Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and Detailed Syllabus (DJS22)

Final Year B.Tech

in

Artificial Intelligence (AI) and Data Science

(Semester 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: 2025-2026

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Scheme for Final Year Undergraduate Program in Artificial Intelligence (AI) and Data Science: Semester VIII (Autonomous)
(Academic Year 2025-26)

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)	Total (TT1 +TT 2)	Term work	CA Total(B)			
1	DJS22ADC801	Data Ethics	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22ADT801	Data Ethics Tutorial	--	--	1	1	--	--	--	--	--	--	--	--	--	25	25	25	1	
2	DJS22ADC802	Knowledge Graph based Neural Network	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22ADL802	Knowledge Graph based Neural Network Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
3@	DJS22ADC8011	AI in Healthcare	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22ADL8011	AI in Healthcare Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJS22ADC8012	Reinforcement and Federated Learning	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22ADL8012	Reinforcement and Federated Learning Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJS22ADC8013	High Performance Computing	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22ADL8013	High Performance Computing Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJS22ADC8014	Quantum Computing	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22ADL8014	Quantum Computing Laboratory		2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
4#	DJS22ILO8021	Project Management	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	3
	DJS22ILO8022	Entrepreneurship Development and Management																		
	DJS22ILO8023	Corporate Social Responsibility																		
	DJS22ILO8024	Human Resource Management																		
	DJS22ILO8025	Corporate Finance Management																		
	DJS22ILO8026	Logistic and Supply Chain Management																		
	DJS22ILO8027	IPR and Patenting																		
	DJS22ILO8028	Digital Marketing Management																		
	DJS22ILO8029	Environmental Management																		
	DJS22ILO8030	Labour and Corporate Law																		
5	DJS22ADP803	Project Stage II	--	10	--	5	2	--	--	--	100	100	--	--	--	100	100	200	5	5
6	DJS22A4	Disaster Management and Preparedness	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Total	14	14	1	20	14	260	50	0	100	410	80	60	140	175	315	725	20	20

@: Department Level Electives, #: Institute Level Electives

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Continuous Assessment (A):

Course	Assessment Tools	Marks	Time (mins)
Theory	a. Term Test 1 (based on 40 % syllabus)	20	60
	b. Term Test 2 (on next 40 % syllabus)	15	60
	c. Assignment / course project / group discussion / presentation / quiz/ any other.	--	--
	Total marks (a + b + c)	35	--
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 & / 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 / *Computer based	Written paper based on the entire syllabus.	65	2
	* 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

Prepared by Checked by Head of the Department Vice Principal Principal

Program: Artificial Intelligence (AI) and Data Science Final Year B.Tech. Semester: VIII
Course: Data Ethics (DJS22ADC801)
Course: Data Ethics Tutorial (DJS22ADT801)

Prerequisite: Data Science Basics, Fundamentals of Computer Science

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 (DJS22ADC801)		
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 practices for data ethics, Emerging Technologies and Ethical Challenges,	**08**

	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.	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

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 Ediiton, 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: OReilly 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.

Prepared by Checked by Head of the Department Vice Principal Principal

Program: Artificial Intelligence (AI) and Data Science **Final Year B.Tech.** **Semester: VIII**
Course: Knowledge Graph based Neural Network (DJS22ADC802)
Course: Knowledge Graph based Neural Network Laboratory (DJS22ADL802)

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 (DJS22ADC802)		
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**

	in GNNs (DropEdge, Graph Augmentation), Mathematical Properties of GNNs, Expressive Power of GNNs (Weisfeiler-Lehman Test), Over-smoothing Problem & Techniques to Mitigate It.	
5	**Semantic Computing and Graph AI**: Semantic Computing in AI, Semantic Computing ,Ontology-Based Reasoning & Knowledge Inference Combining NLP & Knowledge Graphs, Using KGs in NLP, Graph-Based Entity Linking & Relation Extraction, KG + LLM: Retrieval-Augmented Generation (RAG), Leveraging KGs with LLMs, Enhancing LLM explainability with Graph Structures.	07
6	**Explainability and Future of Graph-Based AI:** Explainability in GNNs, XGNN (Explainable Graph Neural Networks), Graph Explainability Metrics: Node Importance, Edge Influence, Mathematical Interpretability in Graph-Based AI, Theoretical Analysis of Message Passing in GNNs, Understanding feature propagation in graphs, Future Trends in Graph-Based AI, Knowledge-Driven AI Systems, Neuro-Symbolic AI & Hybrid Models.	07
	Total	**42**

List of Experiments:

1. Construct a Small-Scale Knowledge Graph.
2. SPARQL Query Basics.
3. Import structured data into Neo4j and visualize the graph.
4. Perform node and relationship queries using Cypher.
5. Apply TransE or ComplEx embeddings to find similar entities in a KG.
6. Demonstrate how node features aggregate during GNN message passing.
7. Train a GNN on a large graph using mini-batch techniques.
8. Perform entity linking in text using a KG-based approach.
9. Integrate a KG with a language model for retrieval-augmented generation.
10. Explain GNN Predictions Using XAI.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Textbooks:

1. A. Hogan, Knowledge Graphs – Fundamentals, Techniques, and Applications, MIT Press, 2022.
2. Jesus Barrasa, Building Knowledge Graphs, O'Reilly Media, 2021.
3. S. Dwivedi, Hands-On Graph Neural Networks, O'Reilly Media, 2023.
4. William L. Hamilton, Graph Representation Learning, MIT Press, 2020.

Reference Books:

1. Aidan Hogan, Eva Blomqvist, Michael Cochez, Claudia d'Amato, Gerard de Melo, Claudio Gutierrez, Sabrina Kirrane, Josiane Xavier Parreira, Axel Polleres, Roberto Navigli , Knowledge Graphs Fundamentals Techniques and Applications, MIT Press, 2022.
2. Lingfei Wu, Peng Cui, Jian Tang, Graph Neural Networks: Foundations Frontiers and Applications, Springer, 2022.

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

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Program: Artificial Intelligence (AI) and Data Science **Final Year B.Tech.** **Semester: VIII**
Course: AI in Healthcare (DJS22ADC8011)
Course: AI in Healthcare Laboratory (DJS22ADL8011)

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

Course Objectives: The objectives of the course are

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 (EHR, medical imaging, wearable/time-series, genomic, claims) and evaluate their quality, interoperability issues, privacy requirements, and ethical/regulatory constraints.
2. Select, implement and evaluate appropriate machine-learning methods (supervised classification, unsupervised clustering, time-series forecasting) for predictive tasks in healthcare, reporting model performance with suitable clinical metrics.
3. Design, train and validate deep learning models (CNNs for imaging, RNNs/Transformers for time-series) for tasks such as disease classification, segmentation, and outcome prediction.
4. Understand AI innovations in personalized medicine, drug discovery, remote monitoring, and healthcare operations

AI in Healthcare (DJS22ADC8011)		
Unit No.	**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 recognitions, 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. Adam Bohr and Kayeh Memarzadeh ,Artificial Intelligence in Healthcare, Elsevier Science & Technology, First Edition, 2020.
2. Jyoti Kataria and Ashwani Kumar ,Machine Learning for Healthcare , Lambert Academic Publishing, First Edition, 2023.
3. Clinical Natural Language Processing, , Academic Press, First Edition, 2022.

4. Vincent C. Müller, Zhonghua Wang, Scott Poon, and Andrew Taylor, Ethics of Artificial Intelligence and Robotics, Stanford Encyclopedia of Philosophy, Summer Edition, 2020.
5. The AI Revolution in Healthcare: Transforming the Future, Sharma Karuna., eBookIt.com 2024.
6. Arjun Panesar, Machine learning and AI for healthcare: Big data for improved health outcomes, Apress, Second Edition, 2021.

Reference Books:

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

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Program: Artificial Intelligence (AI) and Data Science **Final Year B.Tech.** **Semester: VIII**
Course: Reinforcement Learning and Federated Learning (DJS22ADC8012)
Course: Reinforcement Learning and Federated Learning Laboratory (DJS22ADL8012)

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 (DJS22ADC8012)		
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).

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

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

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Program: Artificial Intelligence (AI) and Data Science **Final Year B.Tech.** **Semester: VIII**
Course: High Performance Computing (DJS22ADC8013)
Course: High Performance Computing Laboratory (DJS22ADL8013)

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 resourcesusing 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 (DJS22ADC8013)		
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 (shared memory atomics, warp shuffling).	09
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

List of Experiments:

1. Set up the CUDA environment, install the CUDA Toolkit, and write a basic. CUDA program to understand the CUDA development environment.
2. Implement vector addition using CUDA to introduce students to parallelism, thread. management, and memory allocation in GPU programming.
3. Develop a CUDA program for matrix multiplication to understand parallelism and optimization techniques in GPU computing.
4. Apply CUDA for image processing tasks, like blurring and edge detection, learn how to process images efficiently using GPU parallelism.
5. Implement parallel reduction operations (e.g., sum, min, max) to grasp the concept of efficient parallel reduction.
6. Explore parallel sorting algorithms using CUDA, comparing their performance with CPU based sorting and optimizing CUDA sorting.
7. Employ CUDA to perform a Monte Carlo simulation for estimating mathematical constants or solving real-world problems to understand the power of GPU parallelism.
8. Experiment with CUDA to implement concurrent data structures using locks and atomic operations to learn how to manage data concurrently.
9. Optimize the reduction step in machine learning algorithms using CUDA, focusing on techniques for efficient large-scale data processing.
10. Integrate CUDA-accelerated code with data science frameworks like TensorFlow or PyTorch to develop and run GPU-accelerated machine learning models for practical applications.
11. Perform the Log Analysis-Based Resource and Execution Time Improvement.

Batch wise laboratory work of 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. 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 Ansorge," 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 Sandersand Edward Kandrot, Addison-Wesley "CUDA by Example: An Introduction to General-Purpose GPU Programming", 1st Edition, 2010.
3. Hager, G. andWellein, 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, DouglasEadline 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/
7. Case Study https://www.researchgate.net/publication/265817932_CUDA-based_scientific_computing_Tools_and_selected_applications

Online Resources:

1. High Performance Computing, IISc Bangalore Prof. Mathew Jacob https://nptel.ac.in/courses/106108055
2. Introduction to High-Performance and Parallel Computing https://www.coursera.org/learn/introduction-high-performance-computing?msockid=0fba0991cc8d64af281a1ae9cd3f657a

Prepared by Checked by Head of the Department Vice Principal Principal

Program: Artificial Intelligence (AI) and Data Science **Final Year B.Tech.** **Semester: VIII**
Course: Quantum Computing (DJS22ADC8014)
Course: Quantum Computing Laboratory (DJS22ADL8014)

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 (DJS22ADC8014)		
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).

Batch wise laboratory work of 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

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Shri Vile Parle Kelavani Mandal's

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

(Autonomous College Affiliated to the University of Mumbai)

NAAC Accredited with "A" Grade (CGPA: 3.18)

Program: Common for All Programs	Final Year B.Tech	Semester: VIII
Course: Project Management (DJS22ILO8021)		

Pre-requisites: Basic concepts of Management.

Objectives:

1. To familiarize the students with the use of a structured methodology/approach for every unique project undertaken, utilizing project management concepts, tools and techniques.
2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

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

1. Explain the project management life cycle and the various project phases, as well as the role of the project manager.
2. Apply selection criteria and select an appropriate project from different options.
3. Create a work breakdown structure for a project and develop a schedule based on it. Manage project risk strategically.
4. Use the Earned Value technique and determine & predict the status of the project.
5. Capture lessons learned during project phases and document them for future reference.

Project Management (DJS22ILO8021)		
Unit	**Description**	**Duration**
1	**Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical), Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Introduction to project leadership, ethics in projects, Multicultural and virtual projects, Project management in various organizational structures, PM knowledge areas as per the Project Management Institute (PMI).	8
2	**Initiating Projects:** How to get a project started, selecting a project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating a charter, Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics.	8
3	**Project Planning:** Work Breakdown Structure (WBS) and linear responsibility chart, Project cost estimation and budgeting, top-down and bottom-up budgeting. Networking and Scheduling techniques, PERT, CPM, Crashing project time, Resource loading and levelling, Goldratt's critical chain, GANTT chart, Project Stakeholders and Communication plan, Introduction to Project Management Information System (PMIS). Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks.	10
4	**Monitoring and Controlling Projects:** Planning, monitoring, and controlling cycle, Information needs and reporting, engaging all stakeholders of the projects, communication, and project meetings. With Earned Value Management techniques for measuring the value of work completed, using milestones for measurement, change requests, and scope creep, Project audit. Project Contracting Project procurement	8

	management, contracting and outsourcing.	
5	**Closing the Project:** Customer acceptance, Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report, doing a lessons learned analysis, acknowledging successes and failures.	8
	Total	42

Books Recommended:

Text books:

- Project Management: A managerial approach, Jack Meredith & Samuel Mantel, 7th Edition, Wiley India.
- Project Management: The Managerial Process, 6th edition, Erik Larson, Clifford Gray, McGraw Hill Education.

Reference Books:

- A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed. Project
- Management Institute PA, USA.
- Project Management, Gido Clements, Cengage Learning.
- Project Management, Gopalan, Wiley India.
- Project Management, Dennis Lock, 9th Edition, Gower Publishing England.

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Shri Vile Parle Kelavani Mandal's

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

(Autonomous College Affiliated to the University of Mumbai)

NAAC Accredited with "A" Grade (CGPA: 3.18)

Program: Common for All Programs	Final Year B.Tech	Semester: VIII
Course: Entrepreneurship Development and Management (DJS22ILO8022)		

Objectives:

1. To develop entrepreneurial abilities by providing background information about support systems, skill sets, financial and risk covering institutions.
2. To appraise the students with the fundamentals that can help them make the right decisions for.

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

1. Develop idea generation, creative and innovative skills
2. Prepare a Business Plan
3. Compare different entrepreneur-supporting institutions
4. Correlate a suitable MSME scheme for an entrepreneur
5. Interpret the financial and legal aspects of a business.

Entrepreneurship Development and Management (DJS22ILO8022)		
Unit	**Description**	**Duration**
1	**Meaning of Entrepreneur** Evolution of the concept, Functions of an Entrepreneur, Types of Entrepreneurs, Intrapreneur- an emerging class, Concept of Entrepreneurship, Evolution of Entrepreneurship Development of Entrepreneurship Entrepreneurial, Culture Stages in the entrepreneurial process: Develop idea generation, creative, and innovative skills	08
2	**Business Planning Process** Meaning of business plan, Business plan process, Advantages of business planning Marketing plan, Production/operations plan, Organization plan, Financial plan, Final Project Report with Feasibility Study, Preparing a model project report for starting a new venture.	08
3	**Institutions Supporting Entrepreneurs:** Small industry financing in developing countries, A brief overview of financial institutions in India, Central level and state level institutions - SIDBI-NABARD-IDBI-SIDCO, Indian Institute of Entrepreneurship System. District Industries Centers - Single Window	08
4	**Micro, Small, and Medium Enterprises (MSMES):** MSMEs - Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes, Forms of Business; Make-In India, Start-Up India, Stand-Up India. Women Entrepreneurship; Rural Entrepreneurship; Family Business and First-Generation Entrepreneurs	09
5	**Finance, Accounting, Costing, and Legal Aspects of Business:** Funding new ventures: Conventional Source of Finance, bootstrapping, crowd sourcing- angel investors, VCs, debt financing, due diligence, Legal aspects of business (IPR, GST, Labour law)- Cost, volume, profit, and break-even analysis - Margin of safety and the degree of operating leverage. Capital budgeting for comparing projects or opportunities, Product costing- Product pricing- Introduction to financial statements - Profit & Loss statement, Balance sheet - Cash flow-Closure of Business	09
	Total	42

Books Recommended:

Reference Books:

- Effective Entrepreneurial Management: Strategy, Planning, Risk Management, and
- Organization - by Robert D. Hisrich Veland Ramadani, Springer Publication (2017)
- Entrepreneurship-Theory, Process Practice -by Donald F.Kuratko, Cengage Learning(2014)
- Entrepreneurship 6/E-by Robert D. Hisrich McGraw-Hill Education (India) (2011)
- Entrepreneurship and small business- by Burns, P. New Jersey: Palgrave. (2001).
- Innovation and entrepreneurship by Drucker. F. Peter, Harper business, (2006).
- Entrepreneurship development small business enterprises, Poornima M Charantimath Pearson
- Publication (2013)
- Entrepreneurial Development -Jayshree Suresh, Margham Publishers, Chennai
- The Design of Business- by Martin Roger, Harvard Business Publishing (2009)
- Entrepreneurship-by Roy Rajiv Oxford University Press (2011)

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Shri Vile Parle Kelavani Mandal's

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

(Autonomous College Affiliated to the University of Mumbai)

NAAC Accredited with "A" Grade (CGPA: 3.18)

Program: Common for All Programs	Final Year B.Tech	Semester: VIII
Course: Corporate Social Responsibility (DJS22ILO8023)		

Objectives:

1. To make students understand the concept, theories, and application of CSR for the Development of Society.

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

1. Understand the key characteristics of Corporate Social Responsibility (CSR) in the context of present-day management.
2. Apprise regarding business decision-making, which is informed by ethical values and respect for people, communities, and the environment.
3. Become aware of creating a strategic plan that enables an organization to reach out to its internal and external stakeholders with consistent messages.
4. Understand critical issues of Corporate Social Responsibility (CSR) in a cross-cultural setting.

Corporate Social Responsibility (DJS22ILO8023)		
Unit	**Description**	**Duration**
1	**Introduction to CSR** Meaning and Definition, History of CSR, Concepts of Charity, Corporate Philanthropy, Corporate Citizenship, Sustainability, and Stakeholder Management. Environmental aspects of CSR, Chronological evolution, and Models of CSR in India, including Carroll's model and major codes on CSR Initiatives in India.	09
2	**International Framework for Corporate Social Responsibility** Millennium Development Goals, Sustainable Development Goals, Relationship between CSR and MDGs. United Nations (UN) Global Compact 2011. UN guiding principles on business and human rights. OECD CSR policy tool, ILO Tripartite Declaration of Principles on Multinational Enterprises and Social Policy.	09
3	**CSR-Legislation in India and the World** Section 135 of the Companies Act 2013.Scope for CSR Activities under Schedule VII, Appointment of Independent Directors on the Board, and the Implementation of the Computation of Net Profit in India.	08
4	**The Drivers of CSR in India** Market-based pressure and incentives, civil society pressure, the regulatory environment in India, Counter trends, Review of current trends and opportunities in CSR, Review of successful corporate initiatives, and challenges of CSR. Case Studies of Major CSR Initiatives, Corporate Social Responsibility and Public-Private Partnership (PPP).	08
5	**Identifying key stakeholders of CSR** Role of Public Sector in Corporate, government programs, Nonprofit, and Local Self Governance in implementing CSR, Global Compact Self-Assessment Tool, National Voluntary Guidelines by the Govt. of India, and Roles and responsibilities of corporate foundations.	08
	Total	42

Books Recommended:

Textbooks:

- Corporate Social Responsibility in India, Sanjay K Agarwal, Sage Publications, 2008.
- Corporate Social Responsibility in India, Bidyut Chakrabarty, Routledge, New Delhi, 2015.

Reference Books:

- Corporate Social Responsibility: An Ethical Approach, Mark S. Schwartz, Broadview Press, 2011
- Attaining Sustainable Growth through Corporate Social Responsibility, George Pohle and Jeff Hittner, IBA Global Business Services, 2008.
- Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, William B. Werther Jr. and David Chandler, 2nd Edition, Sage Publications, 2011

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Shri Vile Parle Kelavani Mandal's

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

(Autonomous College Affiliated to the University of Mumbai)

NAAC Accredited with "A" Grade (CGPA: 3.18)

Program: Common for All Programs	Final Year B.Tech	Semester: VIII
Course: Human Resource Management (DJS22ILO8024)		

Objectives:

1. To introduce the students to basic concepts, techniques, and practices of human resource management.
2. To provide an opportunity of learning Human Resource Management (HRM) processes, related to the functions, and challenges in the emerging perspective of today's organizations.
3. To familiarize the students with the latest developments, trends & different aspects of HRM.
4. To acquaint the student with the importance of inter-personal & inter-group behavioral skills in an organizational setting required for future stable engineers, leaders, and managers.

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

1. Understand the concepts, aspects, techniques, and practices of human resource management.
2. Understand the Human Resource Management (HRM) processes, functions, changes, and challenges in today's emerging organizational perspective.
3. Gain knowledge about the latest developments and trends in HRM.
4. Apply the knowledge of behavioral skills learnt and integrate it with interpersonal and intergroup environments, emerging as future stable engineers and managers.

Human Resource Management (DJS22ILO8024)		
Unit	**Description**	**Duration**
1	**Introduction to HR** Human Resource Management- Concept, Scope, and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions. Human resource development (HRD): changing role of HRM, Human resource Planning, Technological change, Restructuring, and rightsizing. Empowerment, TQM, and Managing ethical issues.	08
2	**Organizational Behaviour (OB)** Introduction to OB Origin, Nature and Scope of Organizational Behaviour, Relevance to Organizational Effectiveness and Contemporary Issues. Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness. Perception: Attitude and Value, Effect of perception on Individual Decision-making. Attitude and Behaviour. Motivation: Theories of Motivation and their Applications for Behavioural Change (Maslow, Herzberg, McGregor); Group Behaviour and Group Dynamics: Work groups, formal and informal groups and stages of group development, Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team. Case study.	10
3	**Organizational Structure & Design** Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and stress. Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership. Power and Politics: Sources and uses of power, Politics at the workplace, Tactics and	08

	strategies.	
4	**Human Resource Planning** Recruitment and Selection process, Job-enrichment, Empowerment-Job Satisfaction, employee morale. Performance Appraisal Systems: Traditional & modern methods, Performance Counselling. Career Planning. Training & Development: Identification of Training Needs, Training Methods. Strategic HRM: Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making: Strategic Intent-Corporate Mission, Vision, Objectives, and Goals.	08
5	**Labor Laws and Industrial Relations:** Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act. **Emerging Trends in HR** Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development, managing processes & transformation in HR. Organizational Change, Culture, Environment. Cross-Cultural Leadership and Decision Making: Cross-Cultural Communication and diversity at work, Causes of diversity, managing diversity with special reference to handicapped, women, and ageing people, intra-company cultural differences among employees motivation.	08
	Total	42

Books Recommended:

Reference Books:

- Stephen Robbins, Organizational Behavior, 16th Ed, 2013.
- V SP Rao, Human Resource Management, 3rd Ed, 2010, Excel Publishing.
- Aswathapa, Human Resource Management: Text & Cases, 6th edition,
- C. B. Mamoria and SV Gankar, Dynamics of Industrial Relations in India, 15th Ed, 2015, Himalaya Publishing, 15thedition, 2015
- P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5th Ed, 2013, Himalaya Publishing
- Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Shri Vile Parle Kelavani Mandal's

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

(Autonomous College Affiliated to the University of Mumbai)

NAAC Accredited with "A" Grade (CGPA: 3.18)

Program: Common for All Programs	Final Year B.Tech	Semester: VIII
Course: Corporate Finance Management (DJS22ILO8025)		

Pre-requisites: Basic Knowledge of Algebra, Probability, and Statistics.

Objectives:

1. Overview of the Indian financial system, instruments, and market.
2. Basic concepts of value of money, returns and risks, corporate finance, working capital, and its management.
3. Knowledge about sources of finance, capital structure, and dividend policy.

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

1. Understand the Indian finance system.
2. Apply concepts of time value, money, and risk returns to products, services, and businesses.
3. Understand corporate finance; evaluate and compare the performance of multiple firms.
4. Take Investment, finance, as well as dividend decisions.

Corporate Finance Management (DJS22ILO8025)		
Unit	**Description**	**Duration**
01	**Overview of the Indian Financial System:** Characteristics, Components, and Functions of the Financial System. Financial Instruments: Meaning, Characteristics, and Classification of Basic Financial Instruments: Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. Financial Markets: Meaning, Characteristics and Classification of Financial Markets - Capital Market, Money Market, and Foreign Currency Market Financial Institutions: Meaning, Characteristics, and Classification of Financial Institutions-Commercial Banks, Investment-Merchant Banks, and Stock Exchanges	08
02	**Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance Investment Decision, Financing Decision, and Dividend Decision. Financial Ratio Analysis. **Overview of Financial Statements:** Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios: Stock Market Ratios; Limitations of Ratio Analysis	08
03	**Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-Security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-Security Portfolio. Time Value of Money: Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due: Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	08
04	**Working Capital Management:** Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities. Capital Budgeting: Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion-Accounting Rate of Return,	09

	Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR).	
05	**Capital Structure:** Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure Dividend Policy: Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches- Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	09
	Total	**42**

Books Recommended:

Reference Books:

- Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
- Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.
- Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
- Financial Management, 11th Edition (2015) by 1. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.
- Financial Management, Theory & Practice 8th Edition (2011), by Prasanna Chandra: Tata McGraw Hill Education Private Limited, New Delhi.

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Shri Vile Parle Kelavani Mandal's

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

(Autonomous College Affiliated to the University of Mumbai)

NAAC Accredited with "A" Grade (CGPA: 3.18)

Program: Common for All Programs	Final Year B.Tech	Semester: VIII
Course: Logistic and Supply Chain Management (DJS22ILO8026)		

Objectives:

1. To acquaint with the concept of key drivers of supply chain performance and their inter-relationships with strategy.
2. To acquaint with the design problems and develop an understanding of information technology in supply chain optimization.
3. To acquaint with the complexity of inter-firm and intra-firm coordination in implementing programs such as e-collaboration, quick response, jointly managed inventories and strategic alliances.

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

1. Demonstrate the functional strategy map of supply chain management.
2. Analyze the determinants of Supply Chain and Transportation networks design.
3. Demonstrate the need of coordination and sourcing decisions in supply chain.
4. Understand pricing, revenue management and role of IT in supply chain.
5. Understand various sustainability aspects of a supply chain.

Logistic and Supply Chain Management (DJS22ILO8026)		
Unit	**Description**	**Duration**
01	**Understanding the Supply Chain:** Objective, Importance, Decision Phases, Process Views. **Achieving Strategic Fit and Scope:** Competitive and Supply Chain Strategies, Achieving Strategic Fit, Expanding Strategic Scope, Challenges to Achieving and Maintaining Strategic Fit. **Supply Chain Drivers and Metrics:** Financial Measures of Performance, Drivers of Supply Chain Performance, Framework for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing. **Creating the Responsive Supply Chain:** Product push versus demand pull, The Japanese philosophy, The foundations of agility, A route-map to responsiveness.	8
02	**Designing the Supply Chain and Transportation Networks** **Designing Distribution Networks:** The Role of Distribution in the Supply Chain, Factors Influencing Distribution Network Design, Design Options for a Distribution Network. **Network Design in the Supply Chain:** The Role of Network Design in the Supply Chain, Factors Influencing Network Design Decisions, Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation. **Designing Global Supply Chain Networks:** The Impact of Globalization on Supply Chain Networks, The Offshoring Decision: Total Cost, Risk Management in Global Supply Chains, Discounted Cash Flows, Evaluating Network Design Decisions Using Decision Trees. **Transportation in a Supply Chain:** The Role of Transportation in a Supply Chain, Modes of Transportation and their Performance Characteristics, Design Options for a Transportation Network, Trade-Offs in Transportation Design, Tailored Transportation.	10

03	**Coordination in a Supply Chain:** Lack of Supply Chain Coordination and the Bullwhip Effect, The Effect on Performance of Lack of Coordination, Obstacles to Coordination in a Supply Chain, Managerial Levers to Achieve Coordination, Continuous Replenishment and Vendor-Managed Inventories, Collaborative Planning, Forecasting, and Replenishment. **Sourcing Decisions in a Supply Chain:** The Role of Sourcing in a Supply Chain, In-House or Outsource, Third- and Fourth-Party Logistics Providers, Using Total Cost to Score and Assess Suppliers, Supplier Selection-Auctions and Negotiations, Contracts, Risk Sharing and Supply Chain Performance, Design Collaboration, The Procurement Process.	8
04	**Pricing and Revenue Management in a Supply Chain:** The Role of Pricing and Revenue Management in a Supply Chain, Pricing and Revenue Management for Multiple Customer Segments, Pricing and Revenue Management for Perishable Assets, Pricing and Revenue Management for Seasonal Demand, Pricing and Revenue Management for Bulk and Spot Contracts. **Information Technology in a Supply Chain:** The Role of IT in a Supply Chain, The Supply Chain IT Framework, Customer Relationship Management, Internal Supply Chain Management, Supplier Relationship Management, The Transaction Management Foundation, Managing the supply chain as a network, Seven major business transformations, From 3PL to 4PL. The Future of IT in the Supply Chain.	8
05	**Creating a Sustainable Supply Chain:** The Role of Triple Bottom Line, Key Metrics for Sustainability, Greenhouse gases and the supply chain, Reducing the transport-intensity of supply chains, Beyond the carbon footprint, Reduce, reuse, recycle, Sustainability and Supply Chain Drivers. **Introduction to the Supply Chain of the Future:** Emerging Megatrends.	8
	Total	42

Books Recommended:

Reference Books:

- Logistics & Supply Chain Management, Martin Christopher, Pearson Education Limited, 2016.
- Supply Chain Management Strategy, Planning, and Operation, Sunil Chopra and Peter Meindl, Pearson, 2016.
- Essentials of Supply Chain Management, Michael H. Hugos, Wiley, 2018.
- Supply Chain Management For Dummies, Daniel Stanton, Wiley, 2020.
- Global Supply Chain and Operations Management A Decision-Oriented Introduction to the Creation of Value, Dmitry Ivanov, Alexander Tsipoulanidis and Jörn Schönberger, Springer International Publishing, 2016.
- Supply Chain Management, Sinha, McGraw-Hill Education (India) Pvt Limited, 2012.

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Shri Vile Parle Kelavani Mandal's

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

(Autonomous College Affiliated to the University of Mumbai)

NAAC Accredited with "A" Grade (CGPA: 3.18)

Program: Common for All Programs	Final Year B.Tech	Semester: VIII
Course: IPR and Patenting (DJS22ILO8027)		

Objectives:

1. Understanding, defining, and differentiating different types of intellectual properties (IPs)
2. Assessing different IP management (IPM) approaches
3. Exposure to the Legal management of IP and understanding of real-life practice of IPM.

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

1. Recognize the crucial role of IP for the purposes of product and technology development.
2. Understand how and when to file a patent
3. Apply the knowledge to understand the entire ecosystem
4. Derive value from IP and leverage its value in new product and service development.

IPR and Patenting (DJS22ILO8027)		
Unit	**Description**	**Duration**
1	**Concept of Intellectual Property Law** Idea/Expression dichotomy, Introduction, and the need for intellectual property rights (IPR), Intellectual Property laws, IPR in India: Genesis and development, IPR abroad, Major International Instruments concerning Intellectual Property Rights: Paris Convention, the Berne Convention, the Universal Copyright Convention, the WIPO Convention, the Patent Cooperation Treaty, the TRIPS Agreement, incentive theory, types of IPR, India's New National IP Policy, 2016, Govt. Schemes in IPR IP	8
2	**Patents and Trademarks** Elements of Patentability: Novelty, Non-Obviousness, Industrial Application, Non Patentable Subject Matter, Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties, Patent Office and Appellate Board, Case study of existing patents related to software, healthcare, and devices Concept of Trademarks, Different kinds of marks (brand names, logos, signatures, symbols, well-known marks, certification marks, and service marks), Non Registrable Trademarks, Registration of Trademarks, Rights of holder and assignment and licensing of marks, Infringement, Remedies & Penalties, Trademarks registry and appellate board	10
3	**Copyrights and Designs** Copyrights: Nature, Subject matter: original literary, dramatic, musical, artistic works, cinematograph films and sound recordings, Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright, Infringement, Remedies & Penalties, Related Rights, distinction between related rights and copyrights Design: meaning and concept of novel and original, procedure for registration, effect of registration and term of protection.	8
4	**GI, PVP, and LDP** Geographical indication: meaning, difference between GI and trademarks, procedure for registration, effect of registration, and term of protection. Plant variety protection: meaning, benefit sharing, farmers' rights, procedure for registration, effect of registration, and term of protection. Layout Design protection: meaning, procedure for registration, effect of registration, term of protection	8

5	**Beyond IP** Introduction to Competition Law: concept of competition, relationship and Interaction between IPR and competition law, IP and competition issues, Technology transfer agreements. EU experience with IP and Competition Law, the Indian Competition Act, and IPR protection, IPR issues in mergers and acquisitions, harmonization of IP protection, and competition Law in India.	8
	Total	42

Books Recommended:

Reference Books:

- Feroz Ali, The Law of Patents, LexisNexis
- Ronald D. Slusky, Invention Analysis and Claiming - A Patent Lawyer's Guide, Second Edition, American Bar Association, 2012.
- Feroz Ali, The Touchstone Effect: The Impact of Pre-grant Opposition on Patents, LexisNexis, 2009.
- Innovation and entrepreneurship by Drucker. F. Peter, Harper's Business, (2006).
- Intellectual Property Rights, Deborah. E. Bouchoux, Cengage Learing.
- Intellectual Property Rights-Unleash The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,
- The Design of Business- by Martin Roger, Harvard Business Publishing (2009)

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Shri Vile Parle Kelavani Mandal's

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

(Autonomous College Affiliated to the University of Mumbai)

NAAC Accredited with "A" Grade (CGPA: 3.18)

Program: Common for All Programs	Final Year B.Tech	Semester: VIII
Course: Digital Marketing Management (DJS22ILO8028)		

Objectives:

1. To explain the evolution of digital marketing and outline the underlying technology and frameworks within which digital marketing operates.
2. To understand digital marketing business models elucidating on the six core digital value elements and how they can be used to generate customer value.
3. To understand the key concepts of developing strategy for digital business and the emerging business structures.
4. To plan the digital marketing strategy roadmap, its four key stages and their elements and understand the 6S Digital Marketing Implementation Stages.
5. To understand digital marketing planning & operations setup.
6. To explain the implementation of search campaigns which include Search Engine Marketing (SEM) and Search Engine Optimization (SEO) concepts.
7. To explain upcoming digital marketing concepts including Big Data and Internet of Things
8. (IoT), Small and Medium Businesses (SMB), B2B marketing and Social, Local and Mobile (SoLoMo) concept.

Outcomes: Upon Completion of the course, the learner should be able to:

1. Understand the digital marketing framework & model and consumer behaviour.
2. Develop a digital marketing strategy roadmap.
3. Explain the terminology and concepts for developing web-specific media plans.
4. Understand concepts related to digital campaign management and revenue generation models.
5. Get a perspective on global digital marketing technology/tools and future trends.

Digital Marketing Management (DJS22ILO8028)		
Unit	**Description**	**Duration**
1	**Introduction to Digital Marketing** Emergence of Digital Marketing as a tool, media consumption drivers for a new marketing environment, applications, and benefits of digital marketing. **Digital Marketing Framework:** Delivering enhanced customer value, market opportunity analysis, and digital services development, ASCOR framework, and critical success factors for digital marketing. **Digital Marketing Models Creation:** Factors impacting the digital marketplace, value chain digitization, and business models. **The Consumer for Digital Marketing:** Consumer behavior on the internet, evolution of consumer behavior models, managing consumer demand, integrated marketing communications (IMC), and impact of digital channels on IMC.	8
2	**Digital Marketing Strategy Development** Elements of the assessment phase, macro-micro environmental analysis, and marketing situation analysis. **Digital Marketing Internal Assessment and Objectives Planning:** Analyzing the present offerings mix, marketing mix, core competencies analysis, and internal resource mapping. Digital presence analysis, digital marketing objectives development, and review.	10

	Digital Marketing Strategy Definition Understanding digital business strategy and structures, consumer development strategy, offering mix for Digital, digital pricing models, managing promotional channels, and developing the extended Ps- People, process, programs, and performance. **Digital Marketing Strategy Roadmap:** Developing a digital marketing strategy roadmap, the 6s digital marketing implementation strategy, and marketing across the product life cycle.	
3	**Digital Marketing Planning and Setup** Understanding digital media planning terminology and stages, steps to creating a marketing communications strategy, introduction to search marketing, display marketing, and social media marketing. **Digital Marketing Operations Setup:** Basics of lead generation and conversion marketing, website content development and management, elements of user experience, web usability, and evaluation.	8
4	**Digital Marketing Execution** Basic elements of digital campaign management, search execution, display execution, social media execution, and content marketing. Digital Marketing Execution Elements Digital revenue generation models, managing service delivery and payments, managing digital implementation challenges like e-commerce, internal & external, and consumer-specific challenges.	8
5	**Digital Business - Present and Future** Digital Marketing - Global Landscape, digital marketing overview, global spend, advertising spend, and technology/tools landscape. Data technologies (Big data and IOT) impacting marketing, segment-based digital marketing, and SoLoMo - the next level of hyperlocal marketing.	8
	Total	42

Books Recommended:

Reference Books:

- Fundamentals of Digital Marketing by Puneet Singh Bhatia, Pearson Education Limited.
- Digital Marketing by Seema Gupta- McGraw-Hill Education.
- Digital Marketing Excellence: Planning, Optimizing, and Integrating Online Marketing by
- Dave Chaffey and P. R. Smith, 5th edition, Taylor & Francis.
- Digital Marketing: Strategy, Implementation and Practice- 6th edition by Dave Chaffey, Fiona Ellis-Chadwick, Pearson Education Limited.
- Digital marketing by Vandana Ahuja, Oxford University Press.
- The Art of Digital Marketing by Ian Dodson, John Wiley & Sons.

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA: 3.18)

Program: Common for All Programs	Final Year B.Tech	Semester: VIII
Course: Environmental Management (DJS22ILO8029)		

Pre-requisites: Basic Knowledge of Probability and Statistics.

Objectives:

1. Understand and identify environmental issues relevant to India and global concerns
2. Learn concepts of ecology
3. Familiarise with environment-related legislation
4. Understand Environmental Auditing Procedures.

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

1. Identify Environmental issues and get familiarized with the concept of the Ecosystem and environmental management.
2. Know policies and legal aspects and understand EM system standards.
3. Understand the Environmental Impact Assessment.
4. Understand Environment Auditing procedures.
5. Describe Environmental Management Techniques

Environmental Management (DJS22ILO8029)		
Unit	**Description**	**Duration**
1	**Principles of Environmental Management (EM):** Introduction of EM, Definition, Ecosystem concept, Participants in EM, Ethics and the environment, International Environmental Movement, Environmental issues relevant to India.	8
2	**Policy and Legal Aspects of EM:** - Introduction to various Environmental Policies, Indian and International Environmental laws and legislation. **EM system Standards:** Core Elements, Benefits, Certification Body Assessment & Documentation for EMS, ISO-14000 Standards.	9
3	**Environmental Impact Assessment (EIA):** Purpose, steps, hierarchy of EIA, Environmental Impact Statement and Impact Indicators, Evolution of IA in India and worldwide. Preliminary stages of EIA, Impact, Prediction, Evaluation and Mitigation.	9
4	**Environmental Auditing (EA):-** Objectives, Scope and Types of EA, Audit Methodology, Elements of Audit Process, Auditing of EMS.	8
5	**Environmental Management Techniques: -** Environmental Monitoring and Modelling, Environmental technology Assessment and Environmental Risk Assessment, Eco-mapping.	8
	Total	42

Books Recommended:

Text Books:

- Environmental Management, T V Ramachandra and Vijay Kulkarni, TERI Press
- Environmental Management: Principles and Practice, CJ Barrow, Routledge Publishers, London, 1999

Reference Books:

- A Handbook of Environmental Management, Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing.
- Indian Standard Environmental Management Systems - Requirements with Guidance for Use, Bureau Of Indian Standards, February 2005.
- Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000.
- Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press.
- Environment and Ecology, Majid Hussain, 3rd Ed. Access Publishing, 2015.

Prepared by	Checked by	Head of the Department	Vice Principal	Principal
P.G. Talwelkar	Rupali Karande			

Shri Vile Parle Kelavani Mandal's

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

(Autonomous College Affiliated to the University of Mumbai)

NAAC Accredited with "A" Grade (CGPA: 3.18)

Program: Common for All Programs	Final Year B.Tech	Semester: VIII
Course: Labour and Corporate Law (DJS22ILO8030)		

Objectives:

1. To understand the development and judicial setup of Labour Laws.
2. To learn the laws relating to Industrial Disputes, Social Security, and Working Conditions.
3. To analyse the laws related to corporate governance in different settings.
4. To develop awareness of legal principles involved in economic relationships and business transactions.
5. To develop an understanding of the free enterprise system and the legal safeguards of the same.

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

1. Illustrate the role of a trade union in the industrial setup.
2. Understand the important causes, impact of industrial disputes, and settlement procedures.
3. To provide an in-depth understanding of corporate social responsibility.
4. Apply concepts, principles, and theories to understand simple business laws.
5. Analyse the principles of international business and the strategies adopted by firms to expand globally.

Labour and Corporate Law (DJS22ILO8030)		
Unit	**Description**	**Duration**
1	**Trade Unions and Collective Bargaining:** Trade Unionism in India, Definition of Trade Union and Trade Dispute, General and Political Funds of Trade Union, Civil and Criminal Immunities of Registered Trade Unions, Recognition of Trade Union, Collective Bargaining	8
2	**Industrial Dispute and Instruments of Economic Coercion:** Industrial Dispute and Individual Dispute, Settlement of Industrial Dispute. Concept of strike, Gherao, Bandh, and Lock-out, Types of Strike, Rights to Strike and Lock-out	9
3	**Formation of a Company and Corporate Governance:** Company and Other Forms of Business Organizations, Different Kinds of Companies: One Person Company, Foreign Company. Kinds of Company Meetings and Procedure Powers, Duties, and Kinds of Directors: Independent Director, Women Director. Different Prevention of Oppression and Mismanagement, Investor Protection, Insider Trading, Corporate Fraud.	9
4	**Corporate Social Responsibility and Corporate Liquidation:** Evolution of Corporate Social Responsibility, Corporate Criminal Liability, Corporate Environmental Liability, Different Types of Winding up of Company, Role of Courts in Winding up of Company, Merger and Acquisition of Company, Cross-Border Merger, Takeover Code: Role of SEBI	8
5	Case Studies on A) Labour law B) Labour relations C) Corporate laws D) Securities laws	8
	Total	42

Books Recommended:

Reference Books:

- Surya Narayan Misra, An Introduction to Labour and Industrial Law, Allahabad Law Agency, 1978.
- Indian Law Institute, Cases and Materials on Labour Law and Labour Relations, P.L. Malik, Industrial Law, Eastern Book Company, 2013.
- S.C. Srivastava, Industrial Relations and Labour Law, Vikas Publishing House, New Delhi.
- C.A. Kamal Garg, Bharat's Corporate and Allied Laws, 2013.
- Institute of Company Secretaries of India, Companies Act 2013, CCH Wolter Kluver Business, 2013.
- Saleem Sheikh & William Rees, Corporate Governance & Corporate Control, Cavendish Publishing Ltd., 1995
- Taxmann, A Comparative Study of Companies Act 2013 and Companies Act 1956.

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Program: B. Tech. in Artificial Intelligence (AI) and Data Science **Semester: VIII**
Course: Project Stage II **Course Code: DJS22ADP803**

Course Objectives: To introduce the students to professional engineering practice by providing them with an opportunity to work on an open-ended engineering problem. Typically, the students would apply knowledge from different areas or courses, which they have studied in their curriculum using methods, tools, and techniques, which they learned to a real-world scenario. Students would have to apply not only their engineering knowledge and proficiencies (hard skills), but also to demonstrate their competence in generic, professional skills (soft skills). It also emphasizes the importance of life-long learning as a fundamental attribute of graduate engineers.

Course Outcomes: Students will be able to

1. Develop the proposed solution using appropriate techniques.
2. Test the developed system for its correctness using appropriate techniques.
3. Work effectively as a member of the team.

Guidelines:

1. The department must allocate 2 days in the Semester VIII every week.
2. Students will do coding and testing in Semester VIII.
3. Each group along with its guide/mentor shall identify an appropriate technique/s for testing the developed system.
4. The project assessment for term work will be done at least two times at department level by giving presentation to panel members which consist of at least three (3) members as Internal examiners (including the project guide/mentor) appointed by the Head of the department of respective Program.
5. A report is to be prepared summarizing the findings of the literature survey, coding and testing.
6. Every team must publish their work in national / international conference/journals (if possible, publish in Scopus indexed journals) or file a patent.

Prepared by Checked by Head of the Department Vice Principal Principal

Program: Final Year											Semester: VIII
Course: Disaster Management and Preparedness											Course Code: DJS22A4
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test II / presentation / assignment / course project / group discussion / any other.	AVG		Total Marks = (A+ B)
				-			-	-	-		-
				Laboratory Examination			Term work			Total Term work	
2	-	-	-	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal			-
				-	-	-	-	-		-	

Objectives:

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.

Outcomes: On completion of the course, the learner 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.

Detailed Syllabus: (unit-wise)		
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.	04
6	**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	04
	Total Number of Hours	**28**

Books Recommended:

Reference Books and Reports:

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).
6. Natural Hazards and Disaster Management, Vulnerability and Mitigation, by R B Singh, Rawat Publications (2006).
7. Concepts and Techniques of GIS, by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications (2006).
8. Risk management of natural disasters, by Claudia G. Flores Gonzales, KIT Scientific Publishing (2010).
9. Disaster Management – a disaster manger's handbook, by W. Nick Carter, Asian Development Bank (2008).
10. Disaster Management in India, by R. K. Srivastava, Ministry of Home Affairs, GoI, New Delhi (2011)
11. The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy, by Wil Mara, Marshall Cavendish Corporation, New York, 2011.
12. The Fukushima 2011 Disaster, by Ronald Eisler, Taylor & Francis, Florida, 2013.

(Learners are expected to refer reports published at national and international level and updated information available on authentic web sites.)

Prepared by | Checked by | Head of the Department | Vice Principal | Principal