation project on any of the topic in manufacturing engineering or related field.
- The project work shall be allotted individually on different topics.
- The students shall be encouraged to do their project work in the parent institute itself. In exceptional cases the students shall be permitted to undertake continue their project outside the parent institute with appropriate permission from Head of the institution through the Project Coordinator.
- Department shall constitute an Evaluation Committee to review the project work.
- The Evaluation committee shall consist of at least three faculty members namely internal guide, project coordinator and another expert in the specified area of the project.

Project phase II is a continuation of project phase I which started in the third semester. There shall be three reviews in the fourth semester, first in the beginning of the semester, second in the middle of the semester and the Third at the end of the semester. First review is to evaluate the progress of the work and planned activity; second review shall be presentation and discussion. Third review shall be a presubmission presentation before the evaluation committee to assess the quality and quantity of the work done. This would be a pre qualifying exercise for the students for getting approval for the submission of the thesis. At least one technical paper shall be prepared for possible publication in journals or conferences. The technical paper shall be submitted along with the thesis. The final evaluation of the project shall be done externally.

Annexure-VI