Sri Manakula Vinayagar Engineering College
(An Autonomous institution)
(Approved by AICTE, New Delhi, Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi, ISO 9001 : 2000 Certified Institution &
Accredited by NAAC with 'A' Grade)
Madagadipet, Puducherry - 605 107

Department of Artificial Intelligence and Data Science

Minutes of 6th BOS Meeting

GD Hall, Training and Placement Cell
Sri Manakula Vinayagar Engineering College

21st July 2023 & 12:30 P.M

2.A.10.1

Department of Artificial Intelligence and Data Science
Minutes of 6th Board of Studies

The Sixth Board of Studies meeting for Department of Artificial Intelligence and Data Science was held on 21st July 2023 at 12:30 P.M in the GD Hall, Training and Placement Cell, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS
1	**Dr. J. Madhusudanan,** Professor and Head, Department of AI&DS, SMVEC.	Chairman
2	**Dr. M. Thangaraj,** Professor & Head, Madurai Kamaraj University, Madurai.	Subject Expert (Academic Council Nominee)
3	**Dr. Chandra Mouli P.V.S.S.R,** Associate Professor & Head Central University of Tamil Nadu, Tiruvarur, Tamil Nadu.	Subject Expert (Academic Council Nominee)
4	**Dr. C. Muthu,** Professor & Head, Loyola College, Chennai.	Subject Expert (University Nominee)
5	**Dr. Mohanraj Vengadachalam,** Machine Learning Lead, Standard Chartered GBS, Chennai.	Representative from Industry
6	**Dr. J. Uthayakumar,** Research Head, Genesys Academy, Puducherry.	Postgraduate Alumnus (nominated by the Principal)
7	**Dr. M.Auxilia** Associate Professor, Department of AI&DS, SMVEC	Internal Member
8	**Mr. K.Pragash** Assistant Professor, Department of AI&DS, SMVEC	Internal Member
9	**Mr. R.Rajan** Assistant Professor, Department of AI&DS, SMVEC	Internal Member
10	**Prof. M. Ganesan** Assistant Professor, Department of CSE, SMVEC	Internal Member

11	**Prof. M. Shanmugam** Assistant Professor, Department of CSE, SMVEC	Internal Member
12	**Dr. T. Gayathri** Professor, Department of Maths, SMVEC	Internal Member
13	**Dr. R. Sivakumar** Associate Professor, Dept. of MBA, SMVEC	Internal Member
14	**Ms. K. Mathanavathi** Assistant Professor, Dept. of English, SMVEC	Internal Member

Agenda of the Meeting

1. Review of Fifth BoS
2. Approval of professional electives for semester VII (1 paper) and VIII (10 Papers)
3. Approval of new regulation R2023 for both B.Tech and M.Tech.
4. Approval of the curriculum for both B.Tech and M.Tech courses under R2023.
5. Approval of Semester I and Semester II papers for I year B. Tech under R2023
6. Approval of Semester I and Semester II papers for I year M. Tech under R2023
7. Showcasing achievements and placement details of our department
8. Any other item with the permission of chai

Minutes of the Meeting

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

BOS/2022/AI&DS/UG/6.1	Discussed and approved the Fifth BoS
BOS/2022/AI&DS/UG/6.2	Professional Elective Syllabi and VIII semesters for the B.Tech – Artificial Intelligence and Data Science have been approved with the following suggestions **(Given in Annexure I).**

Sl.No	Regulation	Semester	Subject Name with Code	Unit	Particulars
1	R-2020	VII	Data Analytics with Power BI U20ADE716	-	The expert members are satisfied with the contents included in the syllabus.
2	R-2020	VIII	AI in Bioinformatics U20ADE821	-	The expert members are satisfied with

2.A.10.3

					the contents included in the syllabus
3	R-2020	VIII	AI in Ecommerce U20ADE822	-	The expert members are satisfied with the contents included in the syllabus
4	R-2020	VIII	Ethical Hacking U20ADE823	-	Suggested to include defence mechanisms in any of the unit
5	R-2020	VIII	AI in Agriculture U20ADE824	-	The expert members are satisfied with the contents included in the syllabus
6	R-2020	VIII	ML OPS U20ADE825	I	Suggested to add feedback loop mechanism in unit I
7	R-2020	VIII	AI in Automobile Industry U20ADE826	-	The expert members are satisfied with the contents included in the syllabus. Real time demonstration can be given to students for collision detection
8	R-2020	VIII	AI in Customer Service U20ADE827	-	The expert members are satisfied with the contents included in the syllabus
9	R-2020	VIII	AI in Smart Cities U20ADE828	-	Suggested to procure hardware for real time demonstration
10	R-2020	VIII	Healthcare Data Analytics U20ADE829	-	The expert members are satisfied with the contents included in the syllabus

2.A.10.4

11	R-2020	VIII	AI in Finance U20ADE830	-	The expert members are satisfied with the contents included in the syllabus

BOS/2022/AI&DS/UG/6.3	Discussed about the new regulation R2023 for both B.Tech and M.Tech
BOS/2022/AI&DS/UG/6.4	Discussed about the Approval of the curriculum for both B.Tech and M.Tech courses under R2023 **(Given in Annexure II).** – Approved and Recommended to the AC
BOS/2022/AI&DS/UG/6.5	Approval of Semester I and Semester II papers for I year B. Tech under R2023 Accepted the syllabus without any corrections, as most of the subjects are common **(Given in Annexure III).**
BOS/2022/AI&DS/UG/6.6	Approval of Semester I and Semester II papers for I year M. Tech under R2023 Suggested to change course in M. Tech Curriculum such that the subjects taught in B. Tech is not repeated in M.Tech Curriculum **(Given in Annexure III).**

Sl.No	Regulation	Semester	Subject Name with Code	Unit	Particulars
1	R-2023	I	P23ADE205 Data Visualization Using Power BI	V	The expert members suggested to add case studies in the unit V
2	R-2023	II	P23ADE207 Next Generation Databases	All	The expert members suggested to add few advanced topics in all units
3	R-2023	II	P23ADE213 Full Stack Development	IV	The expert members suggested to remove streaming concept in unit IV

BOS/2022/AIDS/UG/6.7	Showcased achievements and placement details of our department and the members appreciated the students and entire department.
BOS/2022/AIDS/UG/6.8	Got suggestions from the BoS Members for B.Tech honors degree and they approved the subjects. Members have suggested few new courses to be added in the Employability Enhancement Courses

2.A.10.5

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

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	**Dr. J. Madhusudanan,** Professor and Head, Department of AI&DS, SMVEC.	Chairman	
2	**Dr. M. Thangaraj,** Professor & Head, Madurai Kamaraj University, Madurai.	Subject Expert	
3	**Dr. Chandra Mouli P.V.S.S.R,** Associate Professor & Head Central University of Tamil Nadu, Tiruvarur, Tamil Nadu.	Subject Expert	
4	**Dr. C. Muthu,** Professor & Head, Loyola College, Chennai.	Subject Expert	
5	**Dr. Mohanraj Vengadachalam,** Machine Learning Lead, Standard Chartered GBS, Chennai.	Industrial Expert	
6	**Dr. J. Uthayakumar,** Research Head, Genesys Academy, Puducherry.	Member	
7	**Dr. M. Auxilia** Associate Professor, Department of AI&DS, SMVEC	Internal Member	
8	**Mr. K. Pragash** Assistant Professor, Department of AI&DS, SMVEC	Internal Member	
9	**Mr.R.Rajan** Assistant Professor, Department of AI&DS, SMVEC	Internal Member	
10	**Prof. M. Ganesan** Assistant Professor, Department of CSE, SMVEC	Internal Member	
11	**Prof. M. Shanmugam** Assistant Professor, Department of CSE, SMVEC	Internal Member	
12	**Dr. T. Gayathri** Professor, Department of Maths, SMVEC	Internal Member	

2.A.10.5

13	**Dr. R. Sivakumar** Associate Professor, Dept. of MBA, SMVEC	Internal Member	
14	**Ms. Gajalakshmi** Assistant Professor, Dept. of English, SMVEC	Internal Member	

2.A.10.7

2.A.10.8

Annexure – I
(Revised VII and VIII Semester Professional Elective Curriculum)

SEMESTER – V		
Sl. No.	**Course Code**	**Course Title**
Professional Elective – IV (Offered in Semester VII) *		
1	U20ADE716	Data Analytics with Power BI
2	U20ADE717	AI Ethics
3	U20ADE718	Image and Video Analytics
4	U20ADE719	Social Network Analysis
5	U20ADE720	Time Series Analysis and Forecasting
Professional Elective – V (Offered in Semester VIII) *		
1	U20ADE821	AI in Bioinformatics
2	U20ADE822	AI in Ecommerce
3	U20ADE823	Ethical Hacking
4	U20ADE824	AI in Agriculture
5	U20ADE825	ML OPS
Professional Elective – VI (Offered in Semester VIII) *		
1	U20ADE826	AI in Automobile Industry
2	U20ADE827	AI in Customer Service
3	U20ADE828	AI in Smart Cities
4	U20ADE829	Healthcare Data Analytics
5	U20ADE830	AI in Finance

2.A.10.9

2.A.10.10

U20ADE716	DATA ANALYTICS WITH POWER BI	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

The course will introduce the students to

- To understand the concept of data analytics and Power BI
- To understand the difference data transformation and data preparation
- To understand the data modelling using Power BI
- To understand data visualization methods using charts
- To understand the solving real world problems

Course Outcomes

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

CO1 – Learn the significance and need of data analysis and data visualization
CO2 – Understand the data cleaning and preprocessing frameworks
CO3 – Understand the DAX language for advanced calculations
CO4 – Implememt dashboards using Power BI
CO5 – Apply data analytics for real world applications.

UNIT I INTRODUCTION TO DATA ANALYTICS AND POWER BI **(9 Hrs).**

Overview of data analytics and its significance - Introduction to Power BI and its features - Data visualization and exploration using Power BI - Connecting to data sources in Power BI

UNIT II DATA PREPARATION AND TRANSFORMATION **(9 Hrs)**

Data cleaning and pre-processing techniques in Power BI - Data shaping and transformation using Power Query- Merging, and combining data from multiple sources- Creating calculated columns and measures

UNIT III DATA MODELLING AND ANALYSIS **(9 Hrs)**

Building data models in Power BI- relationships between tables - DAX (Data Analysis Expressions) language for advanced calculations- Aggregations and summarization techniques

UNIT IV ADVANCED DATA VISUALIZATION **(9 Hrs)**

Creating interactive reports and dashboards in Power BI - customizing visualizations - and formatting options, using slicers and filters for data exploration - Implementing drill-down and drill-through functionality

UNIT V POWER BI AND BUSINESS PROBLEM SOLVING **(9 Hrs)**

Solving real-world business problems using Power BI - analysing sales and marketing data – Forecasting and trend analysis - Identifying patterns and outliers - Data-driven decision-making and insights

Text Books

1. Suren Machiraju,Suraj Gaurav,"Power BI Data Analysis and Visualization",DeIG Press,1st edition, 2018
2. Brian Larson,"Data Analysis with Power BI",Mc Graw Hill,1st edition, 2020
3. Dan Clark,"Beginning Microsoft Power BI",Apress, 3rd Edition, 2020.

Reference Books

1. Brett Powell, "Power BI Cookbook: Creating Business Intelligence Solutions of Analytical Data Models, Reports, and Dashboards", 2017
2. Nicole LaBlanc , "Learn Power BI: A Beginner's Guide to Analyzing Data and Creating Business Intelligence Dashboards", 2018
3. Teo Lachev and Edward Price, "Applied Microsoft Power BI: Bring your data to life!", 2017
4. Brett Powell , "Mastering Microsoft Power BI: Expert Techniques for Effective Data Analytics and Business Intelligence", 2018
5. Alberto Ferrari and Marco Russo ,"Analyzing Data with Power BI and Power Pivot for Excel", 2017

2.A.10.11

Web References

1. https://powerbi.microsoft.com/en-us/documentation/
2. https://community.powerbi.com/)
3. https://powerbi.microsoft.com/en-us/blog/
4. https://radacad.com/category/power-bi
5. https://www.sqlbi.com/

COs/POs/PSOs Mapping

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

2.A.10.12

U20ADE821	AI IN BIOINFORMATICS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To learn about Bioinformatics Basics.
- To understand the concept of Sequence alignment and analysis
- To learn various concepts of Genomics and functional annotation
- To understand the concepts of structural bioinformatics
- To understand various applications of genomics and drug discovery in artificial intelligence

Course Outcomes

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

CO1 – Understand the Bioinformatics concepts
CO2 – Understand the sequence analysis fundamentals and alignment algorithms
CO3 - Understand the Genomic data, gene predictions algorithms, and functional annotation tools
CO4 – Understand the protein structure fundamentals
CO5 – Understand the Genomic data analysis and drug target identification.

UNIT I – INTRODUCTION TO AI IN BIOINFORMATICS **(9Hrs)**

Overview of AI in bioinformatics - Applications of AI in bioinformatics - Machine learning and deep learning techniques - Data mining in bioinformatics - Challenges and future trends

UNIT II – SEQUENCE ALIGNMENT AND ANALYSIS **(9Hrs)**

Sequence alignment fundamentals - Pairwise alignment - Multiple sequence alignment - Sequence databases - Pattern recognition and motif discovery

UNIT III – GENE PREDICTION AND FUNCTIONAL ANNOTATION **(9Hrs)**

Gene prediction methods - Gene ontology - Functional annotation tools - Pathway analysis - Network biology and systems biology

UNIT IV – PROTEIN STRUCTURE PREDICTION AND ANALYSIS **(9Hrs)**

HTTP Client/ Server. GORM – What is GORM - using GORM - doing CRUD operations. Rest architecture - Gorm patterns. SQL-JWT-Integrating with JWT.

UNIT V – APPLICATIONS OF AI IN GENOMICS AND DRUG DISCOVERY **(9Hrs)**

Genome-wide association studies - Personalized medicine - Drug target identification - Drug design and optimization - AI-driven drug discovery pipelines

TEXT BOOKS

1. Edward Keedwell, Ajit Narayanan, "Intelligent Bio Informatics",2005
2. Mario Cannataro, Pietro Hiram "Artificial Intelligence in Bio Informatics",2022
3. Jagath C, Bertil Schmidt "Pattern Recognition in Bio Informatics",2007

REFERENCE BOOKS

1. U. Rajendra Acharya, Subhagata Chattopadhyay, and Sumeet Dua,"Artificial Intelligence and Machine Learning for Bioinformatics", 2018
2. Des Higgins and Willie Taylor, "Bioinformatics: Sequence, Structure and Databanks", 2000
3. Arthur M. Lesk ,"Introduction to Bioinformatics",2002
4. Andreas D. Baxevanis and B. F. Francis Ouellette ,"Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins", 1998
5. Jonathan Pevsner, "Bioinformatics and Functional Genomics", 2003

WEB REFERENCES:

1. National Center for Biotechnology Information (NCBI) (https://www.ncbi.nlm.nih.gov/)
2. European Bioinformatics Institute (EMBL-EBI) (https://www.ebi.ac.uk/)
3. Bioinformatics.org (https://www.bioinformatics.org/)
4. AI in Bioinformatics by Towards Data Science (https://towardsdatascience.com/tagged/bioinformatics)
5. AI in Bioinformatics by Medium (https://medium.com/tag/bioinformatics)

2.A.10.13

COs/POs/PSOs Mapping

COs	Program Specific												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	-

2.A.10.14

	AI IN ECOMMERCE	L	T	P	C	Hrs
U20ADE822		3	0	0	3	45

Course Objectives

The course will introduce the students to

- Understand the various concepts and applications of AI in Ecommerce
- Learn techniques for target audience analysis and market segmentation using AI-driven approaches
- Understand the machine learning and natural language processing in Ecommerce
- Understand the deep learning concepts in Ecommerce
- Understand the product recommendations and examine AI-enhanced customer service

Course Outcomes

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

CO1 – Understand the knowledge of the history and applications of AI in Ecommerce
CO2 – Understand the AI-driven Ecommerce strategies and their role in achieving business objectives.
CO3 – Apply the machine learning and natural language processing in Ecommerce
CO4 – Apply the Convolutional Neural Network (CNN) and Recurrent Neural Network (RNN) in Ecommerce
CO5 – Understand the business impact and performance.

UNIT I – INTRODUCTION TO AI IN ECOMMERCE **(9 Hrs)**

AI in Ecommerce Overview - History of AI in Ecommerce - AI Applications in Ecommerce - Personalization and Recommendation Systems - Chatbots and Customer Service

UNIT II – ARTIFICIAL INTELLIGENCE IN ECOMMERCE STRATEGY **(9 Hrs)**

AI-Driven Ecommerce Strategy - Target Audience Analysis - Market Segmentation - AI-Enhanced Marketing Campaigns - Retention and Loyalty Programs

UNIT III – MACHINE LEARNING IN ECOMMERCE **(9 Hrs)**

Machine Learning Applications in Ecommerce - Supervised Learning for Customer Segmentation - Unsupervised Learning for Product Recommendations - Natural Language Processing for Sentiment Analysis

UNIT IV – DEEP LEARNING IN ECOMMERCE **(9 Hrs)**

Deep Learning Applications in Ecommerce - Convolutional Neural Networks for Product Image Analysis - Recurrent Neural Networks for Customer Behaviour Prediction

UNIT V: CASE STUDIES IN AI-POWERED ECOMMERCE **(9 Hrs)**

Personalized Product Recommendations - AI-Enhanced Customer Service - Predictive Inventory Management - Voice-Activated Shopping

Text Books

1. Honghao Gao, Jung Yoon Kim "Intelligent Processing Practices and Tools for E- Commerce",2021
2. Pooja Tiwari, Shalini Agarwal "Applications of Artificial Intelligence in Business and Finance",2021
3. Javier Segovia, Piotr S. Szczepaniak "Ecommerce and Intelligent Methods",2013.

Reference Books

1. Amit Fulay , "Artificial Intelligence for E-commerce: Applications, Opportunities and Challenges", 2022
2. Chris J. Albon, "Machine Learning for E-commerce: Practical Applications and Strategies", 2018
3. Nicholas Locascio, Nikhil Buduma, "Deep Learning for E-commerce: Building Intelligent Systems", 2016
4. Mike Murphy, "AI in Ecommerce: Strategies for Success in the Digital Economy", 2020
5. Liangjie Hong ,Longqi Yang, "E-commerce Personalization: A Practical Guide to AI-Driven Customer Experience", ,2021

WEB REFERENCES:

1. Shopify's AI in Ecommerce Blog (https://www.shopify.com/blog/topics/ai-in-ecommerce)
2. Practical Ecommerce (https://www.practicalecommerce.com/category/ai)
3. AI in Ecommerce by Towards Data Science (https://towardsdatascience.com/tagged/ai-in-ecommerce)
4. AI in Ecommerce by Medium (https://medium.com/tag/ai-in-ecommerce)
5. AI in Ecommerce by Forbes (https://www.forbes.com/sites/forbesbusinesscouncil/2020/08/11/how-ai-is-transforming-e-commerce/)

2.A.10.15

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	-

2.A.10.16

U20ADE823	ETHICAL HACKING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

The course will introduce the students to

- To learn about the importance of information security
- To learn different scanning and enumeration methodologies and tools
- To understand various hacking techniques and attacks
- To be exposed to programming languages for security professionals
- To get familiarized with the different phases in penetration testing

Course Outcomes

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

CO1 – Understand the security concepts
CO2 – Understand the ethical hacking methodology
CO3 – Understand the scanning and vulnerability assessment
CO4 – Understand the system hacking and penetration testing
CO5 – Understand the security tools

UNIT I – INTRODUCTION TO ETHICAL HACKING **(9 Hrs)**

Overview of Ethical Hacking - History and Evolution of Ethical Hacking - Ethical Hacking Terminology - Types of Hackers - Ethical Hacking Method - Legal and Ethical Considerations

UNIT II – FOOTPRINTING AND RECONNAISSANCE **(9 Hrs)**

Footprinting Concepts - Information Gathering Techniques - DNS Enumeration - WHOIS Lookup - Network Scanning - Social Engineering - Reconnaissance Tools and Resources

UNIT III – SCANNING AND VULNERABILITY ASSESSMENT **(9 Hrs)**

Network Scanning Techniques - Port Scanning - Vulnerability Scanning - Common Vulnerabilities and Exploits - Patch Management and Remediation

UNIT IV – SYSTEM HACKING AND PENETRATION TESTING **(9 Hrs)**

Penetration Testing Methodologies - Gaining Access to Target Systems - Password Cracking Techniques - Privilege Escalation - Web Application and Wireless Network Penetration Testing

UNIT V: SECURITY AND COUNTERMEASURES **(9 Hrs)**

Intrusion Detection and Prevention Systems - Firewalls and Network Security - Encryption and Cryptography - Secure Coding Practices - Security Policies and Best Practices

Text Books

1. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy",2013
2. Sean-Philip Oriyano, "CEH v10: Certified Ethical Hacker Version 10 Study Guide"2018

David Kennedy, Jim O'Gorman, Devon Kearns, Mati Aharoni, "Metasploit: The Penetration Tester's Guide", 2011

Reference Books

1. Jon Erickson ,"Hacking: The Art of Exploitation",2003
2. Patrick Engebretson , Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws" 2020
3. Georgia Weidman ,"Penetration Testing: A Hands-On Introduction to Hacking", 2014
4. Justin Seitz ,"Black Hat Python: Python Programming for Hackers and Pentesters", 2014

WEB REFERENCES

1. Offensive Security (https://www.offensive-security.com/)\
2. The Hacker News (https://thehackernews.com/)
3. Cybrary (https://www.cybrary.it/)
4. Hack This Site (https://www.hackthissite.org/)
5. Ethical Hacking Tutorials by Guru99 (https://www.guru99.com/ethical-hacking-tutorials.html)

2.A.10.17

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	-

2.A.10.18

U20ADE824	AI IN AGRICULTURE	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

The course will introduce the students to

- To understand how AI is used in agriculture
- To apply machine learning algorithms for classification
- To understand the smart sensor networks
- To understand quality assessment of agricultural produce using AI
- To build confidence among students to evaluate, choose and incorporate robots in agriculture

Course Outcomes

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

CO1 – Understand the challenges of AI in agriculture
CO2 – Understand crop disease detection
CO3 – Understand the concept of smart irrigation system
CO4 – Understand the crop yield prediction
CO5 – To study about the various robotics applications in agriculture

UNIT I INTRODUCTION TO AI IN AGRICULTURE **(9 Hrs)**

Overview of AI and its applications in agriculture - Importance of AI in solving agricultural challenges - Data collection and pre-processing for agricultural applications - Crop monitoring and yield prediction using AI

UNIT II CROP DISEASE DETECTION AND MANAGEMENT **(9 Hrs)**

Techniques for crop disease detection using AI- Disease classification and identification in plants - Disease management strategies using AI - Precision agriculture and targeted treatments

UNIT III SMART IRRIGATION AND WATER MANAGEMENT **(9 Hrs)**

AI-based irrigation scheduling and optimization - Water demand forecasting for crops - Water resource management using AI - Smart sensor networks for efficient irrigation

UNIT IV CROP QUALITY AND YIELD OPTIMIZATION **(9 Hrs)**

Quality assessment and grading of agricultural produce using AI- Yield prediction and optimization models- Harvest planning and crop yield monitoring - Supply chain optimization in agriculture using AI

UNIT V AGRICULTURAL ROBOTICS AND AUTOMATION **(9 Hrs)**

Robotics applications in agriculture - Autonomous vehicles for field operations - Robotic harvesting and precision spraying - AI-driven farm management and decision support systems

Text Books

1. Vikrant Shete, Bhavesh Patel, "Artificial Intelligence in Agriculture: Opportunities and Challenges", 2020
2. Noureddine Benkeblia, Neftali L. Vazquez-Rowe, "Precision Agriculture Technology for Crop Farming", 2018
3. Ramu Nachiappan, Kaushik Roy, "AI in Agriculture: Techniques, Applications, and Future Challenges", 2022

Reference Books

1. Mahendra Rai and Eric Lichtfouse, "Artificial Intelligence in Agriculture: Applications and Techniques for Crop Management", 2021
2. Amit Joshi "Artificial Intelligence Techniques for Agriculture and Natural Resources Management" ,2020
3. Kaushik Roy, "AI in Agriculture: Techniques, Applications, and Future Challenges", 2022
4. Pradeep Mishra and Krishna Kant, "AI for Agriculture: Building Resilient and Sustainable Food Systems", 2016
5. Ankit Kumar Singh, Shashi Kumar, and Manoj Kumar Singh,"Precision Agriculture Technology for Crop Farming", 2015

Web References

1. https://nifa.usda.gov/
2. https://www.ciat.cgiar.org/
3. https://www.precisionag.com/
4. https://e-agriculture.org/
5. https://agfundernews.com/

2.A.10.19

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	-

2.A.10.20

U20ADE825	ML OPS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

The course will introduce the students to

- To understand ML OPS frameworks
- To understand types of machine learning
- To understand data transformation and normalization
- To understand SDLC and methodologies.
- To understand monitoring of ML models.

Course Outcomes

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

CO1 – Understand ML OPS roles and responsibilities.
CO2 – Uunderstand machine learning models.
CO3 – Understand data collection, security and privacy.
CO4 – Understand Testing strategies for ML models
CO5 – Understand Real time monitoring of ML models.

UNIT I INTRODUCTION TO ML OPS **(9 Hrs)**

What is ML Ops - ML Ops lifecycle - ML Ops challenges - ML Ops benefits - ML Ops frameworks - ML Ops tools - ML Ops best practices - ML Ops culture - ML Ops roles and responsibilities

UNIT II MACHINE LEARNING **(9 Hrs)**

Introduction to machine learning - Machine learning basics - Supervised learning - Unsupervised learning - Reinforcement learning - Machine learning algorithms - Machine learning evaluation - Addressing bias in machine learning models

UNIT III DATA ENGINEERING **(9 Hrs)**

Data collection techniques - Data cleaning and pre-processing - Data wrangling and feature engineering - Data transformation and normalization - Data storage and retrieval systems - Ensuring data security and privacy - Data governance and compliance - Ethical considerations in data engineering

UNIT IV SOFTWARE ENGINEERING **(9 Hrs)**

Software development lifecycle - Agile methodologies for ML Ops projects - Continuous integration and continuous delivery (CI/CD) - Software architecture for scalable ML systems - Design principles for ML Ops applications - Testing strategies for ML models and pipelines - Software quality assurance - Software security

UNIT V DEPLOYMENT AND MONITORING **(9 Hrs)**

Model deployment - Real-time monitoring of ML models - Model retraining and versioning - Model performance metrics - Model drift and concept shift - Model explain ability - Strategies for model deployment in production - Optimization of ML models for performance and efficiency

Text Books

1. Emmanuel Ameisen, "Building Machine Learning Powered Applications: Going from Idea to Product",2020
2. Mark Treveil, Jerry Overton, Chaminda Chandrasekara, "ML Ops: Operationalizing Machine Learning",2021
3. Noah Gift, Alfredo Deza, Kennedy Behrman, "Practical MLOps: Real-World Techniques for Deploying Machine Learning Models",2022

Reference Books

1. Hannes Hapke, "Building Machine Learning Pipelines: Automating Model Life Cycles with TensorFlow" ,2021
2. Andriy Burkov ,"Machine Learning Engineering", 2020
3. Foster Provost and Tom Fawcett, "Data Science for Business", 2013
4. Martin Kleppmann, "Designing Data-Intensive Applications", 2017
5. Jez Humble and David Farley, "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation", 2010

WEB REFERENCES

1. ML Ops Community (https://mlops.community/)
2. Google's Machine Learning Crash Course (https://developers.google.com/machine-learning/crash-course)
3. Towards Data Science (https://towardsdatascience.com/)
4. The DevOps Handbook (https://www.devopshandbook.com/)
5. MLflow (https://mlflow.org/)

2.A.10.21

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	-

2.A.10.22

	AI IN AUTOMOBILE INDUSTRY	L	T	P	C	Hrs
U20ADE826		3	0	0	3	45

Course Objectives

The course will introduce the students to

- To understand the Challenges of AI
- To understand the Technologies for AI in automobile industry.
- To understand the Collision avoidance system
- To understand CAD
- To impart concern for future opportunity and challenges

Course Outcomes

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

CO1 – Understand the challenges of AI
CO2 – Understand the real time data processing system
CO3 – Understand the AI based collision avoidance system.
CO4 – Understand quality control using AI
CO5 – Effects of Security in AI vechicles.

UNIT I INTRODUCTION TO AI IN THE AUTOMOBILE INDUSTRY (9 Hrs)

Overview of AI in the automotive industry - AI in autonomous vehicles - AI-powered driver assistance systems (ADAS) - Impact of AI on car manufacturing - Challenges of AI in Automobile Industry

UNIT II AI APPLICATIONS IN CONNECTED CARS (9 Hrs)

Introduction to connected cars and IoT - AI-driven vehicle connectivity - Intelligent navigation systems – Real time data processing in connected cars - Electric vehicles - Technologies for AI in Automobile Industry: Machine learning - Deep learning - Natural language processing - Computer vision – Robotics

UNIT III AI IN VEHICLE SAFETY AND DRIVER ASSISTANCE (9 Hrs)

AI-based collision avoidance systems - Adaptive cruise control and lane-keeping - Pedestrian and cyclist detection - Driver behaviour analysis - Emergency braking using AI

UNIT IV AI IN AUTOMOTIVE DESIGN AND MANUFACTURING (9 Hrs)

AI in virtual prototyping and simulation - Computer-aided design (CAD) with AI - Quality control using AI vision systems - Robotics and automation in manufacturing - Supply chain optimization with AI.

UNIT V FUTURE TRENDS AND CHALLENGES IN AI AND AUTOMOTIVE INDUSTRY (9 Hrs)

Autonomous driving and automation levels - AI in electric and alternative fuel vehicles - Integration with smart cities and infrastructure - Data governance and security in AI vehicles - Future challenges and opportunities.

Text Books

1. Shashank Dubey, Neetesh Kumar, "AI in Automotive: A Practical Handbook for Designing and Deploying AI Solutions in the Automotive Industry" 2021
2. Christian Müller, Marc Störing, "Artificial Intelligence in the Automotive Industry: Transforming Mobility with AI" 2020
3. Markus Maurer, J. Christian Gerdes, "Autonomous Driving: Technical, Legal and Social Aspects"2019

Reference Books

1. Juanjuan Peng , "AI in Automotive and Transportation Systems",2020
2. Alexey Global, J. Neil Otte ,"Artificial Intelligence in the Automotive Industry: Embracing the Future of Mobility", 2021
3. Yaobin Chen, "Intelligent Vehicles: Fundamentals, Technologies, and Applications" ,2016
4. Markus Maurer, J. Christian Gerdes, Barbara Lenz, and Hermann Winner, "AI in Automotive Engineering: From Driver Assistance to Autonomous Driving", 2019
5. David Hoyle , "Automotive Quality Systems Handbook", 2000"Automotive Quality Systems Handbook" by David Hoyle

WEB REFERENCES

1. Automotive World - https://www.automotiveworld.com/
2. SAE International - https://www.sae.org/
3. NVIDIA Automotive - https://www.nvidia.com/en-us/self-driving-cars/
4. Autonomous Vehicle Engineering - https://www.sae.org/publications/magazines/autonomous-vehicle-engineering
5. AI in Automotive - https://www.aiia.net/automotive

2.A.10.23

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	-

2.A.10.24

U20ADE827	AI IN CUSTOMER SERVICE	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To learn about the challenges of NLP
- To understand the concept of chatbot integration
- To learn about the customer relationship management
- To understand and implementation of speech recognition technologies
- To understand the concept of Object detection and recognition.

Course Outcomes

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

CO1 - Learn about challenges of AI in customer service
CO2 - Concept of Image and Video enhancement and restoration.
CO3 - Various concepts of CRM.
CO4 - Various concept Feature Detection And Description.
CO5 – Concept of Object detection and recognition.

UNIT 1 INTRODUCTION TO AI IN CUSTOMER SERVICE **(9 Hrs)**

Overview of AI in customer service - Role of AI in enhancing customer experiences - AI-powered chatbots and virtual assistants - Natural language processing for customer interactions - Benefits and challenges of AI in customer service

UNIT 2 AI APPLICATIONS IN CUSTOMER SUPPORT **(9 Hrs)**

Automated ticketing and routing using AI - Customer self-service and knowledge bases with AI - Chatbot integration for improved customer interactions - AI-driven sentiment analysis for customer feedback - Personalization and recommendation systems using AI

UNIT 3 AI FOR CUSTOMER RELATIONSHIP MANAGEMENT (CRM) **(9 Hrs)**

AI-driven lead generation and customer acquisition - AI-powered customer segmentation and profiling - Predictive analytics for customer behaviour and preferences - AI in personalized marketing and targeted campaigns - Customer churn prediction and retention strategies using AI

UNIT 4: AI IN VOICE AND SPEECH TECHNOLOGIES FOR CUSTOMER SERVICE **(9 Hrs)**

AI-enabled speech recognition and transcription - Voice biometrics and speaker identification using AI - Natural language understanding and intent recognition - Voice analytics for customer sentiment analysis - AI-powered voice assistants for customer support

UNIT OBJECT DETECTION AND RECOGNITION. **(9 Hrs)**

Emerging AI technologies in customer service - AI ethics and transparency in customer service - AI and automation: Redefining the future of customer service workforce - Impact of AI on customer service operations and cost reduction - The role of AI in hyper-personalization of customer experiences

Text Books

1. Pasquale Stirparo, "AI in Customer Service: A Practical Guide for Customer Experience Professionals", 2021
2. Steven Van Belleghem, "Artificial Intelligence in Customer Experience Management: A Comprehensive Guide for Practitioners", 2020
3. Pam Didner "The AI-Powered Customer: How Artificial Intelligence is Revolutionizing the Way Companies Interact with Customers", 2019

Reference Books

1. Mathew Dixon , "The Effortless Experience: Conquering the New Battleground for Customer Loyalty", 2013
2. Abhijit Bhaduri , "AI-Powered Customer Service: A Practical Guide", 2018
3. Peter J. Rosenwald , "AI in Marketing, Sales and Service", 2021
4. Lior Arussy ,"AI in Customer Experience: Transforming Customer Engagement with Artificial Intelligence", 2016
5. Paul R. Daugherty, "Reimagining Work in the Age of AI", 2018.

2.A.10.25

Web References

1. https://www.ibm.com/cloud/watson-assistant
2. https://cloud.google.com/dialogflow
3. https://www.salesforce.com/products/einstein/overview
4. https://azure.microsoft.com/en-us/services/cognitive-services

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	-

2.A.10.26

U20ADE828	AI IN SMART CITIES	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To learn about Role of AI in Smart Cities
- To learn various applications of urban mobility
- To learn AI for energy efficiency and sustainability
- Understand the IoT frameworks
- To understand various concept and implementation of Social Media Analysis.

Course Outcomes

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

CO1 - Understand the basics of IoT in smart cities
CO2 - Understand the smart technologies using AI
CO3 - understand AI based energy forecasting
CO4 - Analyse the safety concern about public
CO5 - Understand the chatbots and virtual assistants

UNIT 1 INTRODUCTION TO AI IN SMART CITIES **(9 Hrs)**

Overview of AI in smart cities - Role of AI in transforming urban infrastructure - Benefits and challenges of implementing AI in smart cities - AI-powered sensors and Internet of Things (IoT) - Data analytics and predictive modelling

UNIT 2 AI APPLICATIONS IN URBAN MOBILITY **(9 Hrs)**

AI-driven traffic management - congestion prediction - Intelligent transportation systems - smart traffic lights - AI-powered public transportation optimization - Autonomous vehicles and self-driving technology - Smart parking solutions using AI

UNIT 3 AI FOR ENERGY EFFICIENCY AND SUSTAINABILITY **(9 Hrs).**

AI-based energy demand forecasting and optimization - Smart grid management - AI-enabled energy distribution - Energy consumption analytics and smart metering - AI in renewable energy integration and optimization - Sustainable waste management and recycling with AI

UNIT 4 AI FOR PUBLIC SAFETY AND SECURITY **(9 Hrs)**

AI-powered video surveillance and facial recognition - Predictive policing and crime pattern analysis - Emergency response systems using AI and IoT - AI in disaster management - early warning systems - Cybersecurity and AI-enabled threat detection in smart cities

UNIT 5 AI FOR CITIZEN ENGAGEMENT AND SERVICES **(9 Hrs)**

AI-powered smart city platforms and citizen portals - AI-enabled personalized citizen services and recommendations - Chatbots and virtual assistants for citizen support - Social media analytics and sentiment analysis - AI in smart governance

Text Books

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

Reference Books

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

2.A.10.27

Web References

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

COs/POs/PSOs Mapping

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

2.A.10.28

U20ADE829	HEALTHCARE DATA ANALYTICS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- Understand the health data formats, health care policy and standards.
- Learn the significance and need of data analysis and data visualization
- Understand the health data management frameworks
- Learn the use of machine learning and deep learning algorithms in healthcare
- Apply healthcare analytics for critical care applications

Course Outcomes

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

CO1 - To gain knowledge about the healthcare data analytics
CO2 - Understand the concept of correlation and Regressions
CO3 - Understand the various concepts of Machine learning techniques
CO4 - Understand the real world applications of data analytics
CO5 - Learn about the privacy issues in healthcare

UNIT 1 INTRODUCTION TO HEALTHCARE DATA ANALYTICS **(9Hrs)**

Introduction to healthcare data analytics and its significance - NLP pre-processing steps for healthcare data - NLP feature engineering for healthcare data - WordNet and WordNet-based similarity measures - Concept mining in healthcare data analytics

UNIT 2 STATISTICAL ANALYSIS IN HEALTHCARE **(9Hrs)**

Descriptive statistics for healthcare data - Hypothesis testing and significance analysis - Correlation and regression analysis in healthcare

UNIT 3 MACHINE LEARNING FOR HEALTHCARE DATA ANALYTICS **(9Hrs)**

Supervised learning algorithms for healthcare prediction - Unsupervised learning techniques in healthcare - Evaluation and validation of machine learning models in healthcare

UNIT 4 APPLICATIONS OF HEALTHCARE DATA ANALYTICS **(9Hrs)**

Predictive modelling for disease diagnosis and prognosis - Healthcare resource allocation and optimization - Fraud detection and anomaly detection in healthcare data

UNIT 5 ETHICAL AND PRIVACY CONSIDERATIONS IN HEALTHCARE DATA ANALYTICS **(9Hrs)**

Privacy issues and data security in healthcare analytics - Ethical considerations and responsible use of healthcare data

Text Books

1. Wiley V. Midgley, Philip H. Birch, "Healthcare Analytics: From Data to Knowledge to Healthcare Improvement", 2014
2. Nilmini Wickramasinghe, "Healthcare Data Analytics and Management", 2019
3. Trevor L.Strome , "Healthcare Data Analytics for Quality and Performance Improvement", 2013

Reference Books

1. Trevor L. Strome, "Healthcare Analytics for Quality and Performance Improvement", 2013
2. Umit Bititci, Nezih Altay, and Andy Neely, "Data Science for Healthcare: Methodologies and Applications" , 2015
3. Hui Yang , "Healthcare Analytics: From Data to Knowledge to Healthcare Improvement", 2016
4. Chandan K. Reddy and Charu C. Aggarwal, "Healthcare Data Analytics", 2020
5. Sachin Garg and Rajkumar Buyya, "Big Data Analytics in Healthcare: Promise and Potential", 2018

Web References

1. https://www.healthit.gov/
2. https://www.himss.org/
3. https://www.healthdatamanagement.com/
4. https://www.springer.com/journal/41666
5. https://www.ons.gov.uk/

2.A.10.29

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	-

2.A.10.30

U20ADE 830	AI IN FINANCE	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To learn about Finance in AI
- To understand the concept of financial risk management
- To learn various techniques of supervised and unsupervised learning in finance
- To learn about the data security in financial services
- To understand various applications of AI in finance

Course Outcomes

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

CO1 - Understand applications in finance
CO2 - Understand various quantitative techniques in finance
CO3 - Understand the techniques for financial data analysis
CO4 - To study the real world applications of AI in Finance Services
CO5 - To study the compliance aspects of AI in Finance

UNIT 1 INTRODUCTION TO AI IN FINANCE **(9 Hrs)**

Overview of AI and its applications in finance - Basics of financial markets and instruments - Data sources and pre-processing for financial data - Time series analysis and feature engineering

UNIT 2 QUANTITATIVE TECHNIQUES IN FINANCE **(9 Hrs)**

Financial data analysis and visualization - Hypothesis testing and statistical inference in finance - financial risk measurement and management - Portfolio theory and optimization

UNIT 3 AI TECHNIQUES FOR FINANCIAL DATA ANALYSIS **(9 Hrs)**

Supervised learning for financial forecasting - Unsupervised learning in financial applications - Model evaluation and validation in finance - Dimensionality reduction and feature selection

UNIT 4 USE CASES OF AI IN FINANCE SERVICES **(9 Hrs)**

AI-driven trading and investment strategies - Credit risk assessment and loan approval - financial fraud detection and prevention - AI-powered financial advisory services

UNIT 5 ETHICAL AND COMPLIANCE ASPECTS OF AI IN FINANCE **(9 Hrs)**

Data privacy and security in financial AI applications - Ethical considerations in AI-driven financial decision -making - Regulatory requirements and AI compliance - Explainable AI and financial model transparency

Text Books

1. Christian L. Dunis, Peter W. Middleton, "Artificial Intelligence in Financial Markets", 2021
2. Marcos M. López de Prado, "Machine Learning for Asset Managers", 2020
3. Yves Hilpisch, "Artificial Intelligence in Finance", 2020

Reference Books

1. Marcos Lopez de Prado, "Advances in Financial Machine Learning", 2018
2. Stefan Jaimungal ,"Machine Learning for Financial Engineering", 2012
3. Christian L. Dunis, "Artificial Intelligence in Financial Markets", 2021
4. Mark Bennett and Dirk L. Hugen, "Financial Analytics with R: Building a Laptop Laboratory for Data Science", 2016
5. Financial Stability Board, "AI and Machine Learning in Financial Services: Market Developments and Financial Stability Implications", 2019

Web References

1. https://jfds.pm-research.com/
2. https://thefintechtimes.com/
3. https://www.cfainstitute.org/
4. https://www.investopedia.com/
5. https://www.weforum.org/

2.A.10.31

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	-

2.A.10.32

Annexure – II
B.Tech and M.Tech Curriculum
R-2023

2. A. 10. 33

B.TECH CURRICULUM

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC01	Engineering Mathematics – I	BS	2	2	0	4	25	75	100
2	U23ESTC03	Basics of Electrical and Electronics Engineering	ES	3	2	0	3	25	75	100
3	U23CSTC01	Programming In C	ES	3	0	0	3	25	75	100
4	U23ADT101	Digital System Design	ES	3	0	0	3	25	75	100
5	U23ADT102	Fundamental of Data Science	PC	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ENBC01	Communicative English -I	HS	2	0	2	3	50	50	100
Practical										
7	U23CSPC01	Programming in C Laboratory	ES	0	0	2	1	50	50	100
8	U23ESPC03	Engineering Graphics using AutoCAD	ES	0	0	2	1	50	50	100
9	U20ADP101	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 (Multiple Integrals and Transforms)	BS	2	2	0	4	25	75	100
2	U23BSTC01	Physical Science for Engineers	ES	2	2	0	3	25	75	100
3	U23ADTC01	Programming in Python	ES	3	0	0	3	25	75	100
4	U23CSTC03	Data Structures	ES	3	0	0	3	25	75	100
5	U23ADT203	Database Technologies	PC	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ENBC02	Communicative English -II	HS	2	0	2	3	50	50	100
Practical										
7	U23ESPC02	Design Thinking and Idea Lab	ES	0	0	2	1	50	50	100
8	U23ADPC01	Programming in Python Laboratory	ES	0	0	2	1	50	50	100
9	U23CSPC02	Data Structures Laboratory	ES	0	0	2	1	50	50	100
10	U23ADP202	Database Technologies Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Courses										
11	U23ADC2XX	Certification Course-II	AEC	0	0	4	0	100	-	100
Mandatory Course										
12	U23ADM202	Sports Yoga and NSS	MC	0	0	2	0	100	-	100
							23	575	625	1200

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

2.A.10.34

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 for Data Science	BS	2	2	0	4	25	75	100
2	U23ADT304	Software Engineering and Agile software Development	ES	3	0	0	3	25	75	100
3	U23ADT305	Artificial Intelligence & Expert System	PC	3	0	0	3	25	75	100
4	U23ADT306	Basic Machine Learning Techniques	PC	3	0	0	3	25	75	100
5	U23HSTC01	Universal Human Values-II	HS	3	0	0	2	25	75	100
Theory cum Practical										
6	U23ADB301	Design and Analysis of Algorithm	ES	2	0	2	3	50	50	100
Practical										
7	U23ENPC02	General Proficiency – I	HS	0	0	2	1	50	50	100
8	U23MAPC01	Statistical Laboratory	BS	0	0	2	1	50	50	100
9	U23ADP303	Artificial Intelligence& Expert System Laboratory	PC	0	0	2	1	50	50	100
10	U23ADP304	Basic Machine Learning Techniques Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Courses										
11	U23ADC3XX	Certification Course-III	AEC	0	0	4	-	100	-	100
12	U23ADS301	Skill Enhancement Course-I*	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23ADM303	Climate Change	MC	0	0	2	-	100	-	100
							22	675	625	1300

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

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

2.A.10.35

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

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

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

2.A.10.36

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

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

ANNEXURE - I

PROFESSIONAL ELECTIVE COURSES (18 CREDITS)

Sl. No.	Course Code	Course Title
Professional Elective – I (Offered in Semester IV)		
1	U23CSTC01	Automata and Compiler Design
2	U23ADE401	AI in Smart Cities
3	U23ADE402	Ethics in Data Science
4	U23ADE403	Genetic Algorithm
5	U23ADE404	User Experience Design
Professional Elective – II (Offered in Semester V) *		
1	U23ADE505	Speech Processing and Analytics
2	U23ADE506	Reinforcement Learning
3	U23CBEC01	Business Intelligence and Applications
4	U23ADE507	Graph Analytics
5	U23ADE508	Advanced Java Programming
Professional Elective – III (Offered in Semester VI) *		
1	U23ADE609	Web Analytics
2	U23ADE610	AI and Embedded Systems
3	U23ADE611	Pattern Recognition Techniques
4	U23ADE612	Time Series Analysis and Forecasting
5	U23ADE613	Text Analysis
Professional Elective – IV (Offered in Semester VII) *		
1	U23ADE714	Artificial Intelligence in Biometric System
2	U23CBEC02	Virtual Reality
3	U23ADE715	Recommender System
4	U23CSEC01	Go Programming
5	U23ADE716	Predictive Analytics
Professional Elective – V (Offered in Semester VIII) *		
1	U23ADE817	Healthcare Data Analytics
2	U23ADE818	Artificial Intelligence and Green Power Technology
3	U23CBEC03	Augmented Reality
4	U23ADE819	AI in E-Commerce
5	U23ADE820	Ethical Hacking

2.A.10.38

Professional Elective – VI (Offered in Semester VIII) *		
1	U23ADE821	Artificial Intelligence and Machine Learning in Agriculture
2	U23ADE822	AI Ethics
3	U23ADE823	AI in Finance
4	U23ADE824	AI in Customer Service
5	U23ADE825	ML OPS

ANNEXURE - II

OPEN ELECTIVE COURSES (09 CREDITS)

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

2.A.10.39

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

2.A.10.40

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

2.A.10.41

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

2.A.10.42

97	U23XXCX97	Associate Artist	Unity
98	U23XXCX98	Certified Unity Programming	Unity
99	U23XXCX99	VR Development	Unity

ANNEXURE - IV

ABILITY ENHANCEMENT COURSES-(B) SKILL ENHANCEMENT COURSES

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

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

2.A.10.43

Annexure – V

HONOURS PROGRAMME – GENERATIVE AI

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

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

2.A.10.44

M.TECH 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 System for Data Science	PC	3	0	0	3	40	60	100
4	P23ADT103	Artificial Intelligence & 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	IoT and Edge Computing	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 RPA	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

2.A.10.45

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

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

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

BS- Basic Sciences
PC – Professional Core
PE – Professional Elective
HS - Humanities and Social Sciences
PA - Professional Activity
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 Artificial Intelligence and Data Science: 72 credits

2.A.10.46

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 Power BI
3	P23ADE206	Predictive Modelling
4	P23ADE207	Next Generation Databases
5	P23ADE208	Advanced Algorithms
Professional Elective-III		
1	P23ADE209	Business Intelligence and Reporting
2	P23ADE210	Streaming Analytics
3	P23ADE211	Machine Learning with Large datasets
4	P23ADE212	R for Data Science
5	P23ADE213	Full Stack Development
Professional Elective-IV		
1	P23ADE314	Intelligent Interaction
2	P23ADE315	ML and AI applications in Earth science
3	P23ADE316	Optimization for Data Science
4	P23ADE317	Virtual and Augmented Reality
5	P23BDEC02	Analytics of things
Professional Elective-V		
1	P23ADE318	Nature Inspired Optimization Techniques
2	P23ADE319	Information Retrieval Techniques in Data Science
3	P23ADE320	Geo Spatial Analytics
4	P23ADE321	Game Theory for AI and Data Science
5	P23ADE322	Data Analytical Tools and techniques
Professional Elective-VI		
1	P23ADE323	Business Data Analytics
2	P23ADE324	AI in Natural Language processing
3	P23ADE325	Advanced Computer Vision
4	P23ADE326	Real-Time AI Video Analytics
5	P23ADE327	Medical Robotics

2.A.10.47

ANNEXURE- II
ABILITY ENHANCEMENT COURSES

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

2.A.10.48

31	P23XXCX31	Internet Of Things / Solar and Smart Energy System with IoT	CISCO
32	P23XXCX32	Java Script Programming	CISCO
33	P23XXCX33	NGD Linux Essentials	CISCO
34	P23XXCX34	NGD Linux I	CISCO
35	P23XXCX35	NGD Linux II	CISCO
36	P23XXCX36	Advance Java Programming	Ethnotech
37	P23XXCX37	Android Programming / Android Medical App Development	Ethnotech
38	P23XXCX38	Angular JS	Ethnotech
39	P23XXCX39	Catia	Ethnotech
40	P23XXCX40	Communication Skills for Business	Ethnotech
41	P23XXCX41	Coral Draw	Ethnotech
42	P23XXCX42	Data Science Using R	Ethnotech
43	P23XXCX43	Digital Marketing	Ethnotech
44	P23XXCX44	Embedded System Using C	Ethnotech
45	P23XXCX45	Embedded System with IOT / Arduino	Ethnotech
46	P23XXCX46	English For IT	Ethnotech
47	P23XXCX47	Plaxis	Ethnotech
48	P23XXCX48	Sketch Up	Ethnotech
49	P23XXCX49	Financial Planning, Banking and Investment Management	Ethnotech
50	P23XXCX50	Foundation Of Stock Market Investing	Ethnotech
51	P23XXCX51	Machine Learning / Machine Learning for Medical Diagnosis	Ethnotech
52	P23XXCX52	IOT Using Python	Ethnotech
53	P23XXCX53	Creo (Modelling & Simulation)	Ethnotech
54	P23XXCX54	Soft Skills, Verbal, Aptitude	Ethnotech
55	P23XXCX55	Software Testing	Ethnotech
56	P23XXCX56	MX-Road	Ethnotech
57	P23XXCX57	CLO 3D	Ethnotech
58	P23XXCX58	Solid works	Ethnotech
59	P23XXCX59	Staad Pro	Ethnotech
60	P23XXCX60	Total Station	Ethnotech
61	P23XXCX61	Hydraulic Automation	Festo
62	P23XXCX62	Industrial Automation	Festo
63	P23XXCX63	Pneumatics Automation	Festo

2.A.10.49

64	P23XXCX64	Agile Methodologies	IBM
65	P23XXCX65	Block Chain	IBM
66	P23XXCX66	Devops	IBM
67	P23XXCX67	Artificial Intelligence	ITS
68	P23XXCX68	Cloud Computing	ITS
69	P23XXCX69	Computational Thinking	ITS
70	P23XXCX70	Cyber Security	ITS
71	P23XXCX71	Data Analytics	ITS
72	P23XXCX72	Databases	ITS
73	P23XXCX73	Java Programming	ITS
74	P23XXCX74	Networking	ITS
75	P23XXCX75	Python Programming	ITS
76	P23XXCX76	Web Application Development (HTML, CSS, JS)	ITS
77	P23XXCX77	Network Security	ITS & Palo alto
78	P23XXCX78	MATLAB	MathWorks
79	P23XXCX79	Azure Fundamentals	Microsoft
80	P23XXCX80	Azure AI (AI-900)	Microsoft
81	P23XXCX81	Azure Data (DP -900)	Microsoft
82	P23XXCX82	Microsoft 365 Fundamentals (SS-900)	Microsoft
83	P23XXCX83	Microsoft Security, Compliance and Identity (SC-900)	Microsoft
84	P23XXCX84	Microsoft Power Platform (PI-900)	Microsoft
85	P23XXCX85	Microsoft Dynamics Fundamentals 365 – CRM	Microsoft
86	P23XXCX86	Microsoft Excel	Microsoft
87	P23XXCX87	Microsoft Excel Expert	Microsoft
88	P23XXCX88	Securities Market Foundation	NISM
89	P23XXCX89	Derivatives Equinity	NISM
90	P23XXCX90	Research Analyst	NISM
91	P23XXCX91	Portfolio Management Services	NISM
92	P23XXCX92	Cyber Security	Palo alto
93	P23XXCX93	Cloud Security	Palo alto
94	P23XXCX94	PMI – Ready	PMI
95	P23XXCX95	Tally – GST & TDS	Tally

2.A.10.50

96	P23XXCX96	Advance Tally	Tally
97	P23XXCX97	Associate Artist	Unity
98	P23XXCX98	Certified Unity Programming	Unity
99	P23XXCX99	VR Development	Unity

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

2.A.10.51

Annexure – III

B.Tech and M.Tech I and II Semester Syllabus

R-2023

2.A.10.52

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

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

UNIT – I	Matrices	Periods:12
Rank of a Matrix – Systems of Linear Equations – Characteristic equation – Cayley Hamilton Theorem – Eigen values and Eigen vectors of a real Matrix – Diagonalization of Matrices.		CO1

UNIT – II	Differential Equations (Higher Order)	Periods:12
Linear Differential equations of higher order with constant coefficients – Euler's linear equation of higher order with variable coefficients – Method of Variation of parameters.		CO2

UNIT – III	Functions of Several Variables	Periods:12
Partial derivatives – Total derivatives – Maxima and Minima of two variables – Lagrange's Method of multipliers.		CO3

UNIT – IV	Multiple Integrals	Periods:12
Multiple Integrals – Change of order of integration (Cartesian form). Applications: Area as a double integral (Cartesian form) – Volume as a triple integral (Cartesian form).		CO4

UNIT – V	Vector Calculus	Periods:12
Gradient – Divergence and Curl – Directional derivatives – Irrotational and Solenoidal vector fields – Properties (Statement only) – Gauss Divergence Theorem and Stoke's Theorem (without proofs).		CO5

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

Text Books

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

Reference Books

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

Web References

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

2.A.10.53

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

2.A.10.54

Department	EEE and ECE	Programme: B.Tech.						
Semester	I/II	Course Category : ES				End Semester Exam Type: TE		
Course Code	U23ESTC03	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Basics of Electrical and Electronics Engineering	3	0	0	3	25	75	100

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

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

Section A – Electrical Engineering

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

Section B – Electronics Engineering

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

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

2.A.10.55

Text Books

1. R. K. Rajput, "Basic Electrical and Electronics Engineering", University Science Press, 2nd Edition, 2017.
2. Dr. R. Saravanakumar, Dr.V. Jegathesan, Dr. K. Vinoth Kumar, Dr. K. Kowsalya, "Basic Electrical and Electronics Engineering", Wiley Publisher, 2nd Edition, 2022.
3. R. Muthusubramaniam, S. Salivahanan and K. A. Mureleedharan, "Basic Electrical Electronics and Computer Engineering", Tata McGraw Hill, 2018.

Reference Books

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

Web References

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

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

2.A.10.56

Department	Computer Science and Engineering				Programme: B.Tech.			
Semester	I/II				Course Category: ES		End Semester Exam Type: TE	
Course Code	U23CSTC01				Periods / Week	Credit	Maximum Marks	
					L T P	C	CAM	ESE TM
Course Name	Programming in C				3 - -	3	25	75 100
(Common to All Branches)								
Prerequisite	NIL							
Course Outcomes	On completion of the course, the students will be able to							BT Mapping (Highest Level)
	CO1	Comprehend the basics of Computers.						K2
	CO2	Illustrate the concepts of control structures and looping.						K2
	CO3	Implement programs using arrays and functions.						K3
	CO4	Demonstrate programs using Structure and Pointers.						K3
	CO5	Build the programs using Union and File management Operations.						K3

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

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

Text Books

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

Reference Books

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

Web References

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

2.A.10.57

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

2.A.10.58

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

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

UNIT-I	Review of Number Systems	Periods: 12	
Review of Number systems – Conversion of Number systems – Binary addition and subtractions – Binary representation: Signed magnitude representation and Compliment representations – Binary codes – Boolean Algebra – Boolean functions – canonical forms.			CO1
UNIT-II	**Boolean Function and Combinational Logic Design**	**Periods: 12**	
Simplifications of Boolean function: Theorems and laws – K"Map and QuineMcCluskey method – Introduction to combinational circuits – Design procedures of Combinational circuits – Adders - Subtractors – Binary parallel Adder – Decoder – Encoder – Priority Encoder. Multiplexer – Demultiplexer.			CO2
UNIT-III	**Sequential Logic Design**	**Periods: 12**	
Introduction to Sequential Circuits – Latches – Types of Latches: SR Latch and D Latch – Flip-Flop – Types of Flip-Flops: RS, JK, D, and T Flip-Flops – Excitation table of Flip-Flops. Counters: Asynchronous Counters – Synchronous counters – Mod counters. Shift registers – Types of Shift registers.			CO3
UNIT-IV	**Reconfiguration Digital Circuits**	**Periods: 12**	
Introduction to Reconfiguration Digital Circuits – Memory – Hierarchy of Memory – RAM – Types of Ram – Memory Decoding of RAM – ROM. Programmable Logic Devices: Programmable Logic Array – Programmable Array Logic – Implementation of combinational circuits using RAM, ROM, PLA and PAL.			CO4
UNIT-V	**VHDL**	**Periods: 12**	
Introduction to Hardware Description Language and VHDL – Design flow – Entity, architecture, process, configuration and package declarations – Signals and data types.			CO5

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

Text Books

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

Reference Books

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

Web References

1. https://nptel.ac.in/courses/117/105/117105080/1.
2. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
3. https://www.coursera.org/learn/digital-systems
4. https://academic.csuohio.edu/chu_p/rtl/chu_rtL_book/silde/chap01_1.pdf
5. https://bohr.wlu.ca/nznotinas/pc319/lectures/01%20digital_system_design.pdf

2.A.10.59

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

2.A.10.60

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

AI & DS

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

UNIT-I	**Introduction to Data Science**	**Periods: 09**
Introduction to Data Science – History of Data Science – Relationship between Data Warehouse – Big Data and Data Science – Scope of Data Science – Data Science with other Fields – Relationship between Data Science and Information Science. Data: Data types – Structured vs Unstructured data – Quantitative vs Qualitative data – The four levels of data – Data Collection – Data Preprocessing.		**CO1**

UNIT-II	**Data Science in Excel**	**Periods: 09**
Introduction to Excel basic functions – Data Collection and Preparation – Importing Data into Excel from Different Data Sources – Data Cleaning and Preliminary Data Analysis – Correlation and Importance of Variables Technical Requirements. Data Visualization in Excel – Pivot Tables and Charts – VLOOKUP – Dashboard in Excel.		**CO2**

UNIT-III	**Mathematical Preliminaries**	**Periods: 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. Logarithms: Logarithms and Multiplying Probabilities – Logarithms and Ratios – Logarithms and Normalizing Skewed Distributions		**CO3**

UNIT-IV	**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.		**CO4**

UNIT-V	**Industrialization, Oppurtunities 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.		**CO5**

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

Text Books

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

Reference Books

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

2.A.10.61

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

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

2.A.10.62

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

(Common to ALL Branches except CSBS)

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

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

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

Text Books

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

Reference Books

1. N.P.Sudharshana, C. Savitha," English for Engineers", Cambridge University Press, 2018.
2. Raman, Meenakshi, and Sharma, Sangeetha, "Technical Communication - Principles and Practice", 3rd Edition, Oxford University Press, 2017.
3. Comfort, Jeremy,etal., "Speaking Effectively: Developing Speaking Skills for Business English", Cambridge University Press, Cambridge, Reprint 2011.
4. Wren & Martin, "High School English Grammar and Composition", S Chandh &Co. Ltd, 2015.
5. Boove, Courtland L, "Business Communication Today", Pearson Education, New Delhi, 2002.

2.A.10.63

Web References

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

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

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

2.A.10.64

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

(Common to All Branches)

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

List of Exercises

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

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

Reference Books

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

Web References

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

2.A.10.65

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

2.A.10.66

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

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

List of Experiments

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

Lecture Periods:	Tutorial Periods:	Practical Periods: 3 0	Total Periods: 30

Reference Books

1. James D. Bethune, Engineering Graphics with AutoCAD A Spectrum book 1st edition, Macromedia Press, Pearson, 2020.
2. NS Parthasarathy and Vela Murali, Engineering Drawing, Oxford university press, 2015.
3. M.B Shah, Engineering Graphics, ITL Education Solutions Limited, Pearson **Education** Publication, 2011.
4. Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2017.
5. Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, Vikas Publishing House Pvt Ltd., 7th Edition, New Delhi, 2016.
6. C M Agrawal, Basant Agrawal, Engineering Graphics, McGraw Hill, 2012.
7. Dhananjay A. Jolhe, Engineering Drawing: With An Introduction To CAD McGraw Hill, 2016.
8. James Leach, AutoCAD 2017 Instructor, SDC Publications, 2016.

Web References

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

2.A.10.67

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

2.A.10.68

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

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

List of Exercises

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

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

Reference Books

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

Web References

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

COs/POs/PSOs Mapping

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

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

2.A.10.69

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

2.A.10.70

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

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

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

2.A.10.71

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

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

UNIT-I	Universal Human Values	Periods: 12

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

UNIT-II	Proficiency in English	Periods: 12

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

UNIT-III	Bridge Course in Mathematics and C Programming	Periods: 12

Mathematics:

Fundamentals of differential and integral calculus: Theory and Practice, Limit of function - Fundamental results on limits - Continuity of a function - Concept of differentiation - Concept of derivative - Slope of a curve -Differentiation Techniques - Derivatives of elementary functions from first principle - Derivatives of inverse functions - Logarithmic differentiation - Method of substitution - Differentiation of parametric functions -Differentiation of implicit functions - Higher order derivatives. Integrals of functions containing linear functions -Method of integration (Decomposition method, method of substitution, integration by parts) - Definite integrals. Simple definite integrals - Properties of Definite integrals - Reduction formulae - Area and volume - Length of curve - surface area of a solid.

C Programming:

Features of C and its basic Structure - Keywords - constants - variables - operators - Data types - Formatted input and output statements - Control and Looping statement - Arrays - Functions - Strings - writing simple C programs. **CO3**

UNIT-IV	Literary Activities	Periods: 12

Te Team building activities - Quiz - Oral Exercises - Group discussion, Debate, Extempore, Role play, □□□□□□□ □□□□□□□□□□□□□ - □□□□□□ □□□□ □□□□□□□ □□□□□□ □□□□□□□□□□□□□. **CO4**

UNIT-V	Creative Arts	Periods: 12

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

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

2.A.10.72

Reference Books

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

Web References

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

2.A.10.73

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

(Common to ALL Branches Except CSBS, FT)

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

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

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

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

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

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

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

Text Books

1. T. Veerarajan, "Engineering Mathematics", Tata McGraw Hill, New Delhi, 3rd Edition, 2011.
2. C. P. Gupta, Shree Ram Singh. M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi, 2nd Edition, 2016.
3. H.K. Dass, "Advanced Engineering Mathematics", S. Chand, New Delhi, 22nd, Edition 2019.

Reference Books

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

Web References

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

2.A.10.74

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

2.A.10.75

Department	Physics / Chemistry	Programme: B.Tech.						
Semester	I/II	Course Category: BS				End Semester Exam Type: TE		
Course Code	U23BSTC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Physical Science for Engineers	3	0	0	3	25	75	100

(Common to all Branches)

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

SECTION A - PHYSICS

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

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

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

SECTION B – CHEMISTRY

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

UNIT-V	**Electrochemical Cells and Storage Devices**	**Periods: 8**
Galvanic cells, single electrode potential, standard electrode potential, electrochemical series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes-hydrogen, calomel and Ag/AgCl. Batteries and fuel cells: Types of batteries- alkaline battery-lead storage battery- nickel-cadmium battery- fuel cell H_2 -O_2 fuel cell-applications.		**CO5**

UNIT-VI	**Corrosion**	**Periods: 7**
Corrosion –Introduction - factors – types – chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control – material selection and design aspects – electrochemical protection – sacrificial anode method and impressed current cathodic method. Uses of inhibitors, metallic coating – anodic coating, cathodic coating. Metal cladding, Electroplating of Copper and electroless plating of nickel.		**CO6**

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

Text Books

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

2.A.10.76

Reference Books

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

Web References

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

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

2.A.10.77

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

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Interpret the basic concepts of Python programs.	K2
CO2	Articulate the concepts of Sets, Dictionaries and Object-Oriented concepts.	K2
CO3	Experiment with Numpy package.	K3
CO4	Apply and analyze Data Manipulation with Pandas.	K3
CO5	Illustrate programming concept for Visualization with Matplotlib.	K3

UNIT-I	Introduction to Python	Periods: 09	
Structure of Python Program – Underlying mechanism of Module Execution – Branching and Looping – Problem Solving Using Branches and Loops – Functions – Lambda Functions – Lists and Mutability – Problem Solving Using Lists and Functions.			CO1

UNIT-II	Sequence Datatypes and Object-Oriented Programming	Periods: 09	
Sequences – Mapping and Sets – Dictionaries. Classes: Classes and Instances – Inheritance – Exception Handling – Introduction to Regular Expressions using "re" module.			CO2

UNIT-III	Using Numpy	Periods: 09	
Basics of NumPy – Computation on NumPy – Aggregations – Computation on Arrays – Comparisons – Masks and Boolean Arrays – Fancy Indexing – Sorting Arrays – Structured Data: NumPy's Structured Array.			CO3

UNIT-IV	Data Manipulation with Pandas	Periods: 09	
Introduction to Pandas Objects – Data indexing and Selection – Operating on Data in Pandas – Handling Missing Data – Hierarchical Indexing – Combining Data Sets. Aggregation and Grouping – Pivot Tables –Vectorized String Operations – Working with Time Series – High Performance Pandas – eval() and query().			CO4

UNIT-V	Visualization With Matplotlib	Periods: 09	
Basic functions of Matplotlib – Simple Line Plot – Scatter Plot – Density and Contour Plots – Histograms – Binnings and Density – Customizing Plot Legends – Colour Bars – Three-Dimensional Plotting in Matplotlib.			CO5

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

Text Books

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

Reference Books

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

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

2.A.10.78

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

2.A.1079

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

(Common to all Branches)

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

UNIT-I	**Basic Terminologies of Data Structures**	**Periods: 9**
Introduction: Basic Terminologies – Asymptotic Notations: Complexity analysis. Array and its operations - Searching: Linear Search and Binary Search Techniques. Sorting: Bubble Sort – Selection Sort – Insertion Sort – Heap Sort – Shell Sort. Performance and Comparison among the sorting methods.		**CO1**

UNIT-II	**Stack and Queue Operations**	**Periods: 9**
Stacks and Queues: ADT Stack and its operations. Applications of Stacks: Expression Conversion and evaluation. ADT Queue and its operations. Types of Queue: Simple Queue – Circular Queue – Priority Queue – Deque.		**CO2**

UNIT-III	**Linked List Operations**	**Periods: 9**
Linked Lists: Singly linked list: Representation in memory. Algorithms of several operations: Traversing – Searching – Insertion – Deletion. Linked representation of Stack and Queue. Doubly linked list: operations. Circular Linked Lists: operations.		**CO3**

UNIT-IV	**Trees**	**Periods: 9**
Trees: Basic Tree Terminologies. Different types of Trees: Binary Tree – Threaded Binary Tree – Binary Search Tree – Binary Tree Traversals – AVL Tree- Red Black Tree.		**CO4**

UNIT-V	**Graphs, Tables and Sets**	**Periods: 9**
Graph: Basic Terminologies and Representations – Graph traversal algorithms. Tables: Different types of tables – Hash Table and its operations - Applications. Sets: Representation of Sets- Operations and its applications.		**CO5**

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

Text Books

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

Reference Books

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

Web References

1. https://www.geeksforgeeks.org/data-structures/
2. https://www.javatpoint.com/data-structure-tutorial/
3. https://www.studytonight.com/data-structures/

2.A.10.80

4. https://www.tutorialspoint.com/data_structures_algorithms/
5. https://www.w3schools.in/data-structures-tutorial/intro/

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

2.A.10.81

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

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

UNIT-I	**Introduction**	**Periods: 09**	
Database System Application – Purpose of Database Systems – View of Data – Database Languages – Relational Database – Database Design – System Structure – Database Architecture. Database Design and E-R Model: Overview of the Design Process – The E-R Model – Constraints – E-R Diagrams – E-R Design Issues –Extended E-R features – Reduction to Relational Schemas – Other aspects of Database Design			**CO1**
UNIT-II	**Relational Database Management Systems (RDBMS) and Design**	**Periods: 09**	
Relational database concepts: Tables, rows, columns, keys, constraints- Fundamental Relational Algebra Operations – Extended Relational Algebra Operations- SQL (Structured Query Language) fundamentals- Features of Good Relational Designs – Database Dependencies-1NF – 2NF – 3NF – 4NF			**CO2**
UNIT-III	**Transaction and Concurrency Control**	**Periods: 09**	
Transaction Management: Transaction Concept – Storage Structure – Transaction Atomicity and Durability – Transaction Isolation and Atomicity – Serializability – Recoverability – Transaction Isolation Levels – Implementation of Isolation Levels. Concurrency Control: Lock Based Protocols – Timestamp Based Protocols – Validation Based Protocols. Recovery System: Failure Classification – Remote Backup Systems.			**CO3**
UNIT-IV	**Non-relational databases (NOSQL)**	**Periods: 09**	
Introduction to NoSQL databases: MongoDB-Cassandra- Redis-Key-value stores-document stores-column-family stores-graph databases			**CO4**
UNIT-V	**Emerging Trends and Technologies**	**Periods: 09**	
New database technologies and trends- Blockchain databases-Time-series databases: Time Series Data- A New World for Time Series Databases- Storing and Processing Time Series Data-Time Series Tools			**CO5**

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

Text Books

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

Reference Books

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

Web References

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

2.A.10.82

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

2.A.10.83

Department	English	Programme: B.Tech.						
Semester	II	Course Category: HS			End Semester Exam Type: TE			
Course Code	U23ENBC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Communicative English - IIWe	2	-	2	3	50	50	100

(Common to ALL Branches except CSBS)

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

UNIT-I	**Business Correspondence**	**Periods:10**	
Business Writing: Circular, Agenda, Memoranda, Notice, Instruction, Minutes, Email Writing ,Report Writing- Official and Demi Official Letters : Applying for Educational / Car / Home Loans / Joining Report, Leave Letter, Industrial Visit, In plant Training, Letter to the Editor, Calling for a quotation, Placing Order, Letter of Complaints, Letter seeking Clarification, Resume', Job Application Letter, Bio-data, CV			**CO1**
UNIT-II	**Functional Writing Skills**	**Periods:10**	
Four Modes of Writing, Sentence Structure , Art of condensation: Summary Writing and Note Making, Use of phrase and clause in sentence, Principles of paragraph writing, Techniques of Essay Writing, Jumbled Sentence, Paraphrasing			**CO2**
UNIT-III	**Etiquettes**	**Periods:10**	
Etiquette: Meaning, Kinds: Corporate Etiquette, Meeting Etiquette, Telephone Etiquette, Email Etiquette, Social Media Etiquette, Dining Etiquette, Communication Etiquette			**CO3**
UNIT-IV	**Communication Practice-II**	**Periods:15**	
List of Exercises Listening: Letter writing tips Speaking: Just a Minute, Impromptu Speech, Contemporary Issues Reading: Variety of examples for Modes of Writing Writing: Different types of letters			**CO4**
UNIT-V	**Interpersonal Communication-II**	**Periods:15**	
List of Exercises Listening: Videos on different types of Etiquettes Speaking: Team Presentation, Negotiation Skills Reading: Phrases and Clauses Writing: Free writing on any given topic, Paraphrasing Practice			**CO5**

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

Text Books

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

Reference Books

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

2.A.10.84

Web References

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

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

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

2.A.10.85

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

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

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

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

List of Lab Activities and Experiments

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

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

Text Books

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

2.A.10.86

Reference Books

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

Web References

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

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

2.A.10.87

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

(Common to All Branches)

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

List of Exercises

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

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

Reference Books

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

Web References

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

2.A.10.88

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

2.A.10.89

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

(Common to all Branches)

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

List of Experiments

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

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 3 0**	**Total Periods: 30**

Reference Books

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

Web References

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

2.A.10.90

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

2.A.10.91

Department	Artificial Intelligence and Data Science	Programme: **B.Tech**						
Semester	II	Course Category: **PC**			End Semester Exam Type: **LE**			
Course Code	**U23ADP202**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Database Technologies Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(AI &DS)

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

List of Experiments:

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

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

Reference Books

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

Web References

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

COs/POs/PSOs Mapping

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

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

2.A.10.92

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

2.A.10.93

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

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

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

2.A.10.94

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

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

UNIT-I	Introduction to Physical Education	Periods: 06
Definition, Aims and Objectives of Physical Education - Changing trends in Physical Education **Physical Fitness, Wellness and Lifestyle:** Importance of Physical Fitness and Wellness - Components of Physical fitness - Components of Health related fitness - Components of wellness - Preventing Health Threats through Lifestyle Change - Concept of Positive Lifestyle.		CO1

UNIT-II	Yoga and Lifestyle	Periods: 06
Importance of Yoga - Elements of Yoga - Introduction - Asanas, Pranayama, Meditation and Yogic Kriyas - Yoga for concentration and related Asanas (Sukhasana, Tadasana, Padmasana and Shashankasana) - Relaxation Techniques for improving concentration - Yog-nidra. Asanas as preventive measures – Hypertension – Obesity - Back Pain-Diabetes - Asthema.		CO2

UNIT-III	Training and Planning in sports	Periods: 06
Training - Warming up and limbering down-Skill, Technique and Style - Objectives of Planning – Tournament - Knock-Out, League/Round Robin and Combination. **Psychology and Sports** - Important of Psychology in Physical Education and Sports - Differentiate Between Growth and Development - Adolescent problems and their Management - Emotion: Concept, Type and Controlling of emotions - Concepts and Types of Aggressions in Sports - Psychological benefits of exercise - Anxiety and Fear and its effects on Sports Performance - Motivation, its type and techniques - Understanding Stress and Coping strategies		CO3

UNIT-IV	Introduction to National Service Scheme	Periods: 06
Orientation of NSS volunteers: History, motto, symbol, awards, structure and activities of NSS - Days of National and International Importance - Sensitizing about the thrust areas and awareness activities - Importance of tree plantation and voluntary blood donation - The role of SHGs and NGOs in community development – CSR - Life skills and youth development-extension activities in HEIs - various clubs and schemes like RRC, ELC, YRC, UBA, SBA, etc.,		CO4

UNIT-V	Community Issues and the use of technology	Periods: 06
Common Problems of rural India - Technology development and its suitability – Sustainability - Value addition to agricultural products - Service learning and youth volunteering – Shramdaan - Campus cleaning - Field visit to nearby communities - village survey - Initiatives to clean and green environment - preservation of water bodies in adopted villages.		CO5

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

Reference Books

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

2.A.10.95

Web References

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

Evaluation methods

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

2.A.10.96

Department	Mathematics	Programme : M.Tech.					
Semester	I	Course Category: BS			End SemesterExamType:TE		
Course Code	P23MAT105	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Probability and Statistics	2	1	-	3	25	75	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 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.	K3

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.

2.A.10.97

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

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	PSO 3
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 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

2.A.10.98

Department	Artificial Intelligence and Data Science	Programme : M.Tech.						
Semester	I	Course Category: PC			End SemesterExamType:TE			
Course Code	P23ADT101	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Machine Learning Algorithms	3	-	-	3	40	60	100
	(AI&DS)							

Prerequisite	NIL	
Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand the concepts of machine learning algorithms and acquire knowledge on regression models	K2
	CO2 Explore the classification models and analyze the clustering algorithms	K3
	CO3 Demonstrate the dimensionality reduction techniques	K3
	CO4 Explore of Decision learning algorithm and rule-based learning	K3
	CO5 Acquire knowledge on ensemble learning	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:-0	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. 1st 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, 2nd edition, 2012.

2.A.10.99

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

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

2.A.10.100

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**	**-**	**-**	**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	Understand the issues related to the design and analysis of systems with real-time constraints and to learn the features of Real time OS	K3
CO2	Classify and Compare various Uniprocessor and Multiprocessor scheduling mechanisms	K3
CO3	Categorize the difference between traditional and real time databases.	K2
CO4	Acquire knowledge about Data Storage and Management Technologies	K3
CO5	Perceive information about Storage Area Networks characteristics and components.	K3

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- Çaching-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.

2. A. 10. 101

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

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 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

2. A. 10. 102

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**	**-**	**-**	**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	Acquire an insight into the different search techniques to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach	**K3**
	CO2	Learn the different approaches of knowledge representation and reasoning and develop systems that demonstrate intelligent behavior including dealing with uncertainty	**K3**
	CO3	Formulate solutions by applying the planning and learning approaches to real world problems.	**K2**
	CO4	Learn the intelligent computing models and explore the ways in which real-world problems can be solved by adapting the working principle of nature inspired intelligence	**K3**
	CO5	Examine case studies, learn the benefits of hybridization and propose new hybrid algorithms and validate their results.	**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.

2. A. 10. 103

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

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 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

2. A. 10.104

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	ES E	TM
Course Name	**Research Methodology and IPR**	**2**	**-**	**-**	**2**	**40**	**60**	**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 Knowledge to formulate the research problem.	**K2**
	CO2 Understand the concepts to carry out the literature review, ethics and research analysis.	**K2**
	CO3 Explain the way of writing technical paper and presentation methods.	**K2**
	CO4 Ability to understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.	**K2**
	CO5 Ability to understand about IPR and filing patents in R & D.	**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, 2nd 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", 2nd 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.

2. A. 10. 105

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

COs/POs/PSOs Mapping

	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

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

*Assignment to be given from Unit-5

2. A. 10. 106

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**	-	-	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	To apply supervised algorithms and unsupervised algorithms.	K4
CO2	To develop applications using Regression techniques	K3
CO3	To understand the concepts of Dimensionality Reduction techniques.	K2
CO4	To analyse and apply Decision and Rule based learning concepts	K3
CO5	To develop and boost the Machine learning models using ensemble methods.	K2

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. 1st 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.

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

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

2.A.10.107

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

12. A. 10. 108

Department	Artificial Intelligence and Data Science	Programme: **M.Tech.**						
Semester	I	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**	-	-	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		

2.A.10.109

	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? • Conclude with limitations/issues not addressed by the paper (from the perspective of survey)	6th week	8% (The table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
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: 4 5**	**Total Periods: 45**

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 Methods

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

2. A. 10. 110

Department	Artificial Intelligence and Data Science	Programme: **M.Tech.**						
Semester	I	Course Category Code: **AEC**			End Semester Exam Type: -			
Course Code	P23ADC1XX	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ES E	TM
Course Name	**Ability Enhancement Courses**	-	-	4	-	100	-	100

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

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

2.A.10.111

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	IoT and Edge Computing	3	-	-	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 vision of IoT from a global context along with the uses of IOT devices.	**K2**
	CO2 Determine the Market perspective of IoT.	**K2**
	CO3 Design a portable IOT using Raspberry Pi	**K3**
	CO4 Describe the importance of edge computing	**K2**
	CO5 Illustrate the applications in Industrial Automation and identify Real World Design Constraints	**K2**

UNIT – I	**Introduction and Enabling Technologies**	**Periods:9**
finition and Characteristics - Physical Design - Things in IoT- Protocols, Logical Design - Communication Models - Communication APIs - Difference between IoT and M2M - SDN and NFV for IoT - Software Defined Networking - Network Function Virtualization - System Management with NETCONF-YANG - Need for IoT Systems Management - Network Operator Requirements – NETCONF - YANG.		**CO1**

UNIT – II	**IoT Protocols**	**Periods:9**
IoT Access Technologies: Physical and MAC layers - topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN — Network Layer: IP versions, Constrained Nodes and Constrained Networks — Optimizing IP for IoT - From 6LoWPAN to 6Lo - Routing over Low Power and Lossy Networks – Application Transport Methods- Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT		**CO2**

UNIT – III	**IoT Platforms Design Methodology**	**Periods:9**
IoT Physical Devices and Endpoints — Introduction to Raspberry PI - Interfaces (Serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets - Controlling output -Reading input from pins		**CO3**

UNIT – IV	**Introduction to Edge Computing**	**Periods:9**
Fog computing vs Edge computing - Need for edge computing - benefits of Edge computing. Lightweight Container Middleware for Edge Cloud Architectures - Clusters for Lightweight Edge Clouds - Architecture Management — Storage and Orchestration - IoT Integration - Security Management for Edge Cloud Architectures.		**CO4**

UNIT – V	**Physical Servers and Cloud Offerings**	**Periods:9**
Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Web Server — Web server for IoT - Cloud for IoT - Python web application framework - Designing a RESTful web API.		**CO5**

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

Textbooks

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things: A Hands-on Approach", VPT, 1st edition,2014.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things — Key applications and Protocols", Wiley, 2nd edition, 2012.
3. Rajkumar Buyya, Satish Narayana Srirama "Fog and Edge Computing: Principles and Paradigms",Wiley-Blackwell, 1st edition, 2019.
4. Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A Hands-on Approach", Universities Press,2015
5. Matt Richardson & Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 3rd edition,2016

2. A. 10. 112

References
1. Jonathan Follett, "Designing for Emerging - UX for Genomics, Robotics, and the Internet of Things Technologies", O'Reilly, 1st edition, 2014.
2. Charalampos Doukas, "Building Internet of Things with the Arduino", Create space Publishers, 2012
3. Donald Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black", Mc.Graw Hill, 1st edition, 2015.
4. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Thing — Introduction to a New Age of Intelligence", Elsevier, 2014.
5. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
Web References
1. https://www.wired.co.uk/article/internet-of-things-what-is-explained-iot
2. https://www.ibm.com/blogs/internet-of-things/what-is-the-iot/
3. https://www.geeksforgeeks.org/edge-computing/
4. https://www.i-scoop.eu/internet-of-things-guide/edge-computing-iot/

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 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

2.A.10.113

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**	**-**	**-**	**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 Understand the basics of NLP	**K3**
	CO2 Apply the basic ML and DL techniques for NLP	**K2, K3**
	CO3 Understand and realize the advanced NLP Techniques.	**K2**
	CO4 Understand the concept of NLU, NLG and apply the concept of Information Retrieval	**K2,K3**
	CO5 Apply ethics to be followed while building NLP Applications and how to use NLP Libraries	**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), 3rd edition,2016

2. A. 10. 114

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, 1st 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

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 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

2.A.10.115

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**	**-**	**-**	**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	Understand basic neural network activation function and loss functions.	K2
CO2	Able to apply different Convolutional Neural Network.	K2
CO3	Understand different deep learning regularization and optimization methods.	K2
CO4	Understand different Neural Network Model	K2
CO5	Understand Neural Style transfer and autoencoding process	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	**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.

2. A. 10. 116

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	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 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

2.A.10.117

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	-	-	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.	K3
CO2	Describe the Different Types of Variables, Control Flow and Data Manipulation Techniques	K2, K3
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, K3
CO5	Understand the Deployment of the Robot and to maintain the connection.	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.
3. Hadoop: The Definitive Guide,Tom White, 4th Edition,2015

2. A. 10. 118

Reference Books
1. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, "Introduction to Robotic Process Automation:
2. a Primer", Institute of Robotic Process Automation,1st edition 2015.
3. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & become an RPA Consultant", Independently Published, 1st edition 2018.
4. Srikanth Merianda," Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 1st edition 2018.
5. 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/

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 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

2.A.10.119

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	-	-	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	Understand the role of neural networks in engineering & artificial intelligence.	K2
CO2	Understand regularization methods for gradient problem.	K2
CO3	Apply various optimization techniques and fine-tuning process.	K3
CO4	Understand various Neural Network models.	K3
CO5	Apply deep learning Network in various applications.	K3

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

2. A. 10. 120

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 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

2-A-10.121

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**	-	-	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: 45	Total Periods: 45

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

2. A. 10. 122

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Attendance		
	Presentation using ICT	Report	viva			
Marks	30	30	30	10	-	100

2. A. 10 - 123

Department	Artificial Intelligence and Data Science	Programme: **M.Tech.**						
Semester	II	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 COURSES**	-	-	4	-	**100**	-	**100**

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

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

Z. A. 10. 124

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**	**-**	**-**	**3**	**40**	**60**	**100**

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

Prerequisite	-

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Perform Software engineering processes.	**K2**
	CO2	Make use of software design.	**K3**
	CO3	Apply different software testing strategies.	**K3**
	CO4	Illustrate different Agile Methodology.	**K2**
	CO5	Make use of different process of Agile Methodology.	**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**
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.		**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.

2. A. 10. 125

Web References

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

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	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 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

2. A. 10 - 126

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**	**-**	**-**	**3**	**40**	**60**	**100**

(AI &DS)

Prerequisite	**Python Basics**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the roles and stages of data science projects	**K2**
	CO2 Explain 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 Demonstrate 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.

2.A.10.127

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

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

2.110.128

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**	**-**	**-**	**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 Understand the data science process and how its components interact	**K3**
	CO2 Classify, formulate the data science problems and manage large dataset	**K3**
	CO3 Plan modeling, apply basic machine learning algorithms and evaluate the model.	**K2**
	CO4 Create effective visualization of data and work with data science projects	**K3**
	CO5 Use the 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, 2nd 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, 2nd 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.

2. A. 10. 129

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

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 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

2. A. 10. 130

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**	**-**	**-**	**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	Explore the fundamental concepts of big data and analytics.	K3
CO2	To learn Hadoop and develop map-reduce applications	K3
CO3	Design algorithms for handling petabytes of datasets	K2
CO4	Design algorithms and propose solutions for Big Data by optimizing main memory consumption	K3
CO5	Analyse a data in modeling	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.

2. A. 10. 131

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

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 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

2.A.10.132

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**	**-**	**-**	**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 Understand the concepts of Expert systems.	**K2**
	CO2 Acquire knowledge on Knowledge representation techniques.	**K3**
	CO3 Explore the Inference methods.	**K3**
	CO4 Explore and Analyze the Reasoning under uncertainty.	**K2**
	CO5 Demonstrate the design of expert system.	**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.

2. A. 10. 133

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

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 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

2.A.10.134

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	-	-	3	40	60	100

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

Prerequisite	Internet Programming	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand the Web analytics platform, and their evolution.	K3
	CO2 Use the various Data Streams Data.	K3
	CO3 Know how the survey of capturing of data will benefit.	K2
	CO4 Understand Common metrics of web as well as KPI related concepts.	K3
	CO5 Apply various Web analytics versions in existence.	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 analyticsevolution, 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

2.A.10.135

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 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

2. A. 10. 13b

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 Power BI	3	-	-	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 the various Charts using Tableau.	K3
	CO2 Understand and apply Maps in Tableau.	K3
	CO3 Understand the Power BI concepts	K2
	CO4 Apply the Power Querry and M Language in data.	K3
	CO5 Design the concepts in data modelling and create a dashboard.	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 Querry 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

2.A.10.137

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

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 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

2.A.10.138

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	-	-	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 Design and analyze appropriate predictive models	K3
	CO2 Define the predictive models using PMML.	K3
	CO3 Apply statistical tools for analysis.	K3
	CO4 Use various analytical tools available for predictive modeling.	K3
	CO5 Apply predictive modeling markup language in data manipulation .	K3

UNIT-I	Introduction To Predictive Modeling	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 Basics	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, 2nd edition,2011
2. Predictive Modeling with SAS Enterprise Miner Practical Solutions for Business Applications, 3rd edition,2017
3 Mastering Predictive Analytics with R,2nd 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.

2.A.10.139

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

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 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

2.A.10.140

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 Databases**	**3**	**-**	**-**	**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 Understanding the market and technology forces leading to today's next generation databases.	**K3**
	CO2 Mastering in Hadoop architecture with querying in various Hadoop components	**K3**
	CO3 Demonstrating the working of XML and JSON Document Databases	**K3**
	CO4 Understanding the database applications oriented to Graph and Column databases	**K3**
	CO5 Applying 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

3. Tom White, "Hadoop: The Definitive Guide", 4th Edition,2015

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

5.Luc Perkins, Eric Redmond,Jim Wilson,"Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement", 2nd Edition.

2-A-10-141

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

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 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

2.A.10.142

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	-	-	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 Analyze algorithms to determine algorithm correctness	K3
	CO2 Analyze algorithms to determine time efficiency	K3
	CO3 Master a variety of advanced data structures and their implementations	K3
	CO4 Master a variety of different algorithm design techniques	K3
	CO5 Apply and implement the learnt algorithm design techniques to solve problems	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 – Impiementing 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
3. George Heineman (Author), Gary Pollice (Author), Stanley Selkow (Author) "Algorithms in a Nutshell, 2e: A Practical Guide", 2nd edition,2016

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", 2nd edition, Universities Press, Hyderabad, 2008.
4. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", 3rd edition, Pearson Education Asia, 2008.
5. Thomas H. Cormen, Charles E. Leiserson, Introduction to Algorithms, Fourth Edition,2022.

2.A.10.143

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

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 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

2.A.10.144

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

(AI&DS)

Prerequisite	Basic Artificial Intelligence and Data Science	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand the Business intelligence framework and responsibilities	K2
	CO2 Design the ETL process for handling the data from a given source	K3
	CO3 Design a star / snowflake schema for a given problem.	K3
	CO4 Ability to illustrate the data mining concepts with suitable examples.	K3
	CO5 Ability to apply classification and prediction concepts to various applications	K2

UNIT – I	Introduction to Business Intelligence	Periods:9
BI Definitions &Concepts, BI Framework, Data Warehousing concepts and its role in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business, Applications of BI, BI best practices		CO1
UNIT – II	**Basics of Data Integration**	**Periods:9**
Concepts of data integration, Needs and advantages of using data integration, introduction to common data integration approaches,Meta data - types and sources, Introduction to data quality, data profiling concepts and applications, Introduction to ETL using Pentaho data Integration (formerly Kettle).		CO2
UNIT – III	**Introduction to Multi-Dimensional Data Modeling**	**Periods:9**
Data Modelling Introduction to data and dimension modelling, multidimensional data model, ER Modelling vs. multi-dimensional modelling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, Introduction to business metrics and KPIs, Creating cubes using Microsoft Excel.		CO3
UNIT – IV	**Working With BI Tools**	**Periods:9**
Overview of managerial, strategic and technical issues associated with Business Intelligence and Data Warehouse design, implementation, and utilization. Critical issues in planning, physical design process, deployment and ongoing maintenance. Dash Boards and Scorecards Creation.		CO4
UNIT – V	**Future of Business Intelligence**	**Periods:9**
Emerging Technologies, Machine Learning, Predicting the Future with the help of Data Analysis, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.		CO5

LecturePeriods:45	TutorialPeriods:0	PracticalPeriods:-0	TotalPeriods:45

Text Books

1. R N Prasad, Seema Acharya: Fundamentals of Business Analytics, Wiley India, 2nd edition, 2016.
2. David Loshin: Business Intelligence: The Savvy Manager's Guide., Latest Edition By Knowledge Enterprise,2018.
3. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9 th Edition, Pearson 2018
4. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2019.
5. Grossmann W, Rinderle-Fundamental of Business Intelligence 1th Edition, Springer, 2017

Reference Books

1. J.Han and M. Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufman publishers, Harcourt India pvt. Ltd. Latest Edition, 2016
2. Larissa Terpeluk Moss, ShakuAtre, "Business Intelligence roadmap", Addison Weseley.2018
3. CindiHowson, "Successful Business Intelligence: Secrets to making Killer BI Application", Tata McGraw Hill, 2018
4. Mike Biere, "Business intelligence for the enterprise", Addison Weseley, Ausgust 2017
5. Dorian Pyle, "Business Modeling and Data Mining", Elsevier Publication, 2016

Web References

1. https://www.investopedia.com/terms/b/business-intelligence-bi.asp
2. https://www.cio.com/article/272364/business-intelligence-definition-and-solutions.html
3. https://www.javatpoint.com/power-bi

2. A. 10. 145

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 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

2r A.10.146

Department	**Artificial Intelligence and Data Science**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PE**			End Semester Exam Type: **TE**			
Course Code	**P23ADE210**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Streaming Analytics**	**3**	**-**	**-**	**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	Explain the need for stream computing.	**K2**
CO2	Comprehend the architecture of stream analytics.	**K3**
CO3	Build data flow management pipelines for streams.	**K2**
CO4	Process the streaming data.	**K3**
CO5	Deliver the results of streaming analytics.	**K3**

UNIT-I	**Introduction to stream computing**	**Periods: 9**	
Streaming Data – Sources – Difference between Streaming Data and Static Data. Overview of Large-Scale Stream Processing Engines – Issues in Stream Processing.			**CO1**
UNIT-II	**Streaming analytics architecture**	**Periods: 9**	
Phases in Streaming Analytics Architecture - Vital Attributes - High Availability – Low Latency – Horizontal Scalability-Fault Tolerance - Service Configuration and Management – Apache ZooKeeper.			**CO2**
UNIT-III	**Data flow management**	**Periods: 9**	
Distributed Data Flows – At Least One Delivery – Apache Kafka – Apache Flume – Zero MQ - Messages, Events, Tasks& File Passing.			**CO3**
UNIT-IV	**Processing & storing streaming data**	**Periods: 9**	
Distributed Stream Data Processing: Co-ordination, Partition and Merges, Transactions. Duplication Detection using Bloom Filters - Apache Spark Streaming Examples Choosing a storage system – NoSQL Storage Systems.			**CO4**
UNIT-V	**Delivering streaming metrics**	**Periods: 9**	
Visualizing Data – Mobile Streaming Apps –Times Counting and Summation – Stochastic Optimization – Delivering Time Series Data.			**CO5**

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

Text Books

1. By Albert Bifet, Ricard Gavaldà, Geoff Holmes, Bernhard PfahringerStuart, Machine Learning for Data Streams, The MIT Press, 2018.
2. Ted Dunning, Ellen Friedman, Streaming Architecture, O'Reilly Media, Inc, May 2016.
3. SherifSakr, "Large Scale and Big Data: Processing and Management", CRC Press, 2014.

Reference Books

1. Jure Leskovec, AnandRajaraman, Jeffrey D. Ullman, "Mining of Massive Datasets", Cambridge University Press, 2014.
2. Paul C Zikopoulos, Chris Eaton, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw-Hil, 1st edition, 2011.
3. Byron Ellis, "Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data", Wiley, 1st edition, 2014.
4. Bill Franks, "Taming The Big Data Tidal Wave Finding Opportunities In Huge Data Streams With Advanced Analytics", Wiley, 2012.

Web References

1. https://www.tutorialspoint.com/ins-and-outs-of-data-streaming.
2. https://www.javatpoint.com/kafka-key-concepts-of-stream-processing
3. https://flume.apache.org/.
4. https://www.geeksforgeeks.org/data-stream-in-data-analytics/

2.A.10.147

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 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

2.A.10.148

Department	Artificial Intelligence and Data Science	Programme: M.Tech.						
Semester	II	Course Category : PE			End Semester Exam Type: TE			
Course Code	P23ADE211	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Machine Learning with Large Datasets	3	-	-	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	Learn various types of algorithms to handle the large data.	K2
CO2	Apply parallel and distributed ML techniques to get the insights of the large data.	K3
CO3	Identify suitable ML framework to develop the real-world application.	K2
CO4	Demonstrate graph-based learning algorithms.	K3
CO5	Develop scalable learning techniques both in standalone and distributed settings.	K3

UNIT-I	Stream Data mining algorithms	Periods: 9	
Stream Data model, sampling data in a stream, filtering algorithms, counting distinct elements in a stream, estimating moments, Decaying windows, Naïve Baye's, Frequent Item sets: Handling larger datasets in memory, counting frequent itemset in a stream.			CO1
UNIT-II	**Tools for large data sets**	**Periods: 9**	
Introduction to Hadoop, Hadoop streaming Debugging Hadoop, Combiners, Scalable classification, Abstracts for map-reduce algorithms, joins in Hadoop, similarity joins, page rank, spark, phrase finding.			CO2
UNIT-III	**Gradient descent and Hash kernels**	**Periods: 9**	
Learning as optimization, Logistic regression with SGD, Efficient regularized SGD, Hash kernels for logistic regression, matrix factorization with SGD, Distributed matrix factorization with SGD.			CO3
UNIT-IV	**Parallel machine learning algorithms & Randomized algorithms**	**Periods: 9**	
Parallel perceptron, parallel SVM, learning from nearest neighbors, parallel design of Decision trees. Randomized algorithms: Bloom filters, Locality sensitive hashing, online locality sensitive hashing.			CO4
UNIT-V	**Open source ML tools**	**Periods: 9**	
Computer vision-SimpleCV, Tessaract OCR, Detectron, Natural Language Processing- Stanford core NLP, Music and Audio analysis-LibROSA, Other tools-KNIME and Orange.			CO5

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

Text Books

1. Leskovec, Jure, AnandRajaraman, and Jeffrey David Ullman. Mining of massive data sets. Cambridge university press, 2020.
2. Bekkerman, Ron, Mikhail Bilenko, and John Langford, eds. Scaling up machine learning: Parallel and distributed approaches. Cambridge University Press, 2011.
3. John T. Wolohan, "Mastering Large Datasets with Python", Manning Publications, 2020.

Reference Books

1. Goodfellow, Ian, YoshuaBengio, and Aaron Courville. Deep learning. MIT press, 2016.
2. Wilt, Nicholas. The cuda handbook: A comprehensive guide to gpu programming. Pearson Education, 2013.
3. Frank Pane , "Hands On Data Science and Python Machine Learning", Packt Publishers, 2017.
4. Abhishek Kumar, Ashutosh Kumar Dubey, Sreenatha G. Anavatti, Pramod Singh Rathore, Machine Learning Approaches and Applications in Applied Intelligence for Healthcare Data Analytics, 1st edition, March 10, 2022.
5. White, Tom. Hadoop: The definitive guide. " O'Reilly Media, Inc.", 2012.

Web References

1. https://www.geeksforgeeks.org/splitting-data-for-machine-learning-models/.
2. https://www.javatpoint.com/data-preprocessing-machine-learning.
3. https://towardsdatascience.com/beginners-guide-to-machine-learning-with-big-data-d6dbb155673c.

2. A - 10.149

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 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

2. A. 10. 150

Department	Artificial Intelligence and Data Science	Programme: **M.Tech.**						
Semester	II	Course Category : **PE**			End Semester Exam Type: **TE**			
Course Code	**P23ADE212**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**R for Data Science**	**3**	**-**	**-**	**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 Study and use basic fundamental concepts to solve the real-world problem using R programming language.	**K2**
	CO2 Design and implement the solution using scalar, vectors, matrices and statistical problems in R program.	**K3**
	CO3 Design and implement the program using data frame, list to provide the solution for various problem.	**K3**
	CO4 Study about factors and tables and to solve statistical problems.	**K2**
	CO5 Study Minimize and maximize functions, simulation and visualization and statistical analysis using R.	**K2**

UNIT-I	**Introduction**	**Periods: 9**
Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations.		**CO1**

UNIT-II	**Control Structures and Vectors**	**Periods: 9**
Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations.		**CO2**

UNIT-III	**Lists and Data Frames**	**Periods: 9**
Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations		**CO3**

UNIT-IV	**Factors and Tables and Object-Oriented Programming**	**Periods: 9**
Knowledge representation - statistical pattern recognition - Syntactic pattern recognition - optimization techniques in recognition - Mathematical Morphology - Morphological transformation– dilation – erosion - opening and closing -homotopic transformation – skeleton - thinning and thickening. S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation.		**CO4**

UNIT-V	**Data Visualization using R**	**Periods: 9**
Introduction, Types of Data Visualization, Statistical graphs: Scatter Plots, Box Plots, Scatter Plots and Box and Histograms, Advanced Visualization: Using the ggplot2 package to visualize data, applying themes from ggthemes to refine and customize charts and graphs, Building data graphics for dynamic reporting, advantages, disadvantages.		**CO5**

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

Text Books

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

2. A. 10. 15

Reference Books
1. Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations",2018 2. Venables , W.N.,and Ripley,"S programming", Springer, 2019. 3. Roger D. Peng," R Programming for Data Science ", 2016 4. Norman Matloff, "The Art of R Programming- A Tour of Statistical Software Design", 2018 5. Jd long, Paul Teetor, "R Cookbook 2e: Proven Recipes for Data Analysis, Statistics, and Graphics", O'Reilly, 2019.
Web References
1. https://www.r-project.org/about.html 2. https://www.tutorialspoint.com/r/index.htm 3. https://www.javatpoint.com/r-tutorial

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	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 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

2. A. 10. 152

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

(AI &DS)

Prerequisite	**Basics in Java Programming**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the syntax, control structure, and data structure of Java programming.	**K2**
	CO2 Understand the database connectivity to create real-life or business solutions.	**K2**
	CO3 Understand the J2EE Architecture and develop the web application.	**K3**
	CO4 Use Object Relation Mapping using Hibernate to build the database.	**K3**
	CO5 Design and develop the web application using Spring MVC.	**K3**

UNIT-I	**Introduction to Programming**	**Periods: 9**
Introduction to Java Programming: Basic constructs of OOPS – Data types – Operators and control statements – Classes and Methods – Inheritance and Packages Exception handling: Fundamental of Exceptions – Types of Exceptions – Multithreaded programming and I/O.		**CO1**

UNIT-II	**JDBC Programming**	**Periods: 9**
The JDBC Connectivity Model – Database Programming – Connecting to the Database – Creating a SQL Query – Getting the Results – Updating Database Data – Error Checking and the SQL Exception Class – The SQL Warning Class – The Statement Interface – Prepared Statement – Callable Statement – The Result Set Interface – Updatable Result Sets – JDBC Types – Executing SQL Queries – Result Set Meta Data – Executing SQL Updates – Transaction Management.		**CO2**

UNIT-III	**J2EE and Web Development**	**Periods: 9**
J2EE Architecture Types – J2EE Containers – Types of Servers in J2EE Application – HTTP Protocols and API – Request Processing in Web Application – Web Application Structure – Web Containers and Web Architecture Models.		**CO3**

UNIT-IV	**Hibernate**	**Periods: 9**
Introduction to Hibernate – Exploring Architecture of Hibernate – Object Relation Mapping (ORM) with Hibernate – Hibernate Annotation – Hibernate Query Language (HQL), CRUD Operation using Hibernate API.		**CO4**

UNIT-V	**Java Web Frameworks: Spring MVC**	**Periods: 9**
Spring: Introduction – Architecture – Spring MVC – Module – Life Cycle of Bean Factory – Explore Constructor Injection – Dependency Injection – Inner Beans – Aliases in Bean – Bean Scopes – Spring Annotation – Spring AOP Module – Spring DAO – Database Transaction Management – CRUD Operation using DAO and Spring API.		**CO5**

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

Text Books

1. Herbert Schildt, "Complete Reference Java",Mcgraw Hill Education, 7th edition, 2021.
2. Cay. S Hortsmann and Gray Cornell, "Core Java: Volume II – Advanced Features", Pearson, 8th edition, 2008.
3. Deitel and Deitel, "Java How to Program", Prentice Hall, 10th edition, 2016.

Reference Books

1. Herbert Schildt, "Java: A Beginner's Guide", Oracle Press, 6th edition, 2014.
2. Maydene Fisher, Jon Ellis, Jonathan Bruce, and Addison Wesley, "JDBC", API Tutorial and Reference, 3rd edition, 2003.
3. Kathy Walrath, "Java Server Programming Black Book", J2EE, Dream Tech Publishers, 1st edition, 2008.
4. Jeff Linwood and Dave Minter, "Hibernate", Beginning Apress Publication, 2nd edition, 2016.
5. Craig Walls, "Spring in Action", Manning Publication, 3rd edition, 2011.

Web References

1. https://docs.oracle.com/javase/tutorial
2. https://www.javatpoint.com/
3. https://www.tutorialspoint.com/java
4. https://archieve.nptel.ac.in/courses/106/105/106105191/
5. https://www.geeksforgeeks.org

2.A.10.153

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

2. A. 10. 154.