



Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and Detailed Syllabus (DJS23)

Final Year B.Tech

in

Artificial Intelligence (AI) and Data Science

(Semester VII/VIII)

To be Prepared by: - Board of Studies in Artificial Intelligence (AI) and Data Science

To be Recommended by: - Academic Council of Dwarkadas J. Sanghvi College of Engineering

To be Approved by: - Governing Body of Dwarkadas J. Sanghvi College of Engineering

With effect from the Academic Year: 2026-2027

Scheme for Final Year Undergraduate Program in Artificial Intelligence (AI) and Data Science: Semester VII & VIII (Autonomous)
(Academic Year 2026-27)

Sr. No.	Course Code	Course	Teaching Scheme				Semester End Examination (SEE) - A					Continuous Assessment (CA) - B					Aggregate (A+B)	Credits Earned			
			Theory (Hrs)	Practical (Hrs)	Tutorial (Hrs)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Term Test 3 (TT3)	Term Total (TT1 + TT2 + TT3)			CA Total (B)		
1	DJS23SCPC701	Data Ethics	3	--	--	3	2	60	--	--	--	60	15	15	10	40	--	40	100	3	4
	DJS23STPC701	Data Ethics Tutorial	--	--	1	1	--	--	--	--	--	--	--	--	--	--	25	25	25	1	
	DJS23SCPE711	Explainable AI	3	--	--	3	2	60	--	--	--	60	15	15	10	40	--	40	100	3	
2	DJS23SLPE711	Explainable AI Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	--	25	25	50	1	4
	DJS23SCPE712	AI in Healthcare	3	--	--	3	2	60	--	--	--	60	15	15	10	40	--	40	100	3	
	DJS23SLPE712	AI in Healthcare Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	--	25	25	50	1	
	DJS23SCPE713	Reinforcement and Federated Learning	3	--	--	3	2	60	--	--	--	60	15	15	10	40	--	40	100	3	
3	DJS23SLPE713	Reinforcement and Federated Learning Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	--	25	25	50	1	4
	DJS23SCPE714	Knowledge Graph Based Neural Networks	3	--	--	3	2	60	--	--	--	60	15	15	10	40	--	40	100	3	
	DJS23SLPE714	Knowledge Graph Based Neural Networks Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	--	25	25	50	1	
	DJS23SCPE715	Agentic AI	3	--	--	3	2	60	--	--	--	60	15	15	10	40	--	40	100	3	
4	DJS23SLPE715	Agentic AI Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	--	25	25	50	1	4
	DJS23SCPE716	Quantum Computing	3	--	--	3	2	60	--	--	--	60	15	15	10	40	--	40	100	3	
	DJS23SLPE716	Quantum Computing Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	--	25	25	50	1	
	DJS23SCMD701	IoT and Fog Computing	2	--	--	2	2	60	--	--	--	60	15	15	10	40	--	40	100	2	
5	DJS23SLMD701	IoT and Fog Computing Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	--	25	25	50	1	3
	DJS23ITELX12	Research Ecosystem	--	--	2	2	--	--	--	--	--	--	--	--	--	--	50	50	50	2	
	DJS23IPELX13	Major Project	--	8	--	4	2	--	--	--	--	50	--	--	--	--	50	50	100	4	
6	DJS23SCSC701	Leading Projects to Successful Completion	1	--	--	1	--	--	--	--	--	15	15	10	40	--	40	40	1	1	
7	DJS23CHSX11	Disaster Management and Preparedness	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3
	DJS23SCPE811	High Performance Computing	3	--	--	3	2	60	--	--	200	200	15	15	10	40	40	100	3		
	DJS23SCPE812	Probabilistic Graph Models																			
8	DJS23SCPE813	Social Media Analytics																			
9	DJS23IPELX14	Internship (OJT) cum Project	--	36	--	18	2	--	--	--	200	--	--	--	--	--	400	400	600	18	18
10	DJS23SCSC801	AI Enabled Project Management	1	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
11		Total	18	50	3	44	20	300	75	--	250	625	105	105	70	280	600	880	1505	44	44

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Continuous Assessment (A):

Course	Assessment Tools	Marks	Time (mins)
Theory	a. Term Test 1 (based on 40 % syllabus)	15	60
	b. Term Test 2 (on next 40 % syllabus)	15	60
	c. Assignment / course project / group discussion / presentation / quiz/ any other.	10	--
	Total marks (a + b + c)	40	--
Audit course	Performance in the assignments / quiz / power point presentation / poster presentation / group project / any other tool.	--	As applicable
Laboratory	Performance in the laboratory and documentation.	25	
Tutorial	Performance in each tutorial and /or assignment.	25	
Laboratory and Tutorial	Performance in the laboratory and tutorial.	50	

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work

Semester End Assessment (B):

Course	Assessment Tools	Marks	Time (hrs.)
Theory /	Written paper based on the entire syllabus.	60	2
*Computer based	* Computer-based assessment in the college premises.		
Oral	Questions based on the entire syllabus.	25	As applicable
Practical	Performance of the practical assigned during the Examination and the output / results obtained.	25	2
Oral and Practical	Project based courses - Performance of the practical assigned during the examination and the output / results obtained. Based on the practical performed during the Examination and on the entire syllabus.	As per the scheme	2

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Program: Artificial Intelligence (AI) and Data Science Final Year B.Tech. Semester: VII/VIII
Course: Data Ethics (DJS23SCPC701)
Course: Data Ethics Tutorial (DJS23STPC701)

Prerequisite: Basic knowledge of Computer Fundamentals, Data Science/Artificial Intelligence concepts, Cyber Security fundamentals, and awareness of social and ethical implications of digital technologies.

Course Objectives: The objectives of the course are

1. To understand the fundamental principles and significance of data ethics in technology and its impact on individuals and society.
2. To analyze ethical frameworks and apply them to resolve data-related dilemmas in various real-world scenarios.
3. To examine ethical challenges posed by data-driven business models and emerging technologies.
4. To explore privacy laws, data governance practices, and strategies to ensure responsible data handling and secure data storage.
5. To develop critical awareness of bias in algorithms and data, and the need for fairness, transparency, and accountability in data science practices.

Course Outcomes: Students will be able to,

1. Articulate the importance of ethical considerations in data practices and the implications of ethical lapses.
2. Apply ethical theories and frameworks to address data-related ethical challenges in diverse scenarios.
3. Identify sources of bias in algorithms and datasets, and use appropriate techniques to mitigate them.
4. Demonstrate an understanding of privacy laws, data governance, and the ethical obligations associated with data security.
5. Integrate data ethics principles into data-driven business practices enhancing digital trust and responsible data use.
6. Understand data governance principles, tools, and business value through case studies like the VW emissions scandal.

Data Ethics (DJS23SCPC701)		
Unit No.	Description	Duration
1	Introduction to Data Ethics: Overview and Importance of Data Ethics. The significance of data ethics in modern technology, its impact on individuals and society. Historical Examples of Data Ethics Violations: A historical perspective on data ethics violations, such as data breaches and misuse of data. Consequences of ethical lapses and their implications for technology and society. Overview of Ethical Theories: Exploration of ethical theories, including utilitarianism, deontology, virtue ethics, and their application in data ethics. Applying Ethical Frameworks to Data-Related Dilemmas Practical application of ethical frameworks to analyse and address data-related ethical dilemmas. Case Study: Facial recognition technology by the New York Police Department (NYPD) in the wake of protests of police brutality and racial injustice in 2020.	07
2	Data-driven Business Model: Data as payment, good data, Data at risk, Data brokers in a grey area, a need for new business models, Needs of customers: general concern for digital surveillance, targeted ads and prices, demand for data control, act, consumers cookies and using VPM, false data on the rise, obfuscation, from lack of knowledge to resignation, pay for privacy, Best	08

	practices for data ethics, Emerging Technologies and Ethical Challenges, Examination of ethical challenges posed by emerging technologies like AI, IoT, and blockchain. Case Study: COVID-19 Vaccine Distribution and Equity, ethical dilemmas in cutting-edge projects	
3	Bias and Analysis: Introduction and Importance of Algorithm Fairness, the reasons for unfairness, Analyzing and measuring unfairness, Sources of Bias, Dealing with 04 Bias, Mitigating Bias , Further Considerations, addressing different types of bias, Examples, causes and detection strategies of algorithmic biases, Detecting and Addressing Bias in Data and Algorithms, Understanding the types of bias in data and algorithms (selection bias and algorithmic bias), Techniques and tools for identifying and mitigating bias in data-driven projects Case Studies: Aequitas - A Toolkit for Auditing Bias and Fairness in Machine Learning Models.	08
4	Data Privacy: Data Privacy and Legal Frameworks, Data Privacy Laws and Regulations, GDPR, CCPA, and HIPAA, Understanding the key principles and requirements of privacy laws, Data commodification's, examples of companies complying with or violating data privacy regulations, Data Collection and Storage Ethics Considerations for ethical data collection methods, including informed consent, data minimization, and transparency, Exploring fairness in machine learning models and algorithmic transparency Data Storage and Secure Handling: Encryption, and data handling protocols, Strategies for ensuring data security and integrity, Cybersecurity and Data Breaches, Handling Data Breaches Responsibly, Ethical and legal obligations following a data breach, including incident response and notification procedures. Case studies: Facebook's Data Privacy Controversies, Ethical data collection in various contexts.	08
5	Data Ethics and Trust: Introduction to digital trust, the snowden effect, the sharing economy, ethical data use, sharing and access, ethical considerations when sharing data with partners, stakeholders, and the public, Strategies for ensuring responsible data sharing and access Best Practices for Responsible Data Use, Strategies for integrating data ethics into professional practices, software development, system design, and decision-making processes. Case studies: Real-world examples of organizations implementing responsible data use practices. Ethics in Generative AI: Ethical Challenges in Generative AI, Responsible and Trustworthy AI, Case Study: Ethical challenges of generative AI and deepfake technologies, including misinformation, copyright, and identity misuse.	07
6	Data Governance and Regulation: Introduction to Data Governance, Importance of Governance, Examples of Data Governance in action, The Business value of Data Governance, why data Governance is easier in the public cloud, Ingredients of Data Governance: Tools Case studies: The Volkswagen (VW) emissions scandal.	04
Total		42

List of Tutorials:

1. Choose a real-world scenario related to social media, healthcare, education, or any other domain where data is collected, analyzed and used. Write a report that addresses the following questions:
 1. What are the ethical implications of data collection in this scenario?
 2. Who are the stakeholders and what are their interests?
 3. What are the potential consequences of data use in this scenario?
2. Choose a real-world scenario related to social media, healthcare, education, or any other domain where data is collected, analyzed and used. Write a report that addresses the following questions:
 1. Who might be harmed and who might benefit?
 2. What ethical principles should guide the collection, analysis, and use of data in this scenario?
3. Choose a real-world scenario related to social media, healthcare, education, or any other domain where data is collected, analyzed and used. Write a report that addresses the following questions:
 1. How can these principles be implemented in practice?
 2. What are your recommendations for improving the ethical considerations in data collection, analysis, and use in this scenario?
4. What are the potential sources of bias in data analysis and how can they be mitigated?
5. Discuss the challenges and opportunities of implementing thrust in practice, including the role of regulations, ethical frameworks, and stakeholder engagement. Provide examples of organizations that have demonstrated thrust in their data practices and analyse the impact of their actions on society.
6. Research and analyze the different types of data governance and regulation frameworks that exist (e.g. GDPR, CCPA, HIPAA, etc.)
7. Research and analyze recent data privacy violations and their impact on individuals and society (e.g. Facebook-Cambridge Analytic scandal, Equifax data breach, etc.)
8. Case Study : Ethical challenges of deepfake technologies and AI-generated misinformation
Real-world examples of responsible and unethical use of Generative AI

Minimum 8 Tutorials from the above suggested list or any other tutorials based on syllabus will be included, which would help the learner to apply the concept learnt.

Textbooks:

1. Christoph Stuckelberger, Pavan Duggal, "Data Ethics: Building Trust: How Digital Technologies Can Serve Humanity", Globethics Publications, 1st Edition, 2023.
2. Gry Hasselbalch & Pernille Tranberg, "Data Ethics, PubliShare", 1st Edition, 2016.

Reference Books:

1. Ian Foster, Rayid Ghani, Ron S. Jarmin, Frauke Kreuter, Julia Lane, "Big Data and Social Science: Data Science Methods and Tools for Research and Practice", Chapman and Hall/CRC, 2nd Edition, 2020.
2. Evren Eryurek, Uri Gilad, Valliappa Lakshmanan, "Data Governance: The Definitive Guide - People, Processes, and Tools to Operationalize Data Trustworthiness", Shroff/O'Reilly, 1st Edition, 2021.
3. Loukides, Mike, Hilary Mason, and DJ Patil. 2018. "Ethics and Data Science. Sebastopol", CA: O'Reilly Media, Doing Good Data Science.
4. Sandvig, Christian, Kevin Hamilton, Karrie Karahalios, and Cedric Langbort. (2014). "Auditing Algorithms: Research Methods for Detecting Discrimination on Internet Platforms." Computational Culture.
5. Ananny, Mike. 2016. "Toward an Ethics of Algorithms: Convening Observation, Probability, and Timeliness. Science", Technology, & Human Values 41(1):93117.



Web Links:

1. An introduction to data ethics and responsible AI - ODI Learning: <https://learning.theodi.org/courses/introduction-to-data-ethics>.
2. Data Ethics 101 - DATAVERSITY: <https://www.dataversity.net/articles/data-ethics-101-2/>.
3. An Introduction to Data Ethics - Markkula Center for Applied Ethics : An Introduction to Data Ethics - Markkula Center for Applied Ethics.
4. An Introduction to Data Ethics: What is the Ethical Use of Data? | DataCamp : <https://www.datacamp.com/blog/introduction-to-data-ethics>.
5. An Introduction to Data Ethics - Markkula Center for Applied Ethics: <https://www.scu.edu/ethics/focus-areas/technology-ethics/resources/an-introduction-to-data-ethics/>.

Online Resources:

1. Ethics in Data Science: <https://www.analyticsvidhya.com/blog/2022/02/ethics-in-data-science-and-proper-privacy-and-usage-of-data/>.
2. Business Insights Harvard: <https://online.hbs.edu/blog/post/data-ethics>.
3. Data Science Professionals: <https://emeritus.org/blog/data-science-and-analytics-data-science-course-curriculum/Suggested-List-of-Experiments>.

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Program: Artificial Intelligence (AI) and Data Science **Final Year B.Tech.**

Semester: VII/VIII

Course: Explainable AI (DJS23SCPE711)

Course: Explainable AI Laboratory (DJS23SLPE711)

Prerequisite: Machine Learning, Deep Learning, Python Programming, AI

Course Objectives: The objectives of the course are

1. To understand how to explain machine learning models with various techniques
2. To familiarize concepts related to Explainable Artificial Intelligence (XAI) and interpretable methods, with emphasis on how to build a trustworthy AI system
3. To understand the performance of a machine learning model and its ability to produce explainable and interpretable predictions

Course Outcomes: Students will be able to

1. Explain the concept and importance of explainable AI.
2. Compare Interpretability and Explainability in Machine Learning Models.
3. Apply XAI Techniques on Machine Learning Models.
4. Evaluate the Interpretability and Trustworthiness of AI Models.
5. Explain the Role of Attention Mechanisms and Feature Visualization in Deep Learning Models.
6. Apply XAI Techniques in Healthcare and Autonomous Systems.

Explainable AI (DJS23SCPE711)

Unit No.	Description	Duration
1	Introduction to Explainable AI Explainability, Fundamentals of XAI, Categorization of XAI , Taxonomy of XAI methods for Machine Learning, Machine Learning Interpretability, Causal Model Induction ,Causality learning ,XAI techniques and limitations	06
2	Interpretability Difference between Interpretability and Explainability Interpretability methods to explain Black-Box Model, Scope of Interpretability, Apply interpretability on Regression, Logistic regression, Generalized Additive Models, Decision Tree, Neural network interpretation, Evaluation of Interpretability	07
3	Deep Explanation Attention Mechanisms, Modular Networks, Feature Identification, Learn to Explain Feature Visualization, Deep Visualization gradcam and Activation maps, Sensitivity analysis	06
4	XAI Model and Methods Ante-hoc Explainability (AHE) models, Post-hoc Explainability (PHE) models, Interactive Machine Learning (IML),Black Box Explanation through Transparent Approximation (BETA) models, Hybrid Models. XAI Techniques, Local Interpretable Model Agnostic Explanations (LIME), Understanding Mathematical representation of LIME, Shapley Additive exPlanations (SHAP), Diverse Counterfactual Explanations (DiCE) , Layer wise Relevance Propagation (LRP), Working and principal of Contrastive Explanation Method (CEM)	09

5	Building Trustworthy Model with Explainable AI Metrics to evaluate XAI, Trustworthy Explainability Acceptance, Power Quality Disturbance (PQD) classification, Methods for measuring human intelligence. Evaluating AI system. Medical diagnosis- Making AI Decisions Trustworthy for Physicians and Patients ,Sales predictions on the house sale	07
6	Applications Application of XAI in Healthcare, Explainable AI Driven Applications for Patient Care and Treatment, Explainable Machine Learning for Autonomous Vehicle Positioning Using SHAP	07
Total		42

List of Experiments:

1. Explore how different types of machine learning models (e.g., decision trees, random forests, neural networks) provide different levels of interpretability and explainability.
2. Train a linear regression model and apply coefficients interpretation.
3. Implement a Generalized Additive Model (GAM) for regression and interpret the individual feature effects using partial dependence plots (PDP).
4. Apply sensitivity analysis to a trained model (e.g., random forest or neural network) to identify the most influential features in prediction outcomes.
5. Apply LIME to interpret local model decisions and visualize results.
6. Use SHAP to explain global and local predictions and analyze feature importance.
7. Apply DiCE to generate counterfactual explanations for a black-box model (e.g., customer churn prediction)
8. Test a Power Quality Disturbance (PQD) classification model and evaluate its performance using trustworthiness metrics
9. Use SHAP or LIME to explain the model's predictions and evaluate its trustworthiness for use by financial analysts and investors.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Textbooks:

1. Molnar, Christoph. "Interpretable machine learning. A Guide for Making Black Box Models Explainable", 2019. <https://christophm.github.io/interpretable-ml-book/>.
2. Explainable Artificial Intelligence: An Introduction to Interpretable Machine Learning, Uday Kamath: John Liu, Springer.

Reference Books:

1. "Explanation in Artificial Intelligence" by Tim Miller, arXiv, 2017
2. "Explainable Artificial Intelligence (XAI) in Biomedicine: Making AI Decisions Trustworthy for Physicians and Patients" by Lötsch, J.; Kringel, D.; Ultsch, A., BioMedInformatics, 2022
3. "A Guide for Making Black-Box Models Interpretable" by Christoph Molnar, GitHub Pages, 2020

Web Links:

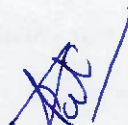
1. <https://arxiv.org/pdf/1902.03076>
2. <https://christophm.github.io/interpretable-ml-book/>
3. <https://arxiv.org/abs/1610.02391>

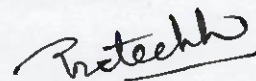
Online Resources:

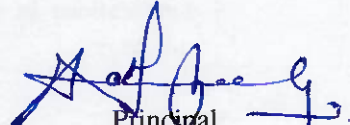
1. Explainable AI: Interpreting Machine Learning Models Explainable AI: Interpreting Machine Learning Models - Coursera
2. AI in Healthcare: Using Machine Learning AI in Healthcare: Using Machine Learning - Coursera
3. Explainable AI - XAI
4. Explainable AI with Python-XAI using Python




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Program: Artificial Intelligence (AI) and Data Science

Final Year B.Tech.

Semester: VII/VIII

Course: AI in Healthcare (DJS23SCPE712)

Course: AI in Healthcare Laboratory (DJS23SLPE712)

Prerequisite: Fundamentals of Machine Learning and Artificial Intelligence, Understanding of Deep Learning and Neural Networks.

Course Objectives: The objective of the course is,

1. To understand the fundamentals of AI and its applications in healthcare.
2. To explore various AI techniques such as machine learning, deep learning, and natural language processing (NLP) in healthcare.
3. To analyze and work with healthcare data, including electronic health records, imaging data, and genetic information.
4. To develop AI models to assist in diagnosis, treatment planning, and patient monitoring.
5. To understand ethical, privacy, and regulatory considerations in applying AI to healthcare.

Course Outcomes: Students will be able to

1. Explain and compare major healthcare data types and evaluate their quality, privacy requirements, and ethical/regulatory constraints.
2. Implement and evaluate appropriate machine-learning methods for predictive tasks in healthcare, reporting model performance with suitable clinical metrics.
3. Design deep learning models for disease classification, segmentation, and outcome prediction.
4. Explain AI innovations in personalized medicine, drug discovery, remote monitoring, and healthcare operations
- 5.

AI in Healthcare (DJS23SCPE712)

Unit	Description	Duration
1	Introduction to AI in Healthcare: Overview of AI in Healthcare: Historical perspective, Types of AI systems in healthcare, Role of AI in healthcare transformation Key Healthcare Domains for AI Applications: Medical imaging, Diagnostics, Drug discovery, Personalized medicine Introduction to Healthcare Data: Electronic Health Records (EHR), Medical imaging data (X-rays, MRIs, CT scans), Genomics and clinical trial data Challenges in Healthcare Data: Data variability, noise, and incompleteness, Data privacy and security concerns, Regulatory constraints.	05
2	Machine Learning in Healthcare: ML techniques for classification, regression, clustering, and time-series analysis; Predictive analytics and clinical decision support systems; Model evaluation metrics (accuracy, AUC, sensitivity, specificity). Use cases: Predictive analytics, clinical decision support systems	09
3	Deep Learning in Healthcare: Introduction to Deep Learning Architectures: Convolutional Neural Networks (CNNs) for medical imaging, Recurrent Neural Networks (RNNs) for time-series health data, Autoencoders for anomaly detection Applications in Medical Imaging: Image classification, segmentation, and detection in radiology	08

4	Natural Language Processing (NLP) in Healthcare: Information extraction from medical literature and EHRs (tokenization, NER, topic modeling), NLP applications: Chatbots, virtual assistants, voice recognition, Clinical decision support using NLP	08
5	AI Ethics, Privacy, and Regulations in Healthcare: Ethical Considerations in AI for Healthcare: Bias in AI models and its implications, AI decision-making in healthcare Privacy and Security in Healthcare AI: Handling sensitive healthcare data, Regulations: HIPAA, GDPR, and their implications for AI Regulatory Aspects and AI Approval: AI in clinical trials and FDA approvals	07
6	Emerging Trends of AI in Healthcare: Wearable AI and Remote Monitoring: AI for patient monitoring using IoT and wearables. AI in Robotics and Surgery: AI-assisted surgeries, robotic platforms, and automation. Telemedicine and AI Integration: AI-driven remote consultations and diagnostics. AI in Drug Discovery and Personalized Medicine: Computational drug discovery; AI-based genomic analysis; Predicting therapy responses; Tailored treatment planning; Case studies.	05
	Total	42

List of Experiments:

1. Perform data preprocessing (cleaning, normalization) on an EHR dataset.
2. Implement classification models (e.g., Decision Trees, Random Forest) to predict disease outcomes using structured healthcare data.
3. Implementing clustering techniques for patient segmentation.
4. Building a CNN model for image classification (e.g., X-ray, MRI).
5. Implement U-Net or similar architecture for segmentation of medical images (e.g., tumor localization).
6. Transfer learning using pre-trained CNNs for medical imaging.
7. Use NLP techniques to extract insights from clinical notes or research papers.
8. Implement Named entity recognition in clinical notes.
9. Evaluating model fairness and bias in healthcare AI models.
10. Analysing privacy concerns in healthcare datasets and applying data anonymization techniques.
11. Mini Project

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt

Textbooks:

1. Artificial Intelligence in Healthcare by Adam Bohr and Kaveh Memarzadeh, Elsevier Science & Technology, First Edition, 2020.
2. Machine Learning for Healthcare by Jyoti Kataria and Ashwani Kumar, Lambert Academic Publishing, First Edition, 2023.
3. Clinical Natural Language Processing by Zhonghua Wang, Scott Poon, and Andrew Taylor, Academic Press, First Edition, 2022.
4. Ethics of Artificial Intelligence and Robotics by Vincent C. Müller, Stanford Encyclopedia of Philosophy, Summer Edition, 2020
5. The AI Revolution in Healthcare: Transforming the Future, Sharma Karuna., eBookIt.com 2024
6. Machine learning and AI for healthcare : Big data for improved health outcomes, Arjun Panesar, Apress, Second Edition, 2021

Reference Books:

1. Machine Learning and Deep Learning Techniques for Medical Image Recognition, Ben Othman Soufiene, Chinmay Chakraborty, CRC Press, 2023
2. Data Science in the Medical Field, Seifedine Kadry, Shubham Mahajan, Academic Press, First Edition, 2024
3. Artificial Intelligence in Brain and Mental Health: Philosophical, Ethical & Policy Issues, Fabrice Jotterand, Marcello Ienca, Springer International Publishing, 2022
4. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again by Eric Topol, Basic Books, First Edition, 2019.
5. Healthcare Data Analytics by Chandan K. Reddy and Charu C. Aggarwal, CRC Press, First Edition, 2015.
6. Artificial Intelligence in Behavioral and Mental Health Care edited by David D. Luxton, Academic Press, First Edition, 2015.

Web Links:

1. IBM in India: <https://www.ibm.com/in-en>
2. Mayo Clinic Press: <https://mcpress.mayoclinic.org/>
3. National Institutes of Health (NIH): National Institutes of Health (NIH) | Turning Discovery Into Health
4. PubMed Biomedical Research Database: <https://pubmed.ncbi.nlm.nih.gov/>

Online Resources:

1. Introduction to AI in Healthcare: Coursera: AI for Medicine Specialization
<https://www.coursera.org/specializations/ai-healthcare>
2. Artificial Intelligence in Healthcare: From Data to Decision
<https://www.udemy.com/course/artificial-intelligence-in-healthcare-from-data-to-decision>
3. Deep Learning for Medical Imaging: Fast.ai Course on Deep Learning, RSNA AI Challenge for Radiology
<https://www.rsna.org/ai-certificate>
4. NLP in Healthcare: Coursera: NLP Specialisation
<https://www.coursera.org/specializations/natural-language-processing>
5. NLP in Healthcare: Google Cloud NLP in Healthcare
<https://cloud.google.com/blog/topics/healthcare-life-sciences>

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Program: Artificial Intelligence (AI) and Data Science Final Year B.Tech. Semester: VII/VIII
Course: Reinforcement Learning and Federated Learning (DJS23SCPE713)
Course: Reinforcement Learning and Federated Learning Laboratory (DJS23SLPE713)

Prerequisite: Machine Learning, Knowledge of Probability, Linear Algebra, and Calculus, Python programming and deep learning frameworks (TensorFlow / PyTorch).

Course Objectives: The objectives of the course are

1. Introduce the fundamental principles and algorithms of Reinforcement Learning (RL).
2. Explain the mathematical foundations underlying Markov Decision Processes (MDP) and dynamic programming.
3. Explore Monte Carlo methods, Temporal Difference learning, and Policy Gradient techniques.
4. Provide an understanding of Federated Learning (FL) architecture, algorithms, and privacy-preserving mechanisms.
5. Enable students to implement RL and FL algorithms using Python and open-source frameworks for real-world applications.

Course Outcomes: Students will be able to,

1. Explain the concepts of reinforcement learning and Markov decision processes.
2. Apply dynamic programming, Monte Carlo, and temporal-difference methods to learning problems.
3. Analyze and implement value-based and policy-based reinforcement learning algorithms.
4. Design and train deep reinforcement learning models using frameworks such as TensorFlow or PyTorch.
5. Explain and implement federated learning architectures for distributed AI model training.
6. Evaluate the performance, privacy, and communication trade-offs in federated learning systems.

Reinforcement Learning and Federated Learning (DJS23SCPE713)

Unit No.	Description	Duration
1	Introduction to Reinforcement Learning: Learning paradigms: Supervised, Unsupervised, Reinforcement. Elements of reinforcement learning: Agent, Environment, Rewards, States, Actions. History and applications of RL (Games, Robotics, Recommenders). Mathematical foundations: Rewards, returns, discounting, value functions. Markov Decision Processes (MDPs).	07
2	Dynamic Programming and Planning: Policy evaluation and improvement. Value iteration and policy iteration. Generalized Policy Iteration (GPI). Applications and convergence issues.	06
3	Model-Free Prediction and Control: Monte Carlo methods: Policy evaluation, control, exploration vs. exploitation. Temporal Difference (TD) Learning: TD (0), SARSA, Q-Learning. On-policy vs. off-policy learning. Eligibility traces and n-step bootstrapping.	09
4	Deep Reinforcement Learning: Function approximation and deep Q-networks (DQN). Experience replay and target networks. Policy gradient methods: REINFORCE algorithm. Actor-Critic methods. Case studies: Game-playing agents, robotics, and navigation tasks.	08

5	Federated Learning Fundamentals: Motivation and need for distributed ML. Federated Learning architecture: Clients, server, and communication protocols. Federated Averaging (FedAvg) algorithm. Data heterogeneity and communication challenges. Case studies: Edge AI, mobile learning, IoT applications.	07
6	Privacy, Security, and Applications in FL: Differential privacy and secure aggregation. Challenges: Communication efficiency, adversarial attacks. Benchmark frameworks: TensorFlow Federated, PySyft. Real-world use cases: Healthcare, finance, and personalized AI.	05
Total		42

List of Experiments:

1. Introduction to Reinforcement Learning Environment (OpenAI Gym setup).
2. Implement discounted reward, return, and value function calculations. (Python, NumPy).
3. Implement a simple MDP and visualize transitions. (Python, Matplotlib).
4. Implement iterative policy evaluation using Bellman expectation equations. (Python, Numpy).
5. Implement Monte Carlo Prediction and Control for a small environment.
6. Implement TD Learning (SARSA and Q-Learning) on a GridWorld environment.
7. Comparison of On-policy and Off-policy learning methods.
8. Develop a Deep Q-Network (DQN) using PyTorch/TensorFlow
9. Implement Policy Gradient and REINFORCE algorithm. Actor-Critic model implementation on a continuous control problem.
10. Actor-Critic model implementation on a continuous control problem.
11. Introduction to Federated Learning framework (TensorFlow Federated / PySyft).
12. Use federated transfer learning when clients have different feature spaces or label spaces using PyTorch/TensorFlow, heterogeneous datasets (e.g., MNIST & SVHN or image + tabular splits)
13. Implement Federated Averaging (FedAvg) algorithm for MNIST dataset.
14. Evaluate privacy-preserving mechanisms (Differential Privacy in FL).
15. Mini Project: RL or FL case study (game agent, edge AI, or personalized model).

Minimum 8 experiments from the above suggested list or any other experiments based on syllabus will be included, which would help the learner to apply the concept learnt.

Textbooks:

1. Saravanan Krishnan, A. Jose Anand, R. Srinivasan, R. Kavitha, S. Suresh, "Handbook on Federated Learning: Advances, Applications and Opportunities", CRC Pr I Llc, 2025.
2. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", MIT Press, 2nd Edition, 2020.
3. Laura Graesser Wah Loon Keng, "Foundations of Deep Reinforcement Learning," Pearson Education, 1st, Edition, 2020.
4. Jakub Konečný et al., Federated Learning: Strategies for Improving Communication Efficiency, arXiv preprint, 2016
5. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.

Reference Books:

1. Qiang Yang, Yang Liu, "Federated Learning", Springer / BSP Books, 1st Edition, 2025.
2. George Jeno, "Federated Learning with Python: Design and implement a federated learning system and develop applications using existing frameworks" Packt Publishing, 1st Edition, 2022.
3. Phil Winder, "Reinforcement Learning Industrial Applications of Intelligent Agents", O'Reilly, 1st Edition, 2020.
4. Csaba Szepesvari, "Algorithms for Reinforcement Learning," Morgan & Claypool Publishers, 1st Edition, 2019.
5. Enes Bilgin, "Mastering Reinforcement Learning with Python", Packt publication, 1st Edition, 2020.
6. Brandon Brown, Alexander Zai, "Deep Reinforcement Learning in Action", Manning Publications, 1st, Edition, 2020.
7. Micheal Lanham, "Hands-On Reinforcement Learning for Games," Packt Publishing, 1st Edition, 2020.
8. Abhishek Nandy, Manisha Biswas, "Reinforcement Learning: With Open AI, TensorFlow and Keras using Python," Apress, 1st Edition, 2018.

Web Links:

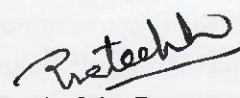
1. NPTEL Course in Reinforcement Learning: https://onlinecourses.nptel.ac.in/noc22_cs75/preview
2. Reinforcement Learning Course (Stanford University): <https://www.youtube.com/watch?v=FgzM3zpZ55o>
3. AI Games with Deep Reinforcement Learning: <https://towardsdatascience.com/how-to-teach-an-ai-to-play-games-deep-reinforcement-learning-28f9b920440a>
4. Deep Reinforcement Learning: <https://www.v7labs.com/blog/deep-reinforcement-learning-guide>
5. TensorFlow Federated documentation: <https://www.tensorflow.org/federated>
6. OpenAI Gym documentation: <https://gym.openai.com>
7. Federated Learning [What Is Federated Learning? | IBM](#)
8. Federated Learning <https://blogs.nvidia.com/blog/what-is-federated-learning/>
9. Federated Learning [8 Innovative applications of federated learning across the globe - OpenSistemas](#)

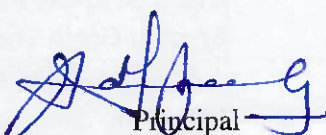
Online Resources:

1. Federated Learning: <https://www.deeplearning.ai/short-courses/intro-to-federated-learning/>
2. Reinforcement Learning : <https://www.coursera.org/courses?query=reinforcement%20learning>


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Head of the Department


Principal

Program: Artificial Intelligence (AI) and Data Science Final Year B.Tech. Semester: VII/VIII

Course: Knowledge Graph based Neural Network (DJS23SCPE714)

Course: Knowledge Graph based Neural Network Laboratory (DJS23SLPE714)

Prerequisite: Mathematics and Graph Theory, Machine Learning Fundamentals, Data Structures and Algorithms.

Course Objectives: The objectives of the course are

1. To understand Graph Fundamentals.
2. To understand and explore Knowledge Graphs.
3. To understand Graph Neural Networks.
4. To design, and implement Knowledge Graphs (KGs) and Graph Neural Networks (GNNs) for advanced AI applications.

Course Outcomes: Students will be able to

1. Understand graph theory fundamentals, knowledge representation models (RDF, OWL), and semantic computing principles.
2. Construct and Query Knowledge Graphs.
3. Apply Graph Embedding's.
4. Develop Graph Neural Network Models.
5. Integrate KGs with NLP and LLMs.
6. Analyze Explainability and Future Trends.

Knowledge Graph based Neural Network (DJS23SCPE714)

Unit No.	Description	Duration
1	Foundations of Knowledge Graphs: Graph Representations: Adjacency Matrix, Edge List, Types of Graphs: Directed, Undirected, Multi-Graphs, Definition Knowledge Graphs, Differences between KGs, Ontologies, and Relational Databases, Triple-Based Representation (Subject, Predicate, Object).	06
2	Querying and Constructing Knowledge Graphs : Graph Query Languages, SPARQL for RDF-based KGs, Cypher Query Language for Graph Databases Building Knowledge Graphs, Using Neo4j, RDF4J, ArangoDB, Constructing a KG from structured & unstructured data, Knowledge Graph Embeddings Introduction to Graph Embeddings, TransE, TransH, TransR, ComplEx, Rotate.	08
3	Graph Neural Networks (GNNs) - Introduction and Foundations: Graph Neural Networks, Limitations of classical deep learning on graphs, How GNNs generalize CNNs & RNNs for graphs Mathematical Foundations of GNNs ,Graph Laplacian and Spectral Graph Theory, Node Feature Aggregation & Message Passing Types of GNNs.	07
4	Advanced GNN Architectures and Optimization: Deep GNN Architectures Graph Recurrent Networks (GRNs),Graph Transformers and Attention-Based GNNs, Optimization & Scalability in GNNs, Mini-batching for Large Graphs, Regularization	07

Web Links:

1. Neo4j Documentation – <https://neo4j.com/docs/>
2. PyTorch Geometric Official Documentation – <https://pytorch-geometric.readthedocs.io/en/latest/>
3. SPARQL 1.1 Query Language Specification – <https://www.w3.org/TR/sparql11-query/>
4. RDF (Resource Description Framework) Overview – <https://www.w3.org/2001/sw/wiki/RDF>
5. Linked Data Principles by W3C – <https://www.w3.org/DesignIssues/LinkedData.html>

Online Resources:

1. Edinburgh University KG Course – <https://opencourse.inf.ed.ac.uk/kg/course-materials/schedule>
2. Coursera: Knowledge Graphs for RAG – <https://www.coursera.org/projects/knowledge-graphs-rag>
3. IISc Graph Neural Networks Course – https://sml.csa.iisc.ac.in/Courses/Spring19/E0_270/Presentations/Graph_Neural_Networks.pdf
4. Udemy: Graph Neural Networks – <https://www.udemy.com/course/graph-neural-network/>
5. USC Course on Knowledge Graphs – <https://web-app.usc.edu/soc/syllabus/20203/32424.pdf>

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Program: B. Tech in Artificial Intelligence (AI) and Data Science Final Year B. Tech Semester: VII/VIII

Course: Agentic AI (DJS23SCPE715)

Course: Agentic AI Laboratory (DJS23SLPE715)

Prerequisite: Natural Language Processing, Large Language Models

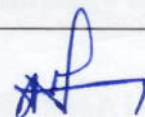
Course Objectives: The Objectives of course are

1. To understand the evolution from Generative AI to Autonomous Agentic Systems.
2. Design and develop autonomous AI agents using modern frameworks.
3. Build tool-augmented and workflow-driven AI systems.
4. To implement Agentic RAG architectures for dynamic, context-aware information retrieval.
5. To develop collaborative Multi-Agent Systems (MAS) using AutoGen and CrewAI.
6. Deploy, monitor, and evaluate AI agents using LLM Ops and AgentOps practices.

Course Outcomes: Students will be able to

1. Design agentic architectures using patterns like Reflection, Tool-use, and ReWOO.
2. Develop workflow-driven autonomous AI agents and prompt techniques using LangChain and LangGraph.
3. Build AI agents integrated with tools, APIs, and memory systems.
4. Implement Agentic RAG applications using vector databases and retrieval pipelines.
5. Develop collaborative multi-agent systems using AutoGen and CrewAI.
6. Deploy, monitor, and evaluate AI agents using AgentOps and observability tools.

Agentic AI (DJS23SCPE715)		
Unit	Description	Duration
1	Foundations of Agentic AI and Autonomous Systems Evolution of Artificial Intelligence, Generative AI overview, Large Language Models recap Introduction to Agentic AI, Reactive AI vs Autonomous AI, Components of AI agents, Agent lifecycle and execution loop, Perception, cognition, planning, action, and learning, Human-in-the-loop systems, Agent Architectures and Design Patterns: Agent architectures and workflows, Reflection pattern, Tool-use pattern, Planning and execution pattern, ReAct (Reasoning and Acting), ReWOO (Reasoning without Observation), Collaborative agent systems AI reasoning and planning, Applications of Agentic AI, Challenges in autonomous systems.	06
2	Prompt Engineering and Reasoning for AI Agents Role-based prompting, Instruction-based prompting, Contextual prompting, Structured prompting, Advanced Reasoning Techniques: Prompt refinement and optimization, Prompt Templates and Dynamic Prompt Generation, Prompt Injection and Jailbreak Attacks, Hallucination reduction techniques, Prompt Evaluation and Testing, Prompt Evaluation and Testing.	05
3	Tool Calling and Agentic Workflows Introduction to Agentic workflows, Workflow modeling and orchestration, Tool calling and function calling concepts, API integration with AI agents, Model Context Protocol (MCP): Introduction, MCP Architecture, MCP Clients and Servers, Tool Discovery, Resource Access, MCP-based Agent Integration, Building MCP-enabled Agentic Workflows, Prompt chaining workflows, Sequential and parallel workflows, Routing and parallelization, Chaining agent memory (Chat Message History, Vector Memory), Task decomposition and planning, Reflection and autonomous decision making,	10



	Agentic Evaluator-Optimizer pattern, Agentic workflow orchestrator patterns, Building Agentic AI workflows with LangChain and LangGraph, Agentic state memory: short and long short term memory Introduction to LangGraph workflows.	
4	Agentic RAG Agentic RAG vs Traditional RAG, Working principle of Agentic RAG, Agentic RAG architecture and components, Limitations of standalone LLMs, Embeddings and semantic search, Vector databases and similarity search, Chunking and retrieval pipelines, Variants of Agentic RAG, Knowledge Graphs in Agentic RAG systems, Applications, Agentic RAG with LlamaIndex, Introduction to CustomGPT.	07
5	Agent Development with AutoGen and CrewAI Autogen introduction, Roles and Conversation, Conversation patterns, Developing Autogen powered agents, CrewAI fundamentals, Task coordination and delegation, Supervisor-worker architecture, Multi-agent system with LangGraph: multi agent systems, workflows, collaboration, multiagent designs.	07
6	Deploying AI agents Introduction to LLM Ops and Agent Ops, AI agent deployment pipelines, Monitoring and observability using LangSmith, Prompt evaluation and benchmarking, Latency and cost optimization, Managing AI workflows, Implementing AI experimentation and Observability, Agent Evaluation Metrics, Task Success Rate, Tool Calling Accuracy, LLM-as-a-Judge, Human Evaluation, Cost and Latency Analysis, Agent Benchmarking, Observability and Monitoring	07
Total		42

List of Experiments

1. Implementing advanced prompt engineering techniques: Few-shot, Role-based, Chain-of-Thought, and ReAct prompting
2. Developing reasoning-enabled AI agents with Reflection and self-correction workflows
3. Building tool-augmented AI agents with calculator, search, and external API tools using LangChain
4. Designing Agentic workflows with prompt chaining, routing, and parallel execution using LangGraph
5. Implementing Agent memory using ChatMessageHistory and vector memory
6. Building autonomous AI workflows with Evaluator-Optimizer and orchestration patterns
7. Developing Retrieval-Augmented Generation (RAG) applications with embeddings and vector databases
8. Building an Agentic RAG-based PDF Question Answering system using LlamaIndex
9. Building AI agents with Knowledge Graph-based retrieval and semantic reasoning
10. Developing multi-agent collaborative systems using AutoGen
11. Implementing task coordination and workflow automation using CrewAI
12. Deploying, monitoring, and evaluating AI agents using FastAPI, Streamlit, and LangSmith
13. Mini Project

Minimum eight experiments from the above-suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Textbooks:

1. Mastering AI Agents: From Design to Deployment of Autonomous Systems by Elbert Gale; January 18, 2025;

Textbooks:

1. Mastering AI Agents: From Design to Deployment of Autonomous Systems by Elbert Gale; January 18, 2025; ISBN-13: 979-8307403822
2. Building AI Agent: Learn Building AI Agents, A Practical Guide for Building Intelligent Agents by Natenapis Faraksa; March 2, 2024
3. Build Your Own AI Agent: A Hands-On Guide for Beginners by Sujai G Pillai; January 13, 2025; ISBN-13: 979-8306885971
4. Anjanava Biswas, Wrick Talukdar, Building Agentic AI Systems, April 2025, O'Reilly, Packt Publishing

Reference Books:

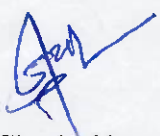
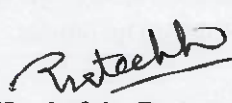
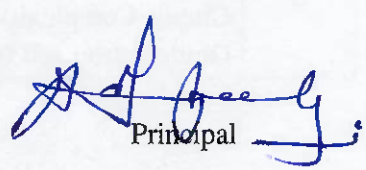
1. Dr. Ali Arsanjani, Juan Pablo Bustos, "Agentic Architectural Patterns for Building Multi-Agent Systems"
2. Eden Marco, Agentic Coding with Claude Code, March 2026, O'Reilly, Packt Publishing
3. Salvatore Raieli, Gabriele Iuculano, Building AI Agents with LLMs, RAG, and Knowledge Graphs.
4. Maria Johnsen, Agentic AI, January 2025, ISBN: 9798305569971

Web Links:

1. Multi Agent system with CrewAI: <https://learn.deeplearning.ai/courses/multi-ai-agent-systems-with-crewai/information>
2. AI agents in LangGraph: <https://learn.deeplearning.ai/courses/ai-agents-in-langgraph/information>
3. Agentic Prompt Engineering [GitHub - promptslab/Awesome-Prompt-Engineering](#): This repository contains a hand-curated resources for Prompt Engineering with a focus on Generative Pre-trained Transformer (GPT), ChatGPT, PaLM etc · [GitHub](#)
4. The Agentic AI Handbook: A Beginner's Guide to Autonomous Intelligent Agents <https://www.freecodecamp.org/news/the-agentic-ai-handbook/>

Online Resources:

1. Agentic AI with LangGraph, CrewAI, AutoGen and BeeAI:
<https://www.coursera.org/learn/agentic-ai-with-langgraph-crewai-autogen-and-beeai?msockid=36eb9fa2db8d63810443894ddaf86285>
2. Building AI Agents and Agentic Workflows Specialization:
<https://www.coursera.org/specializations/building-ai-agents-and-agentic-workflows>.
3. Agentic AI and AI Agents: A Primer for Leaders: <https://www.coursera.org/learn/agentic-ai>
4. Design, Develop, and Deploy Multi-Agent Systems with CrewAI:
<https://www.coursera.org/learn/design-develop-and-deploy-multi-agent-systems-with-crewai>


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Head of the Department
Principal

Program: Artificial Intelligence (AI) and Data Science Final Year B.Tech Semester: VII/VIII

Course: Quantum Computing (DJS23SCPE716)

Course: Quantum Computing Laboratory (DJS23SLPE716)

Prerequisite: Statistics for Data Science, and Machine Learning.

Course Objectives: The objectives of the course are

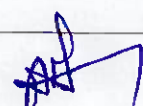
1. To develop a strong foundation in the mathematical and physical principles underlying quantum computing, including linear algebra, probability, and quantum mechanics.
2. To understand the representation, manipulation, and interaction of qubits using various quantum gates and circuits.
3. To explore fundamental quantum algorithms and their applications in computation, cryptography, and optimization.
4. To familiarize students with quantum communication protocols, error correction techniques, and emerging topics such as variation algorithms and quantum machine learning.

Course Outcomes: Students will be able to

1. Students will be able to apply linear algebra and quantum mechanics concepts to describe quantum states, superposition, and unitary evolution.
2. Students will be able to design and analyze quantum circuits using single and multi-qubit gates, including CNOT, Hadamard, and Toffoli gates.
3. Students will be able to implement and explain major quantum algorithms such as Deutsch–Jozsa, Shor’s, and Grover’s algorithms for computational problem-solving.
4. Students will be able to demonstrate understanding of quantum communication schemes such as BB84, quantum teleportation, and superdense coding.
5. Students will be able to analyze quantum error correction codes, fault-tolerant operations, and explore emerging paradigms like VQE, QAOA, and quantum machine learning.

Quantum Computing (DJS23SCPE716)

Unit No.	Description	Duration
1	Mathematical and Physical Foundations Linear Algebra for Quantum Computing: Vectors, Matrices, Complex Numbers, Probability Theory and Random Variables, Quantum Mechanics Basics: States, Postulates, Hilbert Space Formalism, Superposition, Measurement, and Unitary Evolution, Bloch Sphere Representation and Schrödinger Equation.	08
2	Qubits, Quantum Gates, and Multi-Qubit Systems Single-Qubit Gates: X, Y, Z, Hadamard, Phase, and Rotation Gates, Multi-Qubit Systems: Tensor Product, CNOT, SWAP, and Toffoli Gates, Entanglement, Bell States, and EPR Pairs, No-Cloning Theorem and Schmidt Decomposition.	08
3	Quantum Circuits and Computation Quantum Circuit Model and Boolean Circuits, Universal Quantum Gates and Circuit Complexity, Quantum Parallelism and Reversible Computation, Circuit Optimization and Bloch Sphere Operations.	08



4	Quantum Algorithms and Applications Quantum Oracle and Query Model, Deutsch, Deutsch–Jozsa, Bernstein–Vazirani, and Simon Algorithms, Quantum Fourier Transform (QFT) and Phase Estimation, Shor’s Algorithm for Factoring and Grover’s Algorithm for Search, Applications in Cryptography and Optimization.	10
5	Quantum Communication, Error Correction, and Emerging Topics Quantum Key Distribution (BB84 Protocol), Quantum Teleportation and Superdense Coding, Physical Realizations of Qubits: Superconducting, Trapped Ions, Photonic, Quantum Error Correction Codes: Shor and Steane Codes, Fault Tolerance and Noise Models in NISQ Devices, Variational Quantum Algorithms (VQE, QAOA), Intro to Quantum Machine Learning and Quantum Annealing.	08
Total		42

List of the Experiment

1. Prepare single and multi-qubit quantum states (superposition, entangled states, Bell states).
2. Visualizing qubit and multi-qubit states on the Bloch sphere.
3. Observing the effects of various quantum gates on qubits.
1. Implementation and experimental testing of basic gates (Pauli-X, Y, Z, Hadamard, Phase, CNOT, Toffoli, SWAP).
2. Deutsch and Deutsch-Jozsa algorithms: distinguishing between constant and balanced functions.
3. Grover’s search algorithm: amplitude amplification and unstructured search.
4. Simon’s algorithm: finding a secret string with exponential speedup.
5. Shor’s algorithm (simulation): factoring small integers.
6. Preparation, measurement, and verification of Bell states and entanglement.
7. Assignments on BB84 quantum key distribution protocol.
8. Analysis of quantum eavesdropping and protocol robustness.
9. Implementation of three-qubit bit-flip and phase-flip error correction codes.
10. Implement and benchmark quantum key distribution protocols (BB84, E91) on quantum networks to advance secure access for underserved populations. (SDG-9).

Minimum eight experiments from the above-suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Textbooks:

1. Ivan B. Djordjevic, “Quantum Information Processing, Quantum Computing and Quantum Error Correction: An Engineering Approach”, 2nd Edition, Elsevier (Academic Press), 2021.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, “An Introduction to Quantum Computing”, Oxford University Press, 2007.

Reference Books:

1. Michael A. Nielsen and Isaac L. Chuang, “Quantum Computation and Quantum Information”, Cambridge University Press, 2010.
2. Parag Lala, “Quantum Computing”, McGraw Hill India, 2020.
3. Eleanor Rieffel, Wolfgang Polak, “Quantum Computing: A Gentle Introduction”, MIT Press, 2011.

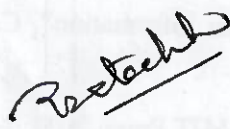
Web Links:

1. IBM Quantum Learning: <https://quantum.cloud.ibm.com/learning>
2. MIT xPRO Quantum Computing Fundamentals: <https://learn-xpro.mit.edu/quantum-computing>

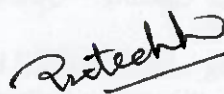
Online Courses:

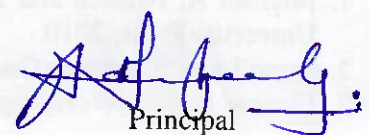
1. Introduction to Quantum Computing course: https://onlinecourses.nptel.ac.in/noc25_cs95/preview
2. Coursera Quantum Computing course: <https://www.coursera.org/learn/quantum-computing>




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Head of the Department


Principal

Program: B. Tech in Artificial Intelligence (AI) and Data Science Final Year B. Tech Semester: VII/VIII

Course: IoT and Fog Computing (DJS23SCMD701)

Course: IoT and Fog Computing Laboratory (DJS23SLMD701)

Prerequisite: Basics of Digital Electronics, Networking and programming basics

Course Objectives: The Objectives of course are

1. Thorough Comprehension of the IoT Ecosystem
2. Skillful Application of Edge Computing Techniques
3. Effective Implementation of Robust Security Measures for IoT and Edge Systems

Course Outcomes: Students will be able to

1. Explain IoT fundamentals, architecture, and communication technologies.
2. Identify sensors, actuators, IoT hardware, and software platforms.
3. Compare IoT development boards, middleware, and platform selection criteria.
4. Describe Industrial IoT, Industry 4.0, and smart automation applications.
5. Explain fog, edge, cloud computing, and IoT security mechanisms.

IoT and Fog Computing (DJS23SCMD701)		
Unit	Description	Duration
1	IoT Fundamentals and Communication Technologies Evolution, Vision, and Applications of IoT, IoT Architecture and Core Functional Stack, Smart Devices and Key Enabling Technologies, M2M vs IoT, IoT Reference Models and Network Levels, LPWAN and Wireless Communication Technologies (Wi-Fi, Bluetooth, ZigBee, LoRaWAN, NB-IoT), Network Layer Protocols and Encapsulation	6
2	IoT Hardware, Sensors, and Software Platforms Sensors and Actuators: Perception Layer in IoT, Environmental, Motion, and Range Sensors, Actuators and Real-World Applications, IoT Hardware Platforms: SoC Basics and Embedded Computing, Arduino, Raspberry Pi, and BeagleBone, Comparison of IoT Development Boards Middleware and IoT Platforms: IoT Middleware Architecture and Functions, Cloud-Based and Open-Source IoT Platforms, Platform Selection Criteria	7
3	Industrial IoT and Industry 4.0 Introduction to Industrial IoT (IIoT), Industrial IoT Applications in Healthcare, Manufacturing, and Smart Offices, IIoT Architecture and Smart Automation, Industry 4.0 Concepts and Design Principles, Cyber-Physical Systems and Smart Manufacturing	5
4	Fog, Edge, and Cloud Computing for IoT Fog Computing Fundamentals and Architecture, Edge vs Fog vs Cloud vs Mist Computing, Applications and Advantages of Fog Computing, OpenFog Architecture, EdgeX Foundry and AWS Greengrass, Fog Topologies and Distributed Processing	5
5	IoT Security and Privacy Security Challenges in IoT Ecosystems, CIA Principles in IoT Security, Authentication, Encryption and Access Control, Privacy Preservation Techniques, Security in M2M Communication, Best Practices for Securing IoT Devices and Networks	5
Total		28

List of Experiments

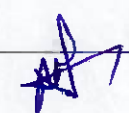
1. Interface a DHT11/DHT22 sensor with Arduino Uno to measure environmental temperature and humidity. Display real-time sensor readings on the Serial Monitor for environmental monitoring applications.
2. Develop a simple LED control circuit using Raspberry Pi GPIO pins and Python programming. Implement blinking operations to understand GPIO interfacing and actuator control.
3. Design an automatic street light system using an LDR sensor and Arduino. The LED should automatically turn ON in darkness and OFF in daylight conditions.
4. Implement a motion detection system using a PIR sensor with Arduino/Raspberry Pi. Trigger an LED or buzzer alarm whenever human movement is detected.
5. Develop a water level monitoring system using an HC-SR04 ultrasonic sensor. Measure and display water level or distance readings through the Serial Monitor or LCD display.
6. Establish communication between IoT devices using the MQTT protocol and ESP8266 Node MCU boards. Publish and subscribe sensor data through an MQTT broker for M2M communication.
7. Create an IoT cloud monitoring system using ESP8266 and DHT11 sensor integrated with ThingSpeak. Upload sensor readings to the cloud and visualize data using real-time graphs.
8. Implement a basic fog computing model using Raspberry Pi for local data processing. Filter or process sensor data at the edge before transmitting it to the cloud.
9. Design a temperature-controlled smart fan system using Arduino and a temperature sensor. Automatically vary fan speed or operation based on surrounding temperature conditions.
10. Develop a simple authentication mechanism for securing IoT device access using ESP8266 or Raspberry Pi. Allow device control only after successful password verification.
11. IoT Network Simulation using Cisco Packet Tracer/Wokwi /Tinkercad /Proteus/Cooja /Blynk Simulate an IoT-based smart home or sensor network using Cisco Packet Tracer. Configure virtual IoT devices, sensors, and network communication to understand IoT architecture and connectivity concepts.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Textbooks:

1. Internet of Things by Surya Durbha and Jyoti Joglekar by Oxford University Press, 2021.
2. Sensors, Cloud and Fog: The Enabling Technologies for the Internet of Things by Sudip Misra, Subhadeep Sarkar and Subarna Chatterjee by CRC Press, 2019.
3. Industry 4.0: The Industrial Internet of Things by Alasdair Gilchrist by Apress, 2023.
4. IoT and Edge Computing for Architects by Perry Lea, Second edition, by Packt, 2020.
5. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things by David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, and Jerome Henry by Cisco press, 2017.

Reference Books:

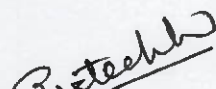
1. 21 IoT Experiments by Yashwant Kanetkar by BPB Publications, 2018.
 2. Internet-of-Things (IoT) Systems: Architectures, Algorithms and Methodologies by Dimitrios Serpanos and Marilyn Wolf by Springer, 2018.
 3. Internet of Things: A Hands-on Approach by Arshdeep Bahga and Vijay Madisetti by Universities Press, 2014.
 4. Internet of Things: Architecture and Design Principles by Raj Kamal by Mc Graw Hill, 2022.
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Web Links:

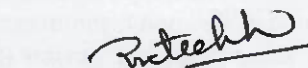
1. IoT and Fog Computing Resources: <https://chatgpt.com/c/6a059896-ed28-83ec-ba64-64fa20d93a47>
2. Think Topics | IBM: <https://www.ibm.com/think/topics>
3. IoT For All | Home: https://www.iotforall.com/?utm_source=chatgpt.com
4. Overview - EdgeX Foundry Documentation: <https://docs.edgexfoundry.org/4.0/>

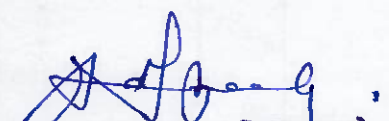
Online Resources:

1. Top Industry 4.0 Courses - Learn Industry 4.0 Online: https://www.coursera.org/courses?query=industry%204.0&utm_source=chatgpt.com
2. NPTEL Internet of Things: nptel.ac.in/courses/106105166?utm_source=chatgpt.com
3. Udemy IoT Courses: https://www.udemy.com/topic/iot/?utm_source=chatgpt.com
4. Azure IoT Hub Documentation | Microsoft Learn: https://learn.microsoft.com/en-us/azure/iot-hub/?utm_source=chatgpt.com


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Program: All programs	Final Year B. Tech.	Semester: VII/VIII
Course: Research Ecosystem (DJS23ITELX12)		

Pre-requisites:

1. Basic understanding of Engineering concepts and problem-solving techniques.
2. Fundamental knowledge of project-based learning, data analysis, and domain-specific tools.
3. Basic exposure to project development, technical report writing, and emerging technologies.

Objectives:

1. To understand and identify complex engineering, societal, and industrial problems suitable for research through structured analysis of literature, patents, and real-world needs.
2. To learn and apply advanced research methodologies—including experimental, simulation-based, and data-driven approaches—for designing and validating engineering solutions.
3. To gain proficiency in selecting and using appropriate tools, software, and platforms (AI/ML, simulation, CAD, IoT, etc.) for experiment design, data acquisition, and performance evaluation.
4. To transform research insights into innovative prototypes, products, or startup concepts by engaging with innovation ecosystems, TRLs, and funding mechanisms.
5. To analyze socio-technical systems, ethics, and sustainability implications of engineering solutions, ensuring responsible and impactful outcomes.
6. To integrate systems thinking, multidisciplinary perspectives, policy awareness, future technology trends, and technical documentation skills to develop comprehensive research proposals and outputs (papers, patents, reports).

Outcomes: On completion of the course, the learner will be able to:

1. Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.
2. Design and apply appropriate research methodologies, tools, and validation techniques to acquire, analyze, and interpret data for engineering solutions
3. Transform research outcomes into innovative prototypes, products, or startup concepts using innovation frameworks, IPR principles, and Technology Readiness Levels (TRLs).
4. Evaluate ethical, socio-technical, policy, and sustainability aspects of engineering solutions to ensure responsible and impactful innovation.
5. Synthesize multidisciplinary knowledge to prepare research proposals and develop scalable, future-ready engineering solutions addressing real-world challenges.

Research Ecosystem (DJS23ITELX12)		
Unit	Description	Duration
1	Research Gap Identification & Advanced Problem Formulation - Identifying high-impact problems from: - Industry and Society - Emerging technologies (AI, IoT, Blockchain, EV, etc.) - Research gap identification techniques: - Systematic Literature Review (SLR) - Patent analysis	5



	- Defining objectives, scope, constraints, and feasibility of the identified problem - Writing problem statement for: - Research paper - Product/Startup idea Activities: - Convert Industry/ Societal problem into research problem. - Analyze research articles and extract research gaps.	
2	Experimental Design, Tools & Validation Techniques - Advanced research methodologies: - Experimental, simulation, data-driven, design thinking - Tool selection: - Computational tools and software, simulation and analysis platforms, system prototyping and testing platforms - Data acquisition: - Data collection interfaces, Principles of data cleaning and organization (primary / secondary data) - Validation techniques: - Accuracy and performance metrics - Benchmarking with existing solutions - Result interpretation & visualization Activities: - Selection of Research Design for final year project. - Apply evaluation metrics (e.g., ML model accuracy, system efficiency).	6
3	Research to Innovation, Product & Startup Ecosystem - Research → Prototype → Product → Startup lifecycle - Intellectual Property Rights (IPR), patents, copyrights - Technology readiness levels (TRL) - Case studies: - AI startups, EV ecosystem, Smart Cities - Industry-academia collaboration models - Funding opportunities (grants, incubation, government schemes - Anusandhan National Research Foundation (ANRF)) Activities: - Convert project into startup idea or product pitch. - Analyze failure of a technology/product.	5
4	Socio-Technical Systems, Ethics & Sustainability - Socio-technical systems: Interaction of people, technology and environment - Ethical issues: - Plagiarism, AI bias, data privacy - Sustainability in Engineering: - Green practices, resource optimization and lifecycle considerations - Impact assessment: - Social, economic, environmental - Policies and governance (data protection laws, standards and compliance requirements) Activities: - Case study: Facial recognition ethics / smart surveillance. - Impact analysis of student's own project.	6
5	Integrated Research, Policy and Future Engineering Challenges - Systems thinking and holistic analysis - Multidisciplinary problem solving: - Healthcare tech, climate tech, smart mobility	6



	• Writing research proposals: ▪ Problem → Methodology → Expected outcomes • Future trends: ▪ AI ethics, Quantum computing, Industry 5.0 / 6.0 • Scaling solutions from lab to society Activities: • Capstone Task: ▪ Identify real-world problem. ▪ Apply research methodology. ▪ Propose: ○ Technical solution ○ Societal impact ○ Possible commercialization	
	Total	28

Part A

Following are the five tutorials to satisfy the term work requirement:

1. **Tutorial 1:** Research Problem Identification, Literature Review and Research Gap Analysis
2. **Tutorial 2:** Research Methodology Selection, Experimental Design and Tool Selection
3. **Tutorial 3:** Research to Startup/Product Development
4. **Tutorial 4:** Ethics and Sustainability Assessment
5. **Tutorial 5:** Research Proposal Development

Details of Tutorials

Tutorial No.	Unit	Tutorial Title	Activity / Deliverable	CO
1	Unit 1	Identifying Research Problems, Literature Review and Research Gap Analysis	• Select an engineering/industrial/societal problem and convert it into a research problem by defining objectives, scope, constraints, and expected outcomes. • Review 5–8 recent research papers, summarize key contributions, and identify research gaps using a literature matrix.	CO1
2	Unit 2	Research Methodology Selection,	• Select an appropriate research methodology (experimental, simulation, data-driven, design thinking, etc.) for the chosen project with justification. • Design the experimental workflow, identify software/tools/platforms	CO2



		Experimental Design and Tool Selection	required, and define data collection methods and evaluation metrics.	
3	Unit 3	From Research to Startup	- Convert the selected project into a product/startup idea by identifying target users, value proposition, Technology Readiness Level (TRL), and commercialization potential. - Study patents/IPR related to the project and prepare a brief report on patentability, copyrights, licensing, and innovation opportunities.	CO3
4	Unit 4	Ethics and Sustainability Assessment	Analyze ethical issues, data privacy, AI bias (if applicable), sustainability, and societal impact of the selected project using a structured framework.	CO4
5	Unit 5	Research Proposal Development	Prepare a concise research proposal including problem statement, literature summary, methodology, expected outcomes, timeline, societal impact, and future scope.	CO5

Final Group Presentation (Part B)

The group presentation should integrate learning from all units and include:

- Identification of a real-world engineering/societal problem.
- Literature review and research gap.
- Selected research methodology and implementation plan.
- Proposed technical solution with validation approach.
- Ethical, societal, and sustainability impact analysis.
- Technology Readiness Level (TRL) assessment.
- Commercialization/startup potential and future scope.

Reference Books:

- Kothari, C. R., Research Methodology: Methods and Techniques, New Age International Publishers, New Delhi, 2023.
- Booth, W. C., Colomb, G. G., Williams, J. M., Bizup, J., & FitzGerald, W. T., The Craft of Research, University of Chicago Press, Chicago, 2024.
- Montgomery, D. C., Design and Analysis of Experiments, Wiley, New York, 2020.
- Singh, Pooja, Katiyar, Aman, Rawat, Shalini, Dhuri, Archana, Research Methodology and IPR, RK Publications, India, 2025.
- Blok, Vincent (Ed.), Putting Responsible Research and Innovation into Practice: A Multi-Stakeholder Approach, Springer Cham, Switzerland, 2022.



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Web Links:

- Research Methodology: Quantitative Methods and Computer Application
(https://onlinecourses.swayam2.ac.in/e-learning/preview/ini26_ma02)
- Research Methodology and IPR
(https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr26_ed28)
- Research and Publication Ethics
(https://onlinecourses.swayam2.ac.in/e-learning/preview/nou26_ge46)
- Research Ethics and Plagiarism
(https://onlinecourses.swayam2.ac.in/e-learning/preview/nou26_ge26)
- Quantitative and Mixed Methods Research for Management
(https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg21)
- Doing Qualitative Research
(https://onlinecourses.swayam2.ac.in/e-learning/preview/nou26_ge61)

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Program: B. Tech. (Common to all Programmes)	B. Tech.	Semester: VII/VIII
Course: Major Project	Course Code: DJS23IPELX13	

Objectives

The primary purpose of the Major Project is to enable students to apply the knowledge and skills acquired across the programme to conceive, design, implement, and evaluate a comprehensive solution to a real-world problem. The project strengthens technical competence, communication, and teamwork by integrating design, development, technical writing, presentation, and collaborative work. It emphasises professional engineering practice and addresses a range of non-technical considerations such as economic factors, safety, reliability, ethics, sustainability, and environmental and societal impact.

Course Outcomes (CO)

On successful completion of the Major Project, the student will be able to:

1. Apply technical knowledge gained from previous courses to identify real-life, industry, or societal problems and design appropriate solutions.
2. Demonstrate the technical skills required to design, develop, build, and test engineering systems, products, software, or hardware using modern engineering and IT tools.
3. Apply project-management skills scheduling work, procuring resources/components, budgeting, documenting technical and non-technical details, and working within defined deadlines as an effective team.
4. Develop and demonstrate the ability to test, validate, debug, and troubleshoot engineering systems (including software, hardware, and process components) and analyse the results.
5. Create technical reports and research papers in the prescribed format and effectively communicate and present the work to evaluators.

Scope and Nature of the Project Work

Final-year students have already undertaken project assignments in their pre-final year through Innovative Product Design / Mini Project work. In the final year, a group of a maximum of four students completes a comprehensive project based on the courses studied. The project work may be internally assigned or externally assigned by research institutes, industry, or similar organisations. Each group is assigned one faculty member as supervisor. The final-year project may be an extension of the Mini Project carried out in the pre-final year.

The main intention of the project work is to enable students to apply the knowledge and skills learnt across the programme to solve or implement a well-defined practical problem. The work may go beyond the scope of the curriculum or build upon courses studied, but the thrust should be on:

- Learning additional skills relevant to the chosen domain.
- Developing the ability to define, design, analyse, and implement a problem and carry it through to completion with proper planning.
- Learning behavioural science and professional ethics by working effectively in a group.
- Selecting a project area aligned with the student's intended higher education, employment, or self-employment goals.
- Choosing a topic that differs from, or meaningfully advances, the Mini Project topic.



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- Using the opportunity to learn modern computational techniques, tools, and model development through an appropriate choice of project.

Continuous Assessment and Term Work

The department maintains a proper record of the progress of each project throughout the semester. At the end of the semester, the work is assessed for the award of Term Work (TW) marks by an approved internal faculty member appointed by the Head of the Institute, on the basis of:

- Scope and objectives of the project work.
- Extent and quality of the literature survey.
- Progress of the work (continuous assessment across reviews).
- Design, implementation, and analysis of the project work.
- Results, conclusions, and future scope.
- Report prepared in the prescribed University / institutional format.

Oral / Practical Examination: An approved external examiner together with an internal examiner appointed by the Head of the Institute assesses the project during the oral examination. The oral examination consists of a presentation by the group along with a demonstration of the work done. Each student is assessed individually for their contribution, understanding, and the knowledge gained.

Project Guide / Topic Allocation Policy

The project guide and topic-allocation policy is explained to students during the Orientation held in Semester VI. Each faculty member is allocated a minimum of one and a maximum of four project groups. As per the timeline in the academic calendar, the list of project topics and areas offered by each faculty member three topics per faculty member is displayed on the notice board. Allocation is carried out over successive rounds, and in each round students submit their preferences against the available topics and guides.

If a topic is preferred by only one group, that group is allocated to the corresponding guide and topic. If a topic is preferred by more than one group, the concerned faculty member reviews the applications and selects one group; the remaining groups carry forward to the next round. After each round, the list of groups and guides allotted so far is displayed, along with the topics and guides that remain available. Unallotted groups then submit fresh preferences from the available list. This process continues over successive rounds until every group has been allotted a guide, ensuring a uniform distribution of project groups among the faculty members.

Assessment Scheme

The Major Project carries a total of 100 marks **Term Work (50)** assessed internally through continuous evaluation, and **Oral / Practical Examination (50)** assessed jointly by internal and external examiners. Each criterion is scored against three performance levels Excellent, Satisfactory, and Below Expectation as detailed below.

Rubric for Term Work (50 Marks)

Assessment Criteria (mapped CO)	Max	Excellent	Satisfactory	Below Exp.
Problem Definition, Objectives & Literature Survey (CO1)	10	8-10	5-7	0-4



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Assessment Criteria (mapped CO)	Max	Excellent	Satisfactory	Below Exp.
Design, Methodology & Implementation Progress – Continuous Assessment (CO2)	10	8–10	5–7	0–4
Project Management & Teamwork (CO3)	10	8–10	5–7	0–4
Report / Thesis Writing – Written Communication (CO5)	10	8–10	5–7	0–4
Research Paper Writing / IPR – Patent or Copyright (CO5)	10	8–10	5–7	0–4
Total	50			

Rubric for Oral / Practical / Presentation / Demonstration (50 Marks)

Assessment Criteria (mapped CO)	Max	Excellent	Satisfactory	Below Exp.
Concept & Problem Definition (CO1)	5	4–5	3	0–2
Design, Methodology & Implementation (CO2)	15	12–15	7–11	0–6
Project Management Skills (CO3)	5	4–5	3	0–2
Demonstration, Testing & Result Analysis (CO4)	15	12–15	7–11	0–6
Presentation & Oral Communication (CO5)	10	8–10	5–7	0–4
Total	50			

Descriptive Assessment Rubric (Performance-Level Descriptors)

The following descriptors define each performance level and are applied consistently across all programmes. Examiners map a student's performance to the most appropriate level for each criterion before awarding the corresponding marks from the tables above.

Criteria	Excellent	Satisfactory	Below Expectation
Concept & Problem Definition	All major and minor objectives are identified and correctly prioritised. The problem statement is precise, relevant and well-scoped. All relevant information is gathered from valid sources and the proposed solution is well justified.	Major objectives identified but one or two minor ones missing or priorities not fully set. Problem statement mostly clear. Sufficient information from largely valid sources; solution mostly justified.	Several major objectives not identified. Problem statement vague or too broad. Insufficient information and/or invalid sources; proposed solution not justified.
Literature Survey	Comprehensive, current and well-organised survey of journals, standards, patents and existing products/systems. Research gap / novelty clearly identified and the	Adequate survey covering most key sources. Gap / novelty identified but only partially justified.	Sparse or outdated survey. Little or no identification of the gap; chosen approach not justified.



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Criteria	Excellent	Satisfactory	Below Expectation
	chosen approach is well justified.		
Design, Methodology & Implementation	Design is based on stated criteria, sound analysis and realistic constraints. Methodology is appropriate and well justified. Implementation is complete and robust and makes effective use of modern engineering / software tools.	Design is reasonable and methodology mostly appropriate. Implementation is largely complete; deeper analysis of alternatives or constraints could improve the outcome.	Only one solution considered or alternatives ignored. Weak methodology and incomplete implementation. Many constraints and criteria ignored.
Project Management & Teamwork	Responsibilities delegated fairly and every member contributes valuably. All members attend meetings and meet deliverable deadlines. Schedule, resources and budget are well managed.	Minor inequities in delegation; some members contribute more than others but all meet their responsibilities. Meetings mostly attended and deadlines mostly met.	Major inequities in delegation, with free-riders or dominating members. Meetings and deadlines frequently missed; poor planning of schedule and resources.
Demonstration, Testing & Result Analysis	Develops and follows logical testing / validation / experimental procedures. Selects appropriate tools, equipment, platforms or datasets and operates them confidently. Aware of errors / limitations, accounts for them, and interprets and relates the results to the objectives and underlying theory.	Procedures mostly followed with occasional oversight. Needs some guidance in selecting tools / equipment and is tentative in operating them. Aware of errors but accounts for them only minimally.	Does not follow a proper procedure. Cannot select appropriate tools / equipment or operates them incorrectly, needing frequent supervision. Makes no attempt to relate results to objectives.
Report / Thesis Writing (Written Communication)	Report is well organised and clearly written; the logic is easy to follow. Wording is precise; figures, tables and analyses enhance understanding. Grammatically correct, free of spelling errors, properly cited and free of plagiarism.	Report is mostly organised and clear; a few sections are harder to follow. Wording is good with minor exceptions; figures are consistent. Few grammatical / spelling errors that do not hinder the reader; some sources not fully cited.	Report lacks organisation and the logic is hard to follow. Figures absent or inconsistent. Grammatical and spelling errors hinder reading. Evidence of plagiarism or inadequate citation.
Research Paper Writing / IPR (Patent or Copyright)	A research / technical paper is drafted to publication standard in the required format, or a patent / copyright application is prepared and filed. Novelty and	A paper draft or IPR document is prepared and largely follows the required format. Novelty and contribution are stated but only partially developed, with minor	No paper / IPR document, or a weak draft that does not follow the required format. Novelty or contribution is unclear or unsupported, with



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Criteria	Excellent	Satisfactory	Below Expectation
	contribution are clearly articulated, claims and results are well supported, and the work is original with proper citations and no plagiarism.	gaps in supporting evidence or formatting.	evidence of plagiarism or inadequate citation.
Presentation & Oral Communication	Slides are error-free and logically present the work and findings; they are readable and the graphics support the main ideas. Speakers are audible and fluent, do not rely on notes and answer questions accurately. Confident body language and eye contact convey strong engagement.	Slides are error-free and logical and mostly readable. Speakers are mostly fluent with minimal reliance on notes and answer most questions well. Slight discomfort or occasional distracting gestures.	Slides contain errors and lack logical flow; key aspects are absent and graphics confuse the audience. Speakers are inaudible or hesitant and rely heavily on notes, with difficulty answering questions. Body language conveys discomfort.

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Head of the Department

Principal

Program: B. Tech in Artificial Intelligence (AI) and Data Science

Final Year B. Tech

Semester: VII/VIII

Course: Leading Projects to Successful Completion (DJS23SCSC701)

Pre-requisite: Basic knowledge of computer fundamentals and operating systems.

Course Objectives: The Objectives of the course are,

1. Understand the project execution phase and apply techniques for monitoring project scope, schedule, cost, risks, and resources.
2. Apply quality management principles and continuous improvement practices to ensure successful project outcomes.
3. Utilize project data, metrics, and analytical tools to support informed decision-making and performance evaluation.
4. Develop leadership, teamwork, and influencing skills required for managing project teams and stakeholders effectively.
5. Apply communication, negotiation, and stakeholder management strategies for successful project execution.
6. Execute project closure activities, document lessons learned, and evaluate project success for organizational learning.

Course Outcomes: Students will be able to,

1. Monitor and control project activities by tracking schedules, budgets, risks, dependencies, and project changes using appropriate project management techniques.
2. Apply quality management principles and continuous improvement practices to enhance project performance and customer satisfaction.
3. Analyze project data and utilize visualization and reporting tools to support data-driven decision-making.
4. Demonstrate leadership, teamwork, conflict resolution, and stakeholder management skills in project environments.
5. Employ effective communication, negotiation, and collaboration techniques to facilitate successful project execution and stakeholder engagement.
6. Perform project closure activities including documentation, knowledge transfer, lessons learned analysis, and project success evaluation.

Leading Projects to Successful Completion (DJS23SCSC701)		
Unit	Description	Duration
1	Introduction to Project Execution Introduction to project execution phase, Importance of project tracking, Common project elements to track, Project tracking methods and tools, Budget tracking and management, Managing multiple project tracks, Understanding project risks and changes, Identifying and tracking dependencies, Risk management techniques, Issue escalation processes, Communicating project changes to stakeholders, Project monitoring and control practices, Risk communication strategies.	08
2	Quality Management and Continuous Improvement Fundamentals of quality management, Quality planning, assurance and control, Quality standards and metrics, Customer relationship management, Communication techniques for customer satisfaction, Measuring customer satisfaction, Accessibility considerations in feedback collection, Continuous improvement concepts, Process improvement methodologies, Data-driven improvement frameworks, Projects, programs and portfolios, Retrospective meetings and reviews, Conducting effective retrospectives, Developing a continuous improvement mindset.	03

3	Data-Informed Decision Making Importance of data in project management, Types of project data, Data collection and prioritization, Identifying relevant project metrics, Data analysis for decision making, Data-driven project management, Storytelling with project data, Data visualization techniques, Presentation and reporting tools, Effective presentation methods, Accessibility in presentations, Communicating insights to stakeholders, Ethical considerations in project data.	03
4	Leadership and Influencing Skills Team effectiveness factors, Team development stages, Team dynamics management, Building high-performing teams, Leadership versus management, Influencing without authority, Emotional intelligence in project management, Conflict resolution techniques, Diversity, equity and inclusion in teams, Ethical leadership practices, Stakeholder influence strategies, Team motivation and engagement, Decision-making and accountability.	03
5	Effective Project Communication Communication planning, Communication methods and channels, Stakeholder communication strategies, Meeting management techniques, Facilitating productive discussions, Active listening skills, Negotiation and persuasion techniques, Handling difficult conversations, Reporting project status and progress, Escalation communication processes, Cross-functional collaboration, Building communication confidence.	05
6	Closing a Project Purpose of project closure, Project closing process, Administrative project closure, Contract closure activities, Project handover procedures, Knowledge transfer and documentation, Creating project closeout reports, Lessons learned documentation, Measuring project success, Final stakeholder communication, Celebrating project achievements, Transitioning resources, Post-project evaluation and review.	03
Total		25

Online Course:

Project Execution: Running the Project | Coursera: <https://www.coursera.org/learn/project-execution-google?msocid=13bdb95be1ac64ad3d35ad3ee01e65c8#about>

Useful Courses:

1. https://www.coursera.org/professional-certificates/google-project-management?utm_source=chatgpt.com
2. https://www.coursera.org/learn/project-planning-and-execution-management?utm_source=chatgpt.com
3. https://www.coursera.org/professional-certificates/ibm-project-manager?utm_source=chatgpt.com
4. https://www.coursera.org/specializations/project-management?utm_source=chatgpt.com

Guidelines:

1. The identified courses are designed to develop students' technical, software engineering, and project management competencies, including the effective use of AI-enabled tools. Each selected course shall carry one credit
2. Faculty members shall act as mentors for the Coursera courses identified for various semesters of the program.
3. One faculty mentor shall be assigned to each class of the program for effective coordination and monitoring of this activity.
4. The assigned faculty mentor shall complete and review the course content before assigning the course to students.

5. The term work for these one-credit courses shall form a part of the Internal Continuous Assessment (ICA) component.
6. The Term work (ICA) component shall carry 40 marks

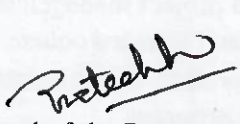
The distribution of marks for term work shall be as follows:

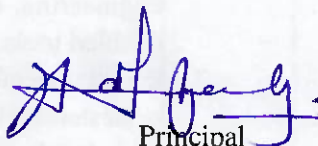
- 15 Marks: Evaluation based on the score obtained in the assigned Coursera course (Marks awarded in proportion to the final Coursera score, scaled to a maximum of 15 marks)
- 15 Marks: Faculty-curated evaluation conducted through the Coursera platform
- 10 Marks: Internal faculty evaluation through quizzes, assignments, presentations, or Project




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Head of the Department
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Program: B. Tech in Artificial Intelligence (AI) and Data Science Final Year B. Tech Semester: VII/VIII

Course: Disaster Management and Preparedness (DJS23ICHSX11)

Prerequisites: Basic knowledge of Environmental Studies, Geography, climate change, civic systems, and computer literacy.

Course Objectives: The objectives of the course are,

1. To provide basic understanding of hazards, disasters and various types and categories of disaster occurring around the world.
2. To identify extent and damaging capacity of a disaster.
3. To study and understand the means of losses and methods to overcome /minimize it.
4. To understand roles and responsibilities of individual and various organizations during and after disaster.
5. To appreciate the significance of GIS, GPS in the field of disaster management.
6. To understand the emergency government response structures before, during and after disaster.

Course Outcomes: Students will be able to,

1. Apply disaster management principles & guidelines.
2. Conduct risk assessments.
3. Develop community awareness & participation.
4. Utilize Science & Technology tools (GIS, GPS).
5. Prepare disaster management plans.

Disaster Management and Preparedness (DJS23ICHSX11)		
Unit	Description	Duration
1	Understanding Disasters & Hazards: • Definition and types of disasters: Natural, Man-made and hybrid disasters, Study of Natural disasters: Flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion etc. Study of Human/Technology Induced Disasters: Chemical, Industrial and Nuclear disasters, internally displaced persons, road and train accidents Fire Hazards, terrorism, militancy. • Hazard & Vulnerability profiles of India (seismic zones, flood-prone areas). • India's vulnerability to disasters, and the impact of disasters on National development.	06
2	Disaster Risk Reduction (DRR) & Mitigation: • Disaster Management Cycle: Prevention, Mitigation, Preparedness, Response, Recovery. Need for disaster prevention and mitigation, mitigation guiding principles, challenging areas, structural and non-structural measures for disaster risk reduction. • Risk Assessment & Vulnerability Analysis. • Science & Technology: Use of information management, Geo informatics like RS, GIS, GPS and remote sensing mitigation measure.	06

3	Disaster Preparedness & Response: • Preparedness Planning, Early Warning Systems (EWS), & Communication. • Emergency Response: Search & Rescue, Logistics, Medical Aid. • Psychological Response & Management (Trauma, Stress). • Role of IT, Media, Govt., NGOs, & Community.	04
4	Recovery, Rehabilitation & Reconstruction: • Post-disaster damage assessment. • Rehabilitation, Reconstruction, & Livelihood Restoration. • Sanitation, Hygiene, & Waste Management.	04
5	Policy, Governance & Capacity Building: • National Disaster Management Authority (NDMA) & Legislation. • Institutional Mechanisms & Community Mobilization. Non-Structural Mitigation: Community based disaster preparedness, capacity development and training, awareness and education, contingency plans.	8
	Case studies on disaster (National /International): • Case study discussion of National Disasters: Tsunami (2004), Bhopal gas tragedy, Kerala and Uttarakhand flood disaster, 26th July 2005 Mumbai flood • Case study discussion of International Disasters: Hiroshima – Nagasaki (Japan), Cyclone Phailin (2013), Fukushima, Daiichi nuclear disaster (2011), Chernobyl meltdown	
Total		28

Books Recommended:

Text books

1. Disaster Management, by Harsh K. Gupta, Universities Press Publications (2003).
2. Disaster Management: An Appraisal of Institutional Mechanisms in India, by O. S. Dagur, published by Centre for land warfare studies, New Delhi, 2011.
3. Introduction to International Disaster Management, by Damon Copolla, Butterworth Heinemann Elsevier Publications (2015).
4. Disaster Management Handbook, by Jack Pinkowski, CRC Press, Taylor and Francis group (2008).
5. Disaster management & rehabilitation, by Rajdeep Dasgupta, Mittal Publications, New Delhi (2007).

Reference Books

1. Natural Hazards and Disaster Management, Vulnerability and Mitigation, by R B Singh, Rawat Publications (2006).
2. Concepts and Techniques of GIS, by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications (2006).
3. Risk management of natural disasters, by Claudia G. Flores Gonzales, KIT Scientific Publishing (2010).
4. Disaster Management – a disaster manager's handbook, by W. Nick Carter, Asian Development Bank (2008).
5. Disaster Management in India, by R. K. Srivastava, Ministry of Home Affairs, GoI, New Delhi (2011)

6. The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy, by Wil Mara, Marshall Cavendish Corporation, New York, 2011.
7. The Fukushima 2011 Disaster, by Ronald Eisler, Taylor & Francis, Florida, 2013.
8. (Learners are expected to refer reports published at national and international level and updated information available on authentic web sites.)



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Principal

Program: Artificial Intelligence (AI) and Data Science
Course: High Performance Computing (DJS23SCPE811)

Final Year B.Tech.

Semester: VII/VIII

Prerequisite: Operating System Fundamentals.

Course Objectives: The objectives of the course are

1. To learn concepts of parallel processing as it pertains to high-performance computing.
2. To design, develop and analyze parallel programs on high performance computing resources using parallel programming paradigm.
3. To build real-world applications and case studies to understand the practical challenges and solutions in the HPC domain.

Course Outcomes: Students will be able to

1. Understand different parallel processing approaches.
2. Identify and evaluate the platforms and technologies involved in achieving high performance computing (HPC).
3. Explore GPU and CUDA Programming.
4. Know the principles of Grid and Cloud Computing with practical examples and applications.
5. Analyze the performance measures in high performance computing.
6. Discover the advanced topic in GPU including libraries and framework.

High Performance Computing (DJS23SCPE811)

Unit No.	Description	Duration
1	Introduction to Parallel Processing: Parallel processing, Levels of Parallelism, Models (SIMD, MIMD, SIMT, SPMD, Data Flow Models, Demand-driven Computation). Loosely coupled and Tightly coupled. Parallel Architecture (Interconnection network, processor Array, Multiprocessor), Challenges in Parallel Computing, Performance Metrics, Distributed vs. Parallel architectures.	05
2	Introduction to High Performance Computing: Introduction to HPC and its significance in data science, Overview of different hardware architectures (CPU, GPU, FPGA), Understanding parallel computing concepts and terminology, Introduction to programming models (shared memory, distributed memory).	07
3	GPU and CUDA Programming: Introduction to GPUs and their architecture, Overview of CUDA programming model CUDA programming basics: memory management, thread hierarchy, kernel execution.	08
4	Grid and Cloud Computing: Data & Computational Grids, Grid Architectures and its relation to various Distributed Technologies, Examples of The Grid Computing, Cloud Computing, High Performance Cloud Computing (HPC2), Cloud Tensor Processing Units (TPUs).	07
5	Performance Optimization: Profiling and performance analysis tools for GPUs, Techniques for optimizing GPU performance (warp divergence, loop unrolling, vectorization), Memory bandwidth optimization techniques, Advanced GPU programming concepts	09

	(shared memory atomics, warp shuffling).	
6	Advanced Topics in GPU: Introduction to GPU accelerated libraries (cuBLAS, cuDNN, cuGraph), GPU computing frameworks (TensorFlow, PyTorch) and their integration with GPUs, Introduction to GPU clusters and distributed GPU computing, Cluster Setup & its Advantages. Case studies : Real-world applications of GPU computing.	06
	Total	42

Textbooks:

1. Edson Borin, Lúcia Maria A. Drummond , Jean-Luc Gaudiot, Alba Melo, Maicon Melo Alves ,High Performance Computing in Clouds: Moving HPC Applications to a Scalable and Cost- Effective Environment, Philippe Olivier Alexandre Navaux, Springer, ISBN-13 978- 3031297687, 2023.
2. Alexander Heifetz,High Performance Computing for Drug Discovery and Biomedicine , Springer Nature, ISBN, 1071634496, 9781071634493, 2023.
3. Richard Ansoorge, Programming in Parallel with CUDA, Cambridge University Press, ISBN- 13 978- 1108479530, 2022.
4. Robert Robey, Yuliana Zamora ,Parallel and High Performance Computing, Manning publisher, ISBN- 13 978-1617296468, 2021
5. Sergey A. Babkin ,The Practice of Parallel Programming, CreateSpace Publisher ISBN-13: 978- 1451536614, Online Edition 2021.
6. Georg Hager, Gerhard Wellein, Introduction to High Performance computing for Scientist and Engineers, CRC press, 2019.
7. Dr Brian Tuomanen, Hands-On GPU Programming with Python and CUDA, Packt Publishing, ISBN- 13 978-1788993913, 2018.

Reference Books:

1. David B. Kirk and Wen-mei W. Hwu., Morgan Kaufmann ,Programming Massively Parallel Processors: A Handson Approach:,4th Edition, 2022.
2. Jason Sanders and Edward Kandrot, Addison-Wesley CUDA by Example: An Introduction to General-Purpose GPU Programming, 1st Edition, 2010.
3. Hager, G. and Wellein, G ,Introduction to High Performance Computing for Scientists and Engineers, CRC Press, ISBN-13 9781439811931, 2010.
4. High Performance Computing For Dummies, Sun and AMD Special Edition, Douglas Eadline Wiley Publishing, Inc. (2009)

Web Links:

1. Parallel Processing <https://hpc.llnl.gov/documentation/tutorials/introduction-parallel-computing-tutorial>
2. Introduction to high performance computing <https://www.cecam.org/workshop-details/an- introduction-to-high-performance-computing-1270>
3. GPU and CUDA Programming https://www.cs.cmu.edu/afs/cs/academic/class/15418-s18/www/lectures/06_gpuarch.pdf
4. Grid and Cloud Computing <https://aits-tpt.edu.in/wp-content/uploads/2022/06/GCC-min.pdf>
5. Performance Optimization <https://link.springer.com/chapter/10.1007/978-3-642-03644- 6 12>
6. Case Study: <https://developer.nvidia.com/blog/a-cuda-dynamic-parallelism-case-study- panda/>

Program: B. Tech in Artificial Intelligence (AI) and Data Science Final Year B. Tech Semester: VII/VIII
Course: Probabilistic Graph Models (DJS23SCPE812)

Prerequisite: Machine learning, Probability

Course Objectives: The Objectives of the course are

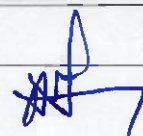
1. Provide a comprehensive understanding of the fundamental concepts and principles of probabilistic and deterministic graph theory
2. Develop the ability to apply various graph theoretical algorithms and techniques for problem solving and analysis
3. Enable students to integrate theoretical knowledge of graph theory to model, analyze, and solve complex real-world problems in computing and related domains

Course Outcomes: Students will be able to

1. Explain the fundamentals of probabilistic graph theory
2. Illustrate various principles of graph theory and algorithms
3. Integrate core theoretical knowledge of graph theory to solve problems

Probabilistic Graph Models (DJS23SCPE812)

Unit No	Description	Duration
1	Fundamentals: Structured Probabilistic Models: probabilistic graphical model, Representation Inference, Learning, Marginal and Joint Distributions, Independence and Conditional Independence. Bayesian Networks: Independence and Separation, from distribution to graphs, Markov properties and minimalism, Examples (Markov chain: HMM, diagnostic system, etc.)	07
2	Markov Networks: Boltzmann machine and Ising models, Markov random field, Parameterization, Cliques and potentials, Markov Network Independencies, Factor graphs. Gaussian Network Models and Exponential Family: Multivariate Gaussians, Gaussian Bayesian network, Gaussian random fields, Exponential families, Entropy and Relative Entropy, Projections.	07
3	Inference: Exact inference: Variable elimination: Analysis of Complexity, Variable elimination, Belief propagation (message passing) on trees, Sum- and Max-product algorithms, Clique tree, Variable Elimination in a Clique Tree	07
4	Sampling Methods: MCMC method, Gibbs sampling Algorithm, Importance sampling, Particle filtering. Approximate inference: Loopy belief propagation, Variational inference and optimization view of inference, Mean field approach	07
5	Parameter learning: Parameterizing graphical models, Parameter estimation in fully observed Bayesian networks: (Maximum likelihood estimation, Bayesian parameter estimation, Example: HMM), Parameter estimation in fully observed Markov networks: Maximum likelihood	06



	estimation (Iterative Proportional Fitting (IPF), Generalized Iterative Scaling (GIS)), Parameter estimation in partially observed graphical models (Expectation-Maximization (EM) - Example: HMM), Learning Conditional Random Fields. Nonparametric Learning: Gaussian processes, Dirichlet processes, Indian Buffet processes	
6	Structure learning: Score-based approach, Chow-Liu algorithm for Bayesian networks, l_1 -regularized convex optimization for Markov random fields, Low-rank regularized learning of latent variable models.	08
Total		42

Textbooks:

1. Koller, D. and Friedman, N. Probabilistic Graphical Models: Principles and Techniques. MIT Press 2009

Reference Books:

1. Jensen, F. V. and Nielsen, T. D. Bayesian Networks and Decision Graphs. Information Science and Statistics. Springer, 2nd edition, 2002.
2. Marloes Maathuis, Mathias Drton, Steffen Lauritzen, Martin Wainwright, Handbook of Graphical Models, Routledge Taylor and Francis group, 2020
3. Kevin P. Murphy Machine Learning: A Probabilistic Perspective. 4th Printing. MIT Press 2013
4. Barber, D. Bayesian Reasoning and Machine Learning. Cambridge University Press, 1st edition 2011
5. Bishop, C. M. Pattern Recognition and Machine Learning (Information Science and Statistics). Springer, 2nd printing 2011
6. Wainwright, M. and Jordan, M. (2008). Graphical Models, Exponential Families, and Variational Inference. Foundations and Trends in Machine Learning, 1:1–305

Web Links:

1. Comprehensive tutorial on Bayesian Networks and learning.
<https://www.ee.columbia.edu/~vittorio/Lecture12.pdf?>
2. Online course specialization from Stanford University: Probabilistic Graphical Models Specialization.
https://www.coursera.org/specializations/probabilistic-graphical-models?utm_source=chatgpt.com

Online Resources:

1. Introductory article – “A Brief Introduction to Graphical Models and Bayesian Networks:
https://www.cs.ubc.ca/~murphyk/Bayes/bnintro.html?utm_source=chatgpt.com
2. Practical tutorial using Python and pgmpy:
https://pgmpy.org/detailed_notebooks/1.%20Introduction%20to%20Probabilistic%20Graphical%20Models.html?utm_source=chatgpt.com

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Program: B. Tech in Artificial Intelligence (AI) and Data Science Final Year B. Tech Semester: VII/VIII
Course: Social Media Analytics (DJS23SPCE6813)

Prerequisite: Graph Theory, Data Mining, Data visualization, Programming

Course Objectives: The Objectives of course are

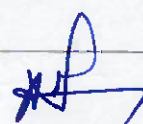
1. Understand the fundamentals of social media and its significance in modern communication.
2. Develop skills in social media analytics and assess the effectiveness of social media strategies using various tools.
3. Apply visualization techniques for interpreting and presenting social media data insights.
4. Examine the ethical and legal implications of utilizing social media data for analytics

Course Outcomes: Students will be able to

1. Understand the fundamental concepts of social media and its impact on communication.
2. Describe the significance of social media analytics in evaluating online presence and decision-making
3. Analyze the effectiveness of social media strategies using quantitative and qualitative metrics
4. Utilize various social media analytics tools to extract and interpret relevant data
5. Apply effective visualization techniques to represent and communicate insights from social media data.
6. Evaluate the ethical and legal considerations involved in the use of social media data for analytics.

Social Media Analytics (DJS23SPCE6813)

Unit No	Description	Duration
1	Social Media Analytics Characteristics of Social Media, Types of Social Media (e.g., Facebook, Instagram, Reddit, Bluesky), Social media landscape, Need for Social Media Analytics (SMA), SMA in small & large organizations. Purpose of Social Media Analytics, Social Media vs. Traditional Business Analytics, Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle, Challenges to Social Media Analytics, Social Media Analytics Tools	07
2	Social Network Structure and its media analytics Types of social networks (e.g., Bluesky, Facebook), Measurement and Collection of Social Network Data. Techniques to study different aspects of OSNs, Follower-follower dynamics, link farming, spam detection, hashtag popularity and prediction, linguistic styles of tweets. Case Study: An Analysis of Demographic and Behavior Trends using Social Media: Facebook, Instagram, and Bluesky.	07
3	Social Media Text, Action & Hyperlink Analytics Social Media Text Analytics - Types of Social Media Text, Purpose, of Text Analytics, steps in Text Analytics, Social Media Text Analysis Tools, embedding techniques for textual representation. Social Media Action Analytics - What Is Actions Analytics? Common Social Media Actions, Actions Analytics Tools, Social Media Hyperlink Analytics - Types of Hyperlinks, Types of Hyperlink Analytics, Hyperlink Analytics Tools, Sentiment Analysis and Stance Detection.	07
4	Social Media Location & Search Engine Analytics Location Analytics - Sources of Location Data, Categories of Location Analytics, Location Analytics and Privacy Concerns, Location Analytics Tools, Search Engine Analytics - Types of Search Engines, Search Engine Analytics, Search Engine Analytics Tools	07



5	Applied Social Data Analytics Application of Topic models, Information Diffusion, Opinions and Sentiments – Mining, Analysis and Summarization, Use of LLMs (Large Language Models) for sentiment and stance analysis. Recommendation Systems, Language dynamics and influence in online communities, Community identification, link prediction and topical search in social networks, Case Study: Sentiment and Stance Analysis Using LLMs.	08
6	Social Media Analytics Applications and Privacy Social media in public sector - Analyzing public sector social media, analyzing individual users, case study. Business use of Social Media - Measuring success, Interaction and monitoring, case study. Privacy - Privacy policies, data ownership and maintaining privacy online, online abuse detection and digital safety measures in social media applications	06
Total		42

Textbooks:

1. Gohar -Seven Layers of Social Media Analytics_ Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, and Location Data, 2015.
2. Jennifer Golbeck-Analyzing the Social Web 1st Edition by, 2017.
3. Matthew A Russell- Mining the Social Web Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites O'Reilly, 2019.
4. Charu Aggarwal -Social Network Data Analytics, Springer, 2011

Reference Books:

1. Matthew Ganis- Social Media Analytics , Techniques and Insights for Extracting Business Value, 2015
2. Alex- Social Media Analytics Strategy Using Data to Optimize Business Performance, 2017
3. Szabo, G., G. Polatkan, O. Boykin & A. Chalkiopoulos -Social Media Data Mining and Analytics, Wiley, 2019.

Web Links:

1. Social Media Data Analytics <https://buffer.com/library/social-media-analytics-tools/>
2. Social Media Analytics <https://www.theknowledgeacademy.com/in/courses/digital-marketing-courses/social-media-analytics/>

Online Resources:

1. Introduction to social media analytics <https://www.coursera.org/learn/social-media-analytics-introduction>

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Program: B.Tech in Artificial Intelligence(AI) and Data Science Final Year B. Tech Semester: VII/VIII

Course: AI Enabled Project Management (DJS23SCSC801)

Pre-requisite: Basic knowledge of Project Management concepts, Data Analysis and Statistics, Artificial Intelligence and Machine Learning.

Course Objectives: The Objectives of the course are

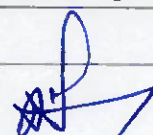
1. To understand the fundamentals of Artificial Intelligence and its role in Agile Project Management.
2. To explore AI-driven techniques for project planning, resource allocation, and predictive analytics.
3. To apply machine learning and deep learning concepts for project forecasting and risk management.
4. To utilize AI tools for real-time project monitoring, reporting, and decision-making.
5. To evaluate ethical, regulatory, and governance aspects of AI adoption in project environments.
6. To analyze emerging AI technologies and their impact on future Agile project management practices.

Course Outcomes: Students will be able to

1. Explain the concepts, principles, and applications of AI in Agile Project Management.
2. Apply AI-based techniques and data-driven approaches for project planning, sprint forecasting, and resource management.
3. Analyze project data using machine learning and predictive analytics to identify risks, delays, and resource constraints.
4. Evaluate AI-enabled monitoring, reporting, and decision-support systems for improving project performance.
5. Assess ethical, regulatory, and bias-related challenges associated with AI implementation in project management.
6. Design AI-assisted project management solutions and recommend future AI adoption strategies for Agile environments.

AI Enabled Project Management (DJS23SCSC801)

Unit	Description	Duration
1	Fundamentals of AI in Agile Project Management Advanced AI Algorithms for Agile,AI-Driven Adaptation in Agile Projects ,Steps for Implementing AI for Dynamic Adjustments,Case Studies on AI-Enhanced Sprint Planning and Performance Forecasting Data Literacy for Agile Project Managers: Integrating Big Data in Agile Workflows for Enhanced Predictive Analysis, Advanced Techniques for Big Data Integration, Big Data Integration in a Sprint Forecasting Workflow, Big Data Techniques and Agile Applications, Exploring AI-Driven Decision Models: Theory and Core Concepts, Types of AI-Driven Decision Models, Step-by-Step Workflow for AI Decision Model Integration, AI Models and Their Functions, Case Study: AI-Driven Sprint Timeline Optimization at Amazon Marketplace, Simulation Exercise: AI-Driven Sprint Prediction	05
2	AI for Resource and Team Management: Machine Learning in Predictive Resource Management, Applying ML in Projects, Foundations of AI-Driven Agile Metrics and Core Concepts, Implementing AI to Track and Predict Agile Metrics,Simulation Exercise: AI-Assisted Resource Forecasting Dashboard ,Use-case: AI-Driven Predictive Resource Analytics to Reduce Delivery Delays , Case Study: AI-Driven Predictive Resource Management for Agile Release Planning, Predictive Analytics in Agile Project Management: Deep Learning for Predictive Modelling, Common Deep Learning Model Choices, Deep Learning	04



	Sprint Risk Prediction: Practical Insights for Project Managers, AI in Risk Management: Understanding Data Patterns, Indicators, Models, and Scoring, Proactive Project Management: Using AI to Predict Delays and Shortages, Case Study: Predicting and Preventing Agile Project Delays Using Deep Learning in a Global Fintech Startup, Simulation Exercise - Management Resource Shortage Forecasting	
3	AI in Project Monitoring and Reporting: Real-Time Monitoring with AI , Detailed Steps: How AI Tools Perform Ongoing Monitoring? AI-Enhanced Reporting , How AI Automates Advanced Agile Reports ? Hands-On Simulation Exercise: AI-Driven Agile Sprint Monitoring and Team Health Dashboard ,Use-case: AI-Driven Sprint Monitoring and Workload, Optimization in a Large E-Commerce Platform, Case Study: Using AI-Driven Real-Time Monitoring to Detect and Prevent Team Burnout in Agile Delivery Ethics, Bias, and Regulation in AI for Project Management: Advanced Ethical Considerations: Decision-Making Transparency, Unintended Consequences of AI Predictions and Ethical Leadership, Regulatory Compliance in Agile AI, Case Study: Mitigating AI Bias in Global Healthcare Resource Allocation, Simulation Exercise -Ethical AI Decision-Making for Agile Resource Allocation Using Ethical AI Analysis Dashboard	04
4	Evaluating and Implementing AI Tools in Agile Projects: Evaluating Return on Investment (ROI) in Agile AI Tools, Measuring Effectiveness and Evaluating Adaptability, Change Management Strategies for AI in Agile, Simulation Exercise: Evaluating AI Project Management Tools Using an Interactive Lovable Dashboard, Use Case: AI-Powered Agile Risk Prediction for Digital Banking Transformation, Case Study: AI-Automated Reporting and Risk Forecasting in Agile Consulting Future Trends and AI in Agile Project Management: The Future of Autonomous Project Management, AI in Remote and Distributed Agile Teams, Case Study - Autonomous AI in Project Management, Simulation Exercise: AI-Driven Collaboration Optimization for Remote Agile Teams using Dashboard, AI-Enhanced Agile and Its Future	04
5	Tracking status updates from Emails, Meetings: Email and Project Management, Dispersed, Distinct, Duplicative, Traffic, One Delay Causes a Queue, Fixing Email with Large Language Models, The Briefing Pattern: Creating a Unified Picture in a Document, LLMs Lack Memory, The Briefing Prompt Pattern,The Briefing Prompt Pattern: Reducing Errors, The Briefing Prompt Pattern: Structured Briefings to Import Into Other Tools, Customizing the Briefing Prompt Pattern: What's New & Action Items, The Prewrite Prompt Pattern: The Assistant that Lays the Groundwork for You, Document Versions for History, Beyond Email, Meeting Transcripts, Notes, Reports, and More	03
6	Amazing Meeting Coordination With ChatGpt: Let Generative AI Schedule Your Meetings, Make Meetings Less Boring with ChatGPT: Meeting Activities, Human Capital: Who Needs to Be There,The LLM-driven Meeting for Enhanced Collaboration, Freeing People to Interact, Multimodal Prompting and Whiteboards	02
Total		22

Online Course:

1. AI for Project Managers and Scrum Masters | Coursera
2. ChatGPT for Project Management: Execution, Tracking, Success | Coursera

Useful Courses:

1. Project Management with AI | Coursera
2. Managing AI Projects: From Strategy to Delivery | Coursera
3. AI Product Management Specialization : r/self learning<https://www.codecademy.com/learn/learn-git>

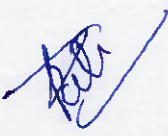
Guidelines:

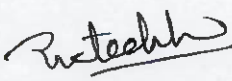
1. The identified courses are designed to develop students' technical, software engineering, and project management competencies, including the effective use of AI-enabled tools. Each selected course shall carry one credit
2. Faculty members shall act as mentors for the Coursera courses identified for various semesters of the program.
3. One faculty mentor shall be assigned to each class of the program for effective coordination and monitoring of this activity.
4. The assigned faculty mentor shall complete and review the course content before assigning the course to students.
5. The term work for these one-credit courses shall form a part of the Internal Continuous Assessment (ICA) component.
6. The Term work (ICA) component shall carry 40 marks

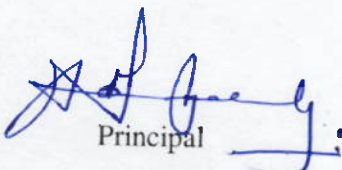
The distribution of marks for term work shall be as follows:

- 15 Marks: Evaluation based on the score obtained in the assigned Coursera course (Marks awarded in proportion to the final Coursera score, scaled to a maximum of 15 marks)
- 15 Marks: Faculty-curated evaluation conducted through the Coursera platform
- 10 Marks: Internal faculty evaluation through quizzes, assignments, presentations, or Project


Prepared by


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Head of the Department


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