Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus (DJ19)

Final Year B.Tech.

in

Artificial Intelligence (AI) and Data Science

(Semester VIII)

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)

Proposed scheme for Final Year Undergraduate Program in Artificial Intelligence (AI) & Data Science: Semester VIII (Autonomous)
(Academic Year 2024-2025)

Sr. No.	Course Code	Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment (B)					Aggregate (A+B)	Credit	
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	End Sem Exam Total	Term Test 1 (TT1)	Term Test 2 (TT2)	Avg (TT1 & TT2)	Term Work	CA Total			
1	DJ19ADC801	Data Ethics	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	125	3	4
	DJ19ADT801	Data Ethics Tutorial	–	–	1	1	–	–	–	–	–	–	–	–	–	25	25		1	
2	DJ19ADC802	Nature Inspired Computing	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	150	3	4
	DJ19ADL802	Nature Inspired Computing Laboratory	–	2	–	1	–	–	25	–	–	25	–	–	–	25	25		1	
3@	DJ19ADC8011	Reinforcement Learning	3	–	–	3	3	75		–	–	75	25	25	25	–	25	150	3	4
	DJ19ADL8011	Reinforcement Learning Laboratory	–	2	–	1	–	–	25	–	–	25	–	–	–	25	25		1	
	DJ19ADC8012	High Performance Computing	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	150	3	
	DJ19ADL8012	High Performance Computing Laboratory	–	2	–	1	–	–	25	–	–	25	–	–	–	25	25		1	
	DJ19ADC8013	AI in Healthcare	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	150	3	
	DJ19ADL8013	AI in Healthcare Laboratory	–	2	–	1	–	–	25	–	–	25	–	–	–	25	25		1	
	DJ19ADC8014	Explainable AI	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	150	3	
	DJ19ADL8014	Explainable AI Laboratory	–	2	–	1	–	–	25	–	–	25	–	–	–	25	25		1	
4	DJ19ILO8021	Project Management	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	100	3	3
	DJ19ILO8022	Entrepreneurship Development and Management	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	100	3	
	DJ19ILO8023	Corporate Social Responsibility	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	100	3	
	DJ19ILO8024	Human Resource Management	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	100	3	
	DJ19ILO8025	Corporate Finance Management	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	100	3	
	DJ19ILO8026	Logistics and Supply Chain Management	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	100	3	
	DJ19ILO8027	IPR and Patenting	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	100	3	
	DJ19ILO8028	Digital Marketing Management	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	100	3	
	DJ19ILO8029	Environmental Management	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	100	3	
	DJ19ILO8030	Labour and Corporate Law	3	–	–	3	3	75	–	–	–	75	25	25	25	–	25	100	3	
5	DJ19ADP803	Project Stage II	–	10	–	5	2	–	–	–	100	100	–	–	–	100	100	200	5	5
Total			12	14	1	20	14	300	50	0	100	450	100	100	100	175	275	725	20	20

@ Any 1 Elective Course

Any 1 Institute Professional Elective

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

Continuous Assessment (A):

Course	Assessment Tools	Marks	Time (hrs.)
Theory	a. One Term test (based on 40 % syllabus)	25	1
	b. Second Term test (next 40 % syllabus) / presentation / assignment / course project / group discussion / any other.	25	1
	Average marks of a and b	25	--
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	

The final certification and acceptance of term work will be subject to satisfactory performance upon fulfilling minimum passing criteria in the term work / completion of audit course.

Semester End Assessment (B):

Course	Assessment Tools	Marks	Time (hrs.)
Theory / * Computer based	Written paper based on the entire syllabus.	75	3
	* 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 & 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: B. Tech. in Artificial Intelligence (AI) and Data Science				Semester: VIII							
Course: Data Ethics				Course Code: DJ19ADC801							
Course: Data Ethics Tutorial				Course Code: DJ19ADT801							
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total Marks (A+ B)	
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.		
				75			25	25	25	100	
				Laboratory Examination			Term work				
3	-	1	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work	25	
				--	--	--	15	10	25		

Prerequisite: - Data Science Basics, Fundamentals of Computer Science

Course Objectives:

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:

On completion of the course, learner 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 (DJ19ADC801)		
Unit	**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	**06**
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, 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	**08**
3.	**Bias & 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**	**08**

	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.	
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	**06**
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	**03**
	TOTAL	**39**

Data Ethics Tutorial (DJ19ADT801)	
Sr. No.	**Title of Experiment**
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: 3. How can these principles be implemented in practice? 4. 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

Books Recommended:

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
2. Data Ethics 101 - DATAVERSITY
3. An Introduction to Data Ethics - Markkula Center for Applied Ethics
4. An Introduction to Data Ethics: What is the Ethical Use of Data? | DataCamp
5. An Introduction to Data Ethics - Markkula Center for Applied 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

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 75 marks.

2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks and 25 marks will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.

2. Total duration allotted for writing each of the paper is 1 hr.

3. Average of the marks scored in both the two tests will be considered for final grading.

Tutorial: (Term work)

Term work shall consist of minimum 8 tutorials.

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

1. Tutorial work (Performance of tutorial): 15 Marks

2. Journal documentation (Write-up and/or Assignments): 10 marks

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.

Prepared by	Checked by	Head of the Department	Vice Principal	Principal
19/12/2024.				

Program: B. Tech. in Artificial Intelligence (AI) and Data Science	Semester: VIII
Course: Nature Inspired Computing	Course Code: DJ19ADC802
Course: Nature Inspired Computing Laboratory	Course Code: DJ19ADL802

Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total Marks (A+ B)
				Theory			Term Test 1	Term Test 2	Avg.		
Lectures	Practical	Tutorial	Total Credits	75			25	25	25		100
				Laboratory Examination			Term work				
				Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work		50
3	2	--	4	25	--	--	15	10	25		

Prerequisite: - Fundamental of AI, Fundamentals of Machine learning

Course Objectives:

1. Understand computational problems and NP-Hard challenges.
2. Learn the principles of evolutionary systems and genetic algorithms.
3. Explore collective systems and swarm intelligence algorithms.
4. Study behavioral systems and neural mechanisms in AI.
5. Introduce immuno-computing and biologically inspired computing hardware.

Course Outcomes:

On completion of the course, learner will be able to

1. Classify computational problems and explain the significance of NP-Hard challenges.
2. Implement evolutionary algorithms using genetic representation, fitness functions, and operators.
3. Design swarm intelligence algorithms like PSO and ACO for solving optimization problems.
4. Analyze behavioral systems and neural mechanisms in AI for sensory processing and learning.
5. Apply immuno-computing for anomaly detection and explore biologically inspired computing hardware
6. Learn biologically inspired computing hardware: memristors, neuromorphic, DNA, and quantum-inspired computing.

Nature Inspired Computing (DJ19ADC802)		
Unit	**Description**	**Duration**
1.	**Introduction to Computational Problems** Computational Problems, Decision Problem, Optimization Problem, Hardness in Optimization Problems, NP class, NP-Hard, examples for NP-Hard problems, tackling NP- Hard problems, Rationale for seeking inspiration from nature.	**06**
2.	**Evolutionary Systems** Pillars of Evolutionary Theory, The Genotype, Artificial Evolution, Genetic representations, Initial Population, Fitness Functions, Selection and Reproduction, Genetic Operators, Evolutionary Measures, Types of Evolutionary Algorithms.	**06**
3.	**Collective Systems** Particle Swarm Optimization Algorithm, Hybrid PSO algorithms, Ant Colony Optimization, Artificial Bee Colony, Firefly Algorithm, Simulation exercise: Implementing ant colony optimization for the traveling salesman problem.	**05**
4.	**Behavioral systems** Behavior in Cognitive Science, Behavior in Artificial Intelligence, Examination of the components and subsystems that comprise behavioral systems, such as sensory processing, motor control, decision-making, and learning. Overview of neural mechanisms underlying behavior, including brain regions, neurotransmitters, and neural circuits involved in various behavioral processes. Evolution and Neural Development in Behavioral Systems.	**10**
5.	**Immuno Computing** Introduction- Immune System, Physiology and main components, Immune Network Theory, Danger Theory, Evaluation Interaction-Immune Algorithms, Bone Marrow Models, Forest's Algorithm, Artificial Immune Networks. Case study analysis: Applications of artificial immune systems in cybersecurity. Design and implementation of a simple anomaly detection system inspired by immune computing.	**09**
6.	**Biologically Inspired Computing Hardware** Overview of Memristors and neuromorphic computing, DNA computing and molecular algorithms, Quantum-inspired computing.	**03**
	TOTAL	**39**

Suggested List of Experiments

Nature Inspired Computing Laboratory (DJ19ADL802)	
Sr. No.	**Title of Experiment**
1	Implement a genetic algorithm to solve a classic optimization problem such as the Knapsack Problem or Traveling Salesman Problem.
2	Experiment with different crossover and mutation operators to observe their impact on convergence speed and solution quality
3	Simulate an ant colony optimization algorithm to find the shortest path in a graph.

4	Train a simple feedforward neural network to classify a dataset such as the Iris dataset or MNIST handwritten digits dataset.
5	Implement a neuroevolution algorithm to evolve neural network agents for playing simple games like Tic-Tac-Toe or Flappy Bird
6	Develop an artificial immune system algorithm for anomaly detection in a synthetic dataset or network traffic data
7	Apply particle swarm optimization or other swarm intelligence algorithms to perform clustering on a dataset such as the Iris dataset or customer segmentation data
8	Investigate the properties of the memristor, such as resistance modulation and memory effects, and explore its potential applications in neuromorphic computing.
9	Investigate the properties of the memristor, such as resistance modulation and memory effects, and explore its potential applications in neuromorphic computing.
10	Implement a quantum-inspired optimization algorithm, such as quantum annealing or quantum- inspired genetic algorithms, to solve a combinatorial optimization problem
11	Develop a hybrid algorithm that combines multiple nature-inspired techniques, such as genetic algorithms and ant colony optimization, to solve a complex optimization problem.

Minimum 8 experiments and mini project 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

Books Recommended:

Textbooks:

1. Nature-Inspired Optimization Algorithms" by Deb, S., & Yang, X.-S. (2019).
2. Swarm Intelligence: Principles, Advances, and Applications" by Engelbrecht, A. P. (2019).
3. Bio-Inspired Computing: Theories and Applications by Islam, S. M. R., Wang, G.-G., & Zou, Z. (Eds.). (2020).

Reference Books:

1. Neuroevolution: From Architectures to Learning" by Floreano, D., Dürr, P., & Mattiussi, C. (2018).
2. Bio-Inspired Computing: Theories and Applications" by Islam, S. M. R., Wang, G.-G., & Zou, Z. (Eds.). (2020).

Web Links:

1. Lecture Notes | Introduction to Algorithms | Electrical Engineering and Computer Science | MIT OpenCourseWare
2. (PDF) Comments on "Time-Weighted Quadratic Performance Indices for Linear Systems"
3. Efficient Multiple Query Answering in Switched Probabilistic Relational Models | SpringerLink
4. IMU-Based Wrist Rotation Control of a Transradial Myoelectric Prosthesis | IEEE Journals & Magazine | IEEE Xplore

Online resources:

1. Coursera:https://www.coursera.org/learn/computational-thinking-problem-solving
2. NPTEL https://onlinecourses.nptel.ac.in/noc21_me43/preview
3. NPTEL Immuno Computing https://onlinecourses.nptel.ac.in/noc22_bt40/preview
4. https://www.sciencedirect.com/science/article/pii/S2314728818300631
5. Behavioural System https://abatechnologies.com/continuing-education/behavioral-systems-analysis

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks and 25 marks will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 8 experiments.

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

1. Laboratory work (Performance of Experiments): 15 Marks
2. Journal documentation (Write-up and/or Assignments): 10 marks

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.

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

Program: B. Tech. in Artificial Intelligence (AI) and Data Science										Semester: VIII	
Course: Reinforcement Learning										Course Code: DJ19ADC8011	
Course: : Reinforcement Learning Laboratory										Course Code: DJ19ADL8011	
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total Marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg		
				75			25	25	25		100
				Laboratory Examination			Term work				
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work		50
				25	--	--	15	10	25		

Prerequisite: - Machine Learning, Deep Learning and Artificial Intelligence.

Course Objectives:

1. To make students learn to build programs that act in a stochastic environment.
2. Students will gain a deep understanding of the fundamental concepts of Reinforcement Learning
3. Based on past experience using various Reinforcement Learning methods.

Course Outcomes:

On completion of the course, learner will be able to

1. Explain basic and advanced Reinforcement Learning techniques.
2. Identify suitable learning tasks to which Reinforcement learning and Deep Reinforcement Learning techniques can be applied.
3. Use appropriate Reinforcement Learning method to solve a given problem
4. Implementing Temporal Difference (TD) learning methods.
5. Apply deep reinforcement learning techniques to complex problem-solving scenarios.
6. Design and Evaluate effective policies in full reinforcement learning problems

Reinforcement Learning (DJ19ADC8011)		
Unit	**Description**	**Duration**
1.	**Introduction to Reinforcement Learning** Introduction: Reinforcement Learning (RL), Elements of Reinforcement Learning, Reinforcement Learning vs Supervised Learning, Approaches of solving Reinforcement Learning: Value based, policy based, model based, Exploration - Exploitation dilemma, Evolutionary methods, Immediate Reinforcement Learning.	**04**
2.	**Immediate Reinforcement Learning:** Bandit Problems: Bandit problems, Value-action based methods (sample average), Greedy method, €-greedy method, Incremental Implementation, Non-stationary problem, Optimistic Initial values, UCB algorithm, Thompson Sampling. **Policy Gradient Approaches:** Linear reward Penalty Algorithm, Parameterised policy representation(Θ), Evaluation of policy($\eta(\Theta)$), REINFORCE algorithm.	**05**
3.	**Full Reinforcement Learning** Difference between Immediate and Full Reinforcement Learning, Agents and Environment, Goals, Rewards, Returns, Policy in Full Reinforcement Learning, Episodic and Continuing Tasks. **Markov Decision Process (MDP)** Markov Property, Finite Markov Decision Process, Value functions, Bellman's equations, optimal value functions, Definition of MDP in Reinforcement Learning, Solution of the Recycling Robot problem	**06**
4.	**Dynamic Programing** Policy evaluation, policy improvement, policy iteration, value iteration, Asynchronous Dynamic Programing, Generalized Policy Iteration (GPI), bootstrap, full back up **Monte Carlo Method** Advantages of Monte Carlo over Dynamic Programing, Monte Carlo Control, on-policy, off-policy, Incremental Monte Carlo, Issues/Assumptions in Monte Carlo Methods, Solution of BlackJack using Monte Carlo Method	**08**
5.	**Temporal Difference Learning** What is Temporal Difference learning, Advantages of Temporal Difference methods over Monte Carlo and Dynamic Programming methods, TD(0), On-policy vs off-policy, SARSA, Q learning **Eligibility traces** N-step Temporal Difference methods, On-line vs Off-line updation, TD(λ) : forward view, backward view, Traces: Accumulating trace, Dutch trace, Replacing trace, Equivalence of forward and backward view, SARSA(λ)	**08**
6.	**Function Approximation** Drawbacks of tabular implementation, Function Approximation, Gradient Descent Methods, Linear parameterization, Policy gradient with function approximation	**08**

	Deep Reinforcement Learning Intro of Deep Learning in Reinforcement Learning, Deep learning training workflow, Categories of Deep learning, Deep Q-Network, Ways of improving Deep Q-Network, REINFORCE in Full Reinforcement Learning, Actor-Critic Algorithm, Algorithm Summary, DDPG, Case study on AlphaGo by Google DeepMind	
	TOTAL	**39**

Suggested List of Experiments

Reinforcement Learning Laboratory (DJ19ADL8011)	
Sr. No.	**Title of Experiment**
1	Bandit Problem: Implement Greedy and Epsilon greedy methods.
2	Bandit Problem: Comparison between Greedy and Epsilon Greedy Policy
3	Bandit Problem: UCB: Upper Confidence Bound
4	Policy Gradient (Convergence) Implement REINFORCE algorithm on a CartPole/ Lunar Lander.
5	Dynamic Programming and Monte Carlo Methods: Implementation of GridWorld using Dynamic Programming
6	Dynamic Programming and Monte Carlo Methods: Jack's Car Rental using Dynamic Programming
7	Dynamic Programming and Monte Carlo Methods: Gamblers Problem using Dynamic Programming
8	Temporal Difference: Implement Frozen lake using SARSA
9	Temporal Difference: Implement Grid world using Q learning
10	Deep Reinforcement Learning: Compare the performance of Reinforcement Learning and Deep Reinforcement Learning on a Cartpole problem.
11	Deep Reinforcement Learning : Implementation of Deep Q-Network algorithm
12	Deep Reinforcement Learning : Actor Critic: Find the optimal policy using the Actor Critic method.

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

Books Recommended:

Textbooks:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", MIT Press, 2 nd Edition, 2018.
2. Laura Graesser Wah Loon Keng, "Foundations of Deep Reinforcement Learning," Pearson Education, 1 st Edition, 2020

Reference Books:

1. Phil Winder, "Reinforcement Learning Industrial Applications of Intelligent Agents", O'Reilly, 1 st Edition, 2020.
2. Csaba Szepesvari, "Algorithms for Reinforcement Learning," Morgan & Claypool Publishers, 1 st Edition, 2019.

3. Enes Bilgin, "Mastering Reinforcement Learning with Python", Packt publication, 1 st Edition, 2020.
4. Brandon Brown, Alexander Zai, "Deep Reinforcement Learning in Action", Manning Publications, 1 st Edition, 2020.
5. Micheal Lanham, "Hands-On Reinforcement Learning for Games," Packt Publishing, 1 st Edition, 2020
6. Abhishek Nandy, Manisha Biswas, "Reinforcement Learning: With Open AI, TensorFlow and Keras using Python," Apress, 1st Edition, 2018.

Web Links:

1. Deep Reinforcement Learning: https://www.v7labs.com/blog/deep-reinforcement-learning-guide
2. AI Games with Deep Reinforcement Learning: https://towardsdatascience.com/how-to-teach-an-ai-to-play-games-deep-reinforcement-learning-28f9b920440a

Online Resources:

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

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.

2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral and practical examination will be based on the entire syllabus of course including the practical performed during laboratory sessions of course.

2. Oral examination will be of 25 marks

Continuous Assessment (B):

Theory:

Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems.

Total duration allotted for writing each paper is 1 hr.

Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 8 experiments.

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

1. Laboratory work (Performance of Experiments): 15 Marks

2. Journal documentation (Write-up and/or Assignments): 10 marks

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.

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

<table>
<tr><td colspan="8">Program: B. Tech. in Artificial Intelligence (AI) and Data Science</td><td colspan="5">Semester: VIII</td></tr>
<tr><td colspan="8">Course: High Performance Computing</td><td colspan="5">Course Code: DJ19ADC8012</td></tr>
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<tr><td>25</td><td>--</td><td>--</td><td>15</td><td colspan="2">10</td><td>25</td></tr>
</table>

Prerequisite: Operating System Fundamentals.

Course Objectives:

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

Course Outcomes: On completion of the course, learner 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.

Detailed Syllabus: High Performance Computing (DJ19ADC8012)		
Unit	**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), Challengesin Parallel Computing, Performance Metrics, Distributed vs. Parallel architectures.	04
2	**Introduction to High Performance Computing:** Principles of HPC, HPC Architectures, HPC vs Parallel Processing, Data partitioning Techniques: Block, cyclic, and block-cyclic partitioning, Domain Decomposition: Spatial, temporal, and functional decomposition, Load balancing, Case Study: Partitioning strategies for matrix multiplication. Communication Models: Shared memory vs. message passing. Point-to-Point Communication: Send/Receive operations in MPI. Collective Communication: Broadcast, scatter, gather, and reduction operations in MPI (MPI_Reduce)	06
3	**GPU and CUDA Programming:** Overview of GPU, evolution of GPU, CPU vs. GPU, overview of CUDA: Features, Benefits, Architecture. Programming Model CUDA: Kernels and kernel launches, Thread and block indexing, CUDA Memory Management: Memory Hierarchy and Memory Management, Case Studies: computational biology, data analytics, and machine learning.	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), CloudTensor Processing Units (TPUs).	07
5	**Performance Optimization:** Speedup, Efficiency and Scalability, Amdahl's Law, Gustafson's Law, Weak vs. Strong Scaling, Performance Bottlenecks, Data Races and Determinism, Data Race Avoidance, Profiling and performance analysistools for GPUs, Techniques for optimizing GPU performance (warp divergence, loop unrolling, vectorization), Memory bandwidth optimization techniques, Advanced GPU programming concepts (sharedmemory atomics, warp shuffling). Case Studies: Scientific Computing with CUDA/Real-life application	08
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
		39

List of Experiments:

High Performance Computing Laboratory (DJ19ADL8012)	
Sr. No.	**Suggested 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, to 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

Books Recommended:

Textbooks:

1. "High Performance Computing in Clouds: Moving HPC Applications to a Scalable and Cost-Effective Environment", Edson Borin, Lúcia Maria A. Drummond , Jean-Luc Gaudiot, Alba Melo, Maicon Melo Alves , Philippe Olivier Alexandre Navaux, Springer, ISBN-13 978-3031297687, 2023.
2. "High Performance Computing for Drug Discovery and Biomedicine", Alexander Heifetz, Springer Nature, ISBN, 1071634496, 9781071634493, 2023.
3. "Programming in Parallel with CUDA", Richard Ansorge, Cambridge University Press, ISBN-13 978-1108479530, 2022.
4. "Parallel and High Performance Computing", Robert Robey, Yuliana Zamora, Manning publisher, ISBN-13 978-1617296468, 2021
5. "The Practice of Parallel Programming", Sergey A. Babkin, CreateSpace Publisher ISBN-13: 978-1451536614, Online Edition 2021.

6. "Introduction to High Performance computing for Scientist and Engineers", Georg Hager, Gerhard Wellein,, CRC press, 2019.

7. "Hands-On GPU Programming with Python and CUDA" , Dr Brian Tuomanen, Packt Publishing, ISBN-13 978-1788993913, 2018.

Reference Books:

1. "Programming Massively Parallel Processors: A Handson Approach:, David B. Kirk and Wen-mei W. Hwu, , Morgan Kaufmann, 4th Edition, 2022.

2. "CUDA by Example: An Introduction to General-Purpose GPU Programming", Jason Sanders and Edward Kandrot, Addison-Wesley, 1st Edition, 2010.

3. "Introduction to High Performance Computing for Scientists and Engineers", Hager, G. and Wellein, G, CRC Press, ISBN-13 9781439811931, 2010.

4. "High Performance Computing For Dummies", Sun and AMD Special Edition, Douglas Eadline Wiley Publishing, Inc. (2009)

Web Links:

1. Parallel Processing https://hpc.llnl.gov/documentation/tutorials/introduction-parallel-computing-tutorial
2. Introduction to high performance computing https://www.cecam.org/workshop-details/an-introduction-to-high-performance-computing-1270
3. GPU and CUDA Programming https://www.cs.cmu.edu/afs/cs/academic/class/15418-s18/www/lectures/06_gpuarch.pdf
4. Grid and Cloud Computing https://aits-tpt.edu.in/wp-content/uploads/2022/06/GCC-min.pdf
5. Performance Optimization https://link.springer.com/chapter/10.1007/978-3-642-03644-6_12
6. Case Study: https://developer.nvidia.com/blog/a-cuda-dynamic-parallelism-case-study-panda/
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

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 75 marks.

2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks and 25 marks will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.

2. Total duration allotted for writing each of the paper is 1 hr.

3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 8 experiments.

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

1. Laboratory work (Performance of Experiments): 15 Marks

2. Journal documentation (Write-up and/or Assignments): 10 marks

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.

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

Program: B. Tech. in Artificial Intelligence (AI) and Data Science										Semester: VIII			
Course: AI in Healthcare										Course Code: DJ19ADC8013			
Course: AI in Healthcare Laboratory										Course Code: DJ19ADL8013			
Teaching Scheme (Hours / week)				Evaluation Scheme									
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total Marks (A+ B)		
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.				
				75			25	25	25		100		
				Laboratory Examination			Term work						
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work		50		
				25	--	--	15	10	25				

Prerequisite: - Fundamental of AI, Machine learning

Course Objectives:

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:

On completion of the course, learner will be able to

1. Apply AI techniques to solve healthcare challenges and improve patient care.
2. Develop machine learning and deep learning models for healthcare applications.
3. Analyze and process healthcare data for diagnosis and prediction.
4. Implement AI solutions for medical imaging, diagnostics, and personalized treatment.
5. Assess ethical and privacy considerations in the deployment of AI solutions in healthcare.
6. Understand AI innovations in personalized medicine, drug discovery, remote monitoring, and healthcare operations

AI in Healthcare (DJ19ADC8013)		Duration
Unit	**Description**	
1.	**Introduction to AI in healthcare:** Overview of AI and its applications in healthcare Types of healthcare data: EHR, imaging, genomics, wearables Introduction to healthcare data standards and interoperability (HL7, FHIR) AI in diagnostics, prognosis, and treatment personalization Case studies: AI applications in healthcare systems	06
2.	**Machine Learning for Healthcare Applications:** Supervised learning for classification and regression tasks in healthcare Unsupervised learning for clustering (e.g., patient segmentation) Model evaluation metrics: accuracy, sensitivity, specificity, AUC Predictive analytics for disease prediction and patient risk scoring	07
3.	**Deep Learning for Medical Imaging:** Introduction to CNNs for image classification and segmentation Applications of deep learning in radiology, pathology, and histology Transfer learning with pre-trained models (e.g., ResNet, VGG) Image preprocessing techniques for medical images (augmentation, normalization) Case studies: AI in radiology and diagnostic imaging	07
4.	**Natural Language Processing in Healthcare:** Text data in healthcare: clinical notes, medical literature, patient records NLP techniques for healthcare: tokenization, named entity recognition, topic modeling Applications of NLP in healthcare: patient data extraction, sentiment analysis Clinical decision support systems using NLP Case studies: NLP in EHR and medical documentation	07
5.	**AI Ethics, Privacy, and Regulatory Considerations in Healthcare:** Ethical considerations in AI for healthcare: bias, fairness, and transparency Privacy and security of healthcare data (HIPAA, GDPR compliance) Regulatory aspects of AI in healthcare (FDA, CE marking) Interpretability and explainability of AI models in healthcare Challenges and future directions of AI in healthcare	07
6.	**Module 6: AI-Driven Healthcare Innovations and Future Trends** AI in Personalized Medicine, AI in Drug Discovery and Development, AI in Drug Discovery and Development, AI for Healthcare Operations and Resource Management, Emerging Trends in AI for Healthcare, Case Study: AI in COVID-19 Response	05
	TOTAL	39

Suggested List of Experiments

AI in Healthcare Laboratory (DJ19ADL8013)	
Sr. No.	**Title of Experiment**
1	Exploring healthcare datasets (EHR and imaging data).
2	Data preparation and pre-processing for healthcare applications.
3	Building a classification model for disease prediction.
4	Implementing clustering techniques for patient segmentation.
5	Model evaluation for healthcare classification problems.
6	Building a CNN model for image classification (e.g., X-ray, MRI).
7	Transfer learning using pre-trained CNNs for medical imaging.
8	Medical image segmentation with U-Net architecture.
9	Text pre-processing and tokenization for clinical text.
10	Named entity recognition in clinical notes.
11	Evaluating model fairness and bias in healthcare AI models.
12	Analysing privacy concerns in healthcare datasets and applying data anonymization techniques.
13	Mini Project

Minimum 8 experiments and mini project 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

Books Recommended:

Textbooks:

1. Artificial Intelligence in Healthcare by Adam Bohr and Kaveh Memarzadeh, Elsevier Science & Technology, First Edition, 2020.
2. Machine Learning for Healthcare by Jyoti Kataria and Ashwani Kumar, Lambert Academic Publishing, First Edition, 2023.
3. Deep Learning and Convolutional Neural Networks for Medical Imaging and Clinical Informatics by Le Lu, Yefeng Zheng, and Gustavo Carneiro, Springer Nature, First Edition, 2019.
4. Clinical Natural Language Processing by Zhonghua Wang, Scott Poon, and Andrew Taylor, Academic Press, First Edition, 2022.
5. Ethics of Artificial Intelligence and Robotics by Vincent C. Müller, Stanford Encyclopedia of Philosophy, Summer Edition, 2020

Reference Books:

1. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again by Eric Topol, Basic Books, First Edition, 2019.
2. Healthcare Data Analytics by Chandan K. Reddy and Charu C. Aggarwal, CRC Press, First Edition, 2015.
3. Biomedical Text Mining and Applications by Sophia Ananiadou and John McNaught, Artech House Inc., First Edition, 2006.
4. Artificial Intelligence in Behavioral and Mental Health Care edited by David D. Luxton, Academic Press, First Edition, 2015.

Web Links:

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

Online Resources:

1. Introduction to AI in Healthcare: Coursera: AI for Medicine Specialization, Stanford's Health AI Projects
2. Machine Learning for Healthcare:Healthcare.ai, Kaggle Datasets for Healthcare
3. Deep Learning for Medical Imaging:Fast.ai Course on Deep Learning, RSNA AI Challenge for Radiology
4. NLP in Healthcare: Google Cloud NLP in Healthcare, Coursera: NLP Specialization

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 75 marks.

2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks and 25 marks will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.

2. Total duration allotted for writing each of the paper is 1 hr.

3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 8 experiments.

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

1. Laboratory work (Performance of Experiments): 15 Marks

2. Journal documentation (Write-up and/or Assignments): 10 marks

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.

29/12/24

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

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</table>

Prerequisite: - Machine Learning, Deep Learning, Python Programming

Course Objectives:

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

Course Outcomes:

On completion of the course, learner will be able to

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

Explainable AI (DJ19ADC8014)		
Unit	**Description**	**Duration**
1.	**Introduction to Explainable AI** **Explainability** – Fundamentals of XAI - Categorization of XAI - Taxonomy of XAI methods for Machine Learning - Machine Learning Interpretability - Causal Model Induction - Causality learning - XAI techniques and limitations	**05**
2.	**Interpretability** Difference between Interpretability and Explainability - Interpretability methods to explain Black-Box Model - Scope of Interpretability - Apply interpretability on Regression, Logistic regression, Generalized Additive Models, Decision Tree - Neural network interpretation - Evaluation of Interpretability	**06**
3.	**Deep Explanation** Attention Mechanisms - Modular Networks - Feature Identification - Learn to Explain - Feature Visualization - Deep Visualization-gradcam and Activation maps - Sensitivity analysis	**05**
4.	**XAI Model and Methods** Ante-hoc Explainability (AHE) models - Post-hoc Explainability (PHE) models - Interactive Machine Learning (IML) - Black Box Explanation through Transparent Approximation (BETA) models - Hybrid Models. XAI Techniques - Local Interpretable Model-Agnostic Explanations (LIME) - Understanding Mathematical representation of LIME - Shapley Additive exPlanations (SHAP) - Diverse Counterfactual Explanations (DiCE) - Layer wise Relevance Propagation (LRP).	**09**
5.	**Building Trustworthy Model with Explainable AI** Metrics to evaluate XAI, Trustworthy Explainability Acceptance, Power Quality Disturbance (PQD) classification, Methods for measuring human intelligence. Evaluating AI system. Medical diagnosis- Making AI Decisions Trustworthy for Physicians and Patients – Sales predictions on the house sale	**07**
6.	**Applications** Application of XAI in Healthcare, Explainable AI Driven Applications for Patient Care and Treatment, Explainable Machine Learning for Autonomous Vehicle Positioning Using SHAP	**07**
	TOTAL	**39**

Suggested List of Experiments

Explainable AI Laboratory (DJ19ADL8014)	
Sr. No.	**Title of Experiment**
1	Explore how different types of machine learning models (e.g., decision trees, random forests, neural networks) provide different levels of interpretability and explainability.
2	Train a linear regression model and apply coefficients interpretation.
3	Implement a Generalized Additive Model (GAM) for regression and interpret the individual feature effects using partial dependence plots (PDP).

4	Apply sensitivity analysis to a trained model (e.g., random forest or neural network) to identify the most influential features in prediction outcomes.
5	Apply LIME to interpret local model decisions and visualize results.
6	Use SHAP to explain global and local predictions and analyze feature importance.
7	Apply DiCE to generate counterfactual explanations for a black-box model (e.g., customer churn prediction).
8	Test a Power Quality Disturbance (PQD) classification model and evaluate its performance using trustworthiness metrics.
9	Use SHAP or LIME to explain the model's predictions and evaluate its trustworthiness for use by physicians and patients.

All 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

Books Recommended:

Textbooks:

1. Molnar, Christoph. "Interpretable machine learning. A Guide for Making Black Box Models Explainable", 2019. https://christophm.github.io/interpretable-ml-book/.
2. Explainable Artificial Intelligence: An Introduction to Interpretable Machine Learning, Uday Kamath: John Liu, Springer, ISBN 9783030833558

Reference Books:

1. "Explanation in Artificial Intelligence" by Tim Miller, arXiv, 2017. https://arxiv.org/abs/1706.07269
2. "Explainable Artificial Intelligence (XAI) in Biomedicine: Making AI Decisions Trustworthy for Physicians and Patients" by Lötsch, J.; Kringel, D.; Ultsch, A., BioMedInformatics, 2022.
3. "A Guide for Making Black-Box Models Interpretable" by Christoph Molnar, GitHub Pages, 2020.

Web Links:

1. XAI - Overview and Taxonomy: A Survey of Explainable AI: Towards a Human-Centric Perspective
2. Interpretability Methods for Machine Learning Models
   Book GitHub Repository
3. Saliency Maps and Grad-CAM
   Grad-CAM: Visual Explanations from Deep Networks via Gradient-Based Localization
4. Explainable AI Techniques
   LIME Library Documentation
   SHAP Documentation and Examples
   DiCE Documentation

Online Resources:

1. Explainable AI: Interpreting Machine Learning Models
   Explainable AI: Interpreting Machine Learning Models - Coursera
2. Machine Learning Interpretability with LIME & SHAP
   Machine Learning Interpretability with LIME & SHAP - Coursera
3. AI in Healthcare: Using Machine Learning
   AI in Healthcare: Using Machine Learning - Coursera
4. Explainable AI
   Explainable AI - Udacity

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 75 marks.

2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks and 25 marks will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.

2. Total duration allotted for writing each of the paper is 1 hr.

3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 8 experiments.

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

1. Laboratory work (Performance of Experiments): 15 Marks

2. Journal documentation (Write-up and/or Assignments): 10 marks

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.

Prepared by Checked by Head of the Department Vice Principal Principal

Program: Final Year (Common for All Programs)				Semester: VIII					
Course: Project Management				Course Code: DJ19ILO8021					
Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Total	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	-	-	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				-	-	-	-	-	-	

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 project management life cycle and the various project phases as well as the role of 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 Earned value technique and determine & predict status of the project.
5. Capture lessons learned during project phases and document them for future reference.

Detailed Syllabus (Unit wise)		
Unit	**Description**	**Duration in Hours**
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 organization structures, PM knowledge areas as per Project Management Institute (PMI).	07
2	**Initiating Projects:** How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter, Effective project team, Stages of team. development & growth (forming, storming, norming & performing), team dynamics.	08
3	**Project Planning:** Work Breakdown structure (WBS) and linear responsibility chart, Project cost estimation and budgeting, Top down and bottoms 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 value of work completed, using milestones for measurement, change requests and scope creep, Project audit. Project Contracting Project procurement management, contracting and outsourcing.	07
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.	07
	Total	39

Books Recommended:

Text books:

1. Project Management: A managerial approach, Jack Meredith & Samuel Mantel, 7th Edition, Wiley India.

2. Project Management: The Managerial Process, 6th edition, Erik Larson, Clifford Gray, McGraw Hill Education.

Reference Books:

1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed. Project Management Institute PA, USA.

2. Project Management, Gido Clements, Cengage Learning.

3. Project Management, Gopalan, Wiley India.

4. Project Management, Dennis Lock, 9th Edition, Gower Publishing England.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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

Program: Final Year (Common for All Programs)	Semester: VIII
Course: Entrepreneurship Development and Management	Course Code: DJ19ILO8022

Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Total		
				75			25	25	25		100
				Laboratory Examination			Term work			Total Term work	--
3	-	-	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal			
				-	-	-	-	-		-	

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 to make right decisions for

Outcomes: Learner 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 suitable MSME scheme for an entrepreneur
5. Interpret financial and legal aspect of a business.

Detailed Syllabus (Unit wise)		
Unit	Description	Duration in Hours
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 entrepreneurial process Develop idea generation, creative and innovative skills	07
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 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	07
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	08
5	**Finance, Account, Costing and Legal Aspect 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 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	39

Books Recommended:

Reference Books:

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

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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

Program: Final Year (Common for All Programs)				Semester: VIII					
Course: Corporate Social Responsibility				Course Code: DJ19ILO8023					
Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)		Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Total
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	-	-	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				-	–	-	–	-	–	

Objectives:

1. To acquaint learners with the concept, theories, and application of CSR for the development of society
2. To impart an understanding of the international framework and legislations of CSR
3. To identify stakeholders and drivers of CSR

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

1. Describe the fundamental concepts of Corporate Social Responsibility (CSR)
2. Recognize the international framework for CSR to enable business decision-making which is informed by human values.
3. Explain CSR Legislation in India and the world
4. Relate the drivers of CSR in India
5. Identify the key stakeholders of CSR

Detailed Syllabus (Unit wise)		
Unit	Description	Duration in Hours
1	**Introduction to CSR** Meaning and Definition, History of CSR, Concepts of Charity, Corporate philanthropy, Corporate Citizenship, Sustainability and Stakeholder Management. Environmental aspect of CSR Chronological evolution and Models of CSR in India Carroll's model Major codes on CSR Initiatives in India.	07
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 tri-partite declaration of principles on multinational enterprises and social policy.	08

3	**CSR-Legislation in India and the World** Section 135 of Companies Act 2013.Scope for CSR Activities under Schedule VII, Appointment of Independent Directors on the Board, and Computation of Net Profit's Implementing Process 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 Govt. of India, Roles and responsibilities of corporate foundations.	08
	Total	39

Books Recommended:

Text books:

1. Corporate Social Responsibility in India, Sanjay K Agarwal, Sage Publications, 2008

2. Corporate Social Responsibility in India, Bidyut Chakrabarty, Routledge, New Delhi, 2015.

Reference Books:

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

Web resources:

1. https://pitt.libguides.com/csr/websites
2. https://study.sagepub.com/sites/default/files/carroll.pdf
3. https://study.sagepub.com/sites/default/files/orlitzkysiegelwaldman.pdf

Online Courses: NPTEL / Swayam

1. History, planning, implementation, evaluation, and development of the CSR cycle in profit making organizations. https://youtu.be/CpB5TehNia8?si=HPHgtIxMOuvoxHQ-
2. Evolution, theories, stakeholders, Corporate Governance and Citizenship https://youtu.be/VM_E0RRUe9I?si=JlcMuOasEqD7br4C

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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

Program: Final Year (Common for All Programs)				Semester: VIII						
Course: Human Resource Management				Course Code: DJ19ILO8024						
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Total	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	-	-	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				-	-	-	-	-	-	

Objectives:

1. To introduce the students with basic concepts, techniques and practices of the human resource management.
2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations.
3. To familiarize the students about 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, learner will be able to:

1. Understand the key concepts, aspects, techniques and practices of the human resource management.
2. Apply Principles of Organizational Behavior to analyze the impact of personality, perception, and motivation on individual behavior and decision-making within organizations.
3. Evaluate Group Dynamics and Team Effectiveness
4. Analyze Strategic HRM and Organizational Structure
5. Demonstrate knowledge of basic labor laws and current trends in HRM, including diversity management and the role of technology in shaping the future of work.

Detailed Syllabus (Unit wise)		
Unit	**Description**	**Duration in Hours**
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, Managing ethical issues.	07
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.	08
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 workplace, Tactics and strategies.	08
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 & 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 difference in employee motivation.	08
	Total	39

Books Recommended:

Reference Books:

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

Web Resources

1. Case studies and best practices in HRM: https://www.shrm.org/
2. Strategic HRM and HR practices: https://www.hr.com/en?t=/
3. Handbook of HRM: https://hrmhandbook.com/

Online Courses: NPTEL/SWAYAM/Courses

1. Human Resource Development by Prof. KBL Srivastava from IIT Kharagpur
https://onlinecourses.nptel.ac.in/noc20_hs48/preview
2. **Management of Human Resources** by Dr. Nayantara Padhi from IGNOU
https://onlinecourses.swayam2.ac.in/nou20_mg02/preview

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, butwith internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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

Program: Final Year (Common for All Programs)				Semester: VIII					
Course: Corporate Finance Management				Course Code: DJ19ILO8025					
Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)		Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Total
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	-	-	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				-	–	-	–	-	–	

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

Objectives:

1. Overview of 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, dividend policy.

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

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

Detailed Syllabus (Unit wise)		
Unit	Description	Duration in Hours
01	**Overview of Indian Financial System:** Characteristics, Components and Functions of 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	07

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.	07
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, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR).	09
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	08
	Total	39

Books Recommended:

Reference Books:

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

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Consisting **One Class Tests for 25 marks** based on approximately 50% of contents and one case study with presentations for 25 Marks.
2. Total duration allotted for writing test paper is 1 hr.
3. Average of the marks scored in the tests and case study will be considered for final grading.

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

Program: Final Year (Common for All Programs)				Semester: VIII							
Course: Logistics and Supply Chain Management				Course Code: DJ19ILO8026							
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total marks (A+ B)
				Theory			Term Test 1	Term Test 2	Total		
Lectures	Practical	Tutorial	Total Credits	75			25	25	25		100
				Laboratory Examination			Term work			Total Term work	--
				Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal			
3	-	-	3	-	-	-	-	-		-	

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, 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. Gain knowledge of various sustainability aspects of a supply chain.

Detailed Syllabus (Unit wise)		
Unit	Description	Duration in Hours
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.	08

	Creating the Responsive Supply Chain: Product push versus demand pull, The Japanese philosophy, The foundations of agility, A route-map to responsiveness.	
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.	11
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.	07
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.	08
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.	05
	Total	39

Books Recommended:

Reference Books:

1. Logistics & Supply Chain Management, Martin Christopher, Pearson Education Limited, 2016.
2. Supply Chain Management Strategy, Planning, and Operation, Sunil Chopra and Peter Meindl, Pearson, 2016.
3. Essentials of Supply Chain Management, Michael H. Hugos, Wiley, 2018.
4. Supply Chain Management For Dummies, Daniel Stanton, Wiley, 2020.
5. 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.
6. Supply Chain Management, Sinha, McGraw-Hill Education (India) Pvt Limited, 2012.

Web Resources

1. Supply chain case studies on cost reduction and management: https://www.logisticsbureau.com/7-mini-case-studies-successful-supply-chain-cost-reduction-and-management/
2. Detailed case study on Zara Clothing Company Supply chain: https://www.scmglobe.com/zara-clothing-company-supply-chain/
3. Latest research on supply chains from Harvard Business School on issues including supply chain management and digital supply chain: https://hbswk.hbs.edu/Pages/browse.aspx?HBSTopic=Supply%20Chain

Online Courses: NPTEL/SWAYAM/Courses

1. **Supply Chain Digitization** by Prof. Priyanka Verma, IIM Mumbai https://onlinecourses.nptel.ac.in/noc24_mg59/preview
2. **Supply Chain Analytics** by Prof. Rajat Agrawal, IIT Roorkee https://onlinecourses.nptel.ac.in/noc21_mg12/preview

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Consisting of **Two Compulsory Class Tests for 25 marks**, First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

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

Program: Final Year (Common for All Programs)				Semester :VIII					
Course : IPR and Patenting				Course Code: DJ19ILO8027					
Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)		Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Total
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	-	-	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				-	-	-	-	-	-	

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.
4. Understanding post-grant processes related to Intellectual Property.

Outcomes: On completion of the course, 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.
5. Identify appropriate Intellectual Property Right for a creation.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration in hours**
1	**Concept of Intellectual Property Law** Idea/ Expression dichotomy, Introduction and the need for intellectual property right (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	6

	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	
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 License, 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, devices. Concept of Trademarks, Different Kinds of Marks: (Brand names, Logos, Signatures, Symbols, Well-known marks, Certification marks, 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.	11
3	**Copyrights and Design** 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.	9
4	**GI, PVP, and LDP** Geographical Indication (GI): Meaning, difference between GI and trademarks, procedure for registration, effect of registration, and term of protection. Plant Variety Protection (PVP): Meaning, benefit sharing, farmers' rights, procedure for registration, effect of registration, and term of protection. Layout Design Protection (LDP): Meaning, procedure for registration, effect of registration, and 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, Indian Competition Act and IPR protection, IPR issues in merger and acquisition, Harmonization of IP protection and competition Law in India	5
	Total	39

Books Recommended:

Text books:

1. Feroz Ali, The Law of Patents, LexisNexis.
2. Ronald D. Slusky, Invention Analysis and Claiming – A Patent Lawyer's Guide, Second Edition, American Bar Association, 2012.
3. Feroz Ali, The Touchstone Effect – The Impact of Pre-grant Opposition on Patents, LexisNexis, 2009.

Reference Books:

1. Innovation and entrepreneurship by Drucker. F. Peter, Harper business, (2006).
2. Intellectual Property Rights, Deborah. E. Bouchoux, Cengage Learning.
3. Intellectual Property Rights—Unleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,
4. The Design of Business by Martin Roger, Harvard Business Publishing (2009)

Web resources:

1. Maps of Intellectual Property - https://cyber.harvard.edu/people/tfisher/IP/IPMaps.htm
2. The Patents Act, 1970 - https://ipindia.gov.in/acts-patents.htm
3. The Trademarks Act, 1957 - https://ipindia.gov.in/acts-rules-tm.htm
4. The Designs Act, 2000 - https://ipindia.gov.in/acts-designs.htm

Online Courses: NPTEL / Swayam

1. Patent Drafting for Beginners, by Prof. Feroz Ali
   https://onlinecourses.nptel.ac.in/noc24_hs59/preview

2. Patent Law for Engineers and Scientists, by Prof. Feroz Ali
   https://onlinecourses.nptel.ac.in/noc24_hs155/preview

3. World Intellectual Property Organisation courses https://www.wipo.int/academy/en/

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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

Program: Final Year (Common for All Programs)				Semester: VIII					
Course: Digital Marketing Management				Course Code: DJ19ILO8028					
Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)		Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Total
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	-	-	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				-	–	-	–	-	–	

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 (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 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.

Detailed Syllabus (Unit wise)		
Unit	**Description**	**Duration in Hours**
1	Emergence of Digital Marketing as a tool, media consumption drivers for 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, critical success factors for digital marketing. Digital Marketing Models Creation Factors impacting digital marketplace, value chain digitization, business models. The Consumer for Digital Marketing Consumer behavior on the internet, evolution of consumer behavior models, managing consumer demand, integrated marketing communications (IMC), impact of digital channels on IMC	07
2	**Digital marketing Strategy Development** Elements of assessment phase, macro-micro environmental analysis, marketing situation analysis. **Digital Marketing Internal Assessment and Objectives Planning** Analyzing present offerings mix, marketing mix, core competencies analysis and internal resource mapping. Digital presence analysis, digital marketing objectives development and review. **Digital Marketing Strategy Definition** Understanding digital business strategy and structures, consumer development strategy, offering mix for Digital, digital pricing models, managing promotional channels and eveloping the extended Ps- People, process, programs and performance. **Digital marketing Strategy Roadmap** Developing digital marketing strategy roadmap, the 6s digital marketing implementation strategy, marketing across the product life cycle.	12
3	**Digital Marketing Planning and Setup** Understanding digital media planning terminology and stages, steps to creating marketing communications strategy, introduction to search marketing, display marketing, 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.	07
4	**Digital marketing Execution** Basic elements of digital campaign management, search execution, display execution, social media execution, 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.	08
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.	05
	Total	39

Books Recommended:

Reference Books:

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

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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

Program: Final Year (Common for All Programs)				Semester: VIII							
Course: Environmental Management				Course Code: DJ19ILO8029							
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total marks (A+ B)
				Theory			Term Test 1	Term Test 2	Total		
Lectures	Practical	Tutorial	Total Credits	75			25	25	25		100
				Laboratory Examination			Term work			Total Term work	--
				Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal			
3	-	-	3	-	-	-	-	-		-	

Pre-requisites: Knowledge of environmental science.

Objectives:

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

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

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

Detailed Syllabus (Unit wise)		
Unit	Description	Duration in Hours
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.	08
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.	09
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.	09

4	**Environmental Auditing (EA):-** Objectives, Scope and Types of EA, Audit Methodology, Elements of Audit Process, Auditing of EMS.	06
5	**Environmental Management Techniques:** Environmental Monitoring and Modelling, Environmental technology Assessment and Environmental Risk Assessment, Eco-mapping.	07
	Total	39

Books Recommended:

Text Books:

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

Reference Books:

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

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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

Program: Final Year (Common for All Programs)				Semester: VIII						
Course: Labour and Corporate Law				Course Code: DJ19ILO8030						
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Total	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	--
3	-	-	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				-	–	-	–	-	–	

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 free enterprise system and legal safeguards of the same.

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

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

Detailed Syllabus (Unit wise)		
Unit	Description	Duration in Hours
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	09
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	08

3	**Formation of a Company and Corporate governance:** Company and Other Forms of Business Organizations, Different Kinds of Company: One Person Company, Foreign Company. Kinds of Company Meetings and Procedure Powers, Duties and Kinds of Director: Independent Director, Women Director Different Prevention of Oppression and Mismanagement Investor Protection, Insider Trading, Corporate Fraud.	08
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	08
5	Case Studies on A) Labour law B) Labour relations C) Corporate laws D) Securities laws	08
	Total	39

Books Recommended:

Reference Books:

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

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, butwith internal choice as appropriate), each carrying15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester, out of which one will be a compulsory term test (on minimum 02 Modules) and the other can either be a termtest or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

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Program: B. Tech. in Artificial Intelligence (AI) and Data Science	Semester: VIII
Course: Project Stage II	Course Code: DJ19ADP803

Teaching Scheme (Hours / week)				Evaluation Scheme								
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total Marks (A+ B)	
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.			
				--			--	-	--		--	
				Laboratory Examination			Term work					
--	10	--	5	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work		200	
				--	--	100	--	100	100			

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: On completion of the course, learner 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.

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