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

Computer Science and Engineering (Data Science)

(Semester VIII)

Proposed scheme for Second Year B.Tech Program for Department of Computer Science and Engineering (Data Science)
Semester VIII
(Academic Year 2023-2024)

| Sr | 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	DJ19DSC801	Data Ethics	2	--	--	2	3	75	--	--	--	75	25	25	25	--	25	100	2	3
	DJ19DST801	Data Ethics Tutorial	--	--	1	1	--	--	--	--	--	--	--	--	--	25	25	25	1	
2	DJ19DSC802	High Performance Computing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19DSL802	High Performance Computing Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
4@	DJ19DSC8011	Introduction to Quantum Computing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19DSL8011	Introduction to Quantum Computing Laboratory	--	2	--	1	--	--	--	--	--	--	--	--	--	25	25	25	1	
	DJ19DSC8012	Geo-Spatial Data Science	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19DSL8012	Geo-Spatial Data Science Laboratory	--	2	--	1	--	--	--	--	--	--	--	--	--	25	25	25	1	
	DJ19DSC8013	Advanced Networking Technology	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19DSL8013	Advanced Networking Technology Laboratory	--	2	--	1	--	--	--	--	--	--	--	--	--	25	25	25	1	
	DJ19DSC8014	Social Network Analysis	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19DSL8014	Social Network Analysis Laboratory	--	2	--	1	--	--	--	--	--	--	--	--	--	25	25	25	1	
5#	DJ19ILO8021	Project Management (PM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	3
	DJ19ILO8022	Entrepreneurship Development and Management (EDM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8023	Corporate Social Responsibility (CSR)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8024	Human Resource Management (HRM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8025	Corporate Finance Management (CFM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8026	Logistics and Supply Chain Management (LSCM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8027	IPR and Patenting (IPR)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8028	Digital Marketing Management (DMM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8029	Environmental Management (EM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8030	Labour and Corporate Law (LCL)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
6	DJ19DSP803	Project Stage - II	--	10	--	5	--	--	--	--	100	100	--	--	--	100	100	200	5	5
		Total	47	20	1	58	50	1200	25	0	100	1325	400	400	400	250	650	1975	58	19

@ Any 1 Elective Course
# Any 1 Institute Professional Elective

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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 / qui / power point presentation / poster presentation / group project / any other tool.	--	As applicable
Laboratory	Performance in the laboratory and documentation.	25	
Tutorial	Performance in each tutorial & / assignment.	25	
Laboratory &Tutorial	Performance in the laboratory and tutorial.	50	

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

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: Data Ethics (DJ19DSC801)		
Course: Data Ethics Tutorial (DJ19DST801)		

Pre-requisite:

1. Data Science Basics
2. Fundamentals of Computer Science

Objectives:
To introduce and understand the fundamental concepts of Data Ethics and familiarize students with Algorithmic bias, Privacy, and Governance of data in an ethical environment.

Outcomes: On completion of the course, the learner will be able to:
1. Describe the basic concepts related to Data Ethics and data driven business model.
2. Explain the concept of Bias and Privacy in relation to Data Ethics.
3. Discuss various digital trust and data governance in different applications.

Data Ethics (DJ19DSC801)		
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 analyze 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.	**05**
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.	**05**
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	
4	**Data Privacy:** Data Privacy and Legal Frameworks, Data Privacy Laws and Regulations, GDPR, CCPA, and HIPAA, Understanding the key principles and requirements of privacy laws, Data commodification's, examples of companies complying with or violating data privacy regulations, Data Collection and Storage Ethics Considerations for ethical data collection methods, including informed consent, data minimization, and transparency, Exploring fairness in machine learning models and algorithmic transparency **Data Storage and Secure Handling:** Encryption, and data handling protocols, Strategies for ensuring data security and integrity, Cybersecurity and Data Breaches, Handling Data Breaches Responsibly, Ethical and legal obligations following a data breach, including incident response and notification procedures. **Case studies:** Facebook's Data Privacy Controversies, Ethical data collection in various contexts.	05
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	04
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	**26**

Data Ethics Tutorial (DJ19DST801)	
Tut.	**Suggested Tutorials**
1	Choose a real-world scenario related to social media, healthcare, education, or any other domain where data is collected, analyzed and used. Write a report that addresses the following questions: 1. What are the ethical implications of data collection in this scenario? 2. Who are the stakeholders and what are their interests? 3. What are the potential consequences of data use in this scenario?
2	Choose a real-world scenario related to social media, healthcare, education, or any other

	domain where data is collected, analyzed and used. Write a report that addresses the following questions: 1. Who might be harmed and who might benefit? 2. What ethical principles should guide the collection, analysis, and use of data in this scenario? 3. 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?
3	What are the potential sources of bias in data analysis and how can they be mitigated?
4	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 analyze the impact of their actions on society.
5	Research and analyze the different types of data governance and regulation frameworks that exist (e.g. GDPR, CCPA, HIPAA, etc.)
6	Research and analyze recent data privacy violations and their impact on individuals and society (e.g. Facebook-Cambridge Analytic scandal, Equifax data breach, etc.)

*The Term Work will be calculated based on Tutorial Performance (15m) and Quizzes (10m).

Books Recommended:
Textbooks:

1. Christoph Stückelberger, 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: O'Reilly Media., "Doing Good Data Science"

4. Sandvig, Christian, Kevin Hamilton, Karrie Karahalios, and Cedric Langbort. (2014). "Auditing Algorithms: Research Methods for Detecting Discrimination on Internet Platforms." Computational Culture.

5. Ananny, Mike. 2016. "Toward an Ethics of Algorithms : Convening Observation , Probability , and Timeliness." Science, Technology, & Human Values 41(1):93–117.

Web Links:

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/

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: High Performance Computing (DJ19DSC802)		
Course: High Performance Computing Laboratory (DJ19DSL802)		

Pre-requisite: System Fundamentals

Objectives: This course in High-Performance Computing (HPC) for Data Science with an emphasis on GPU parallel computing introduces students to the fundamental concepts and practical skills necessary for harnessing the power of Graphics Processing Units (GPUs) in data-intensive computations. Throughout the course, students will explore GPU architecture, CUDA programming, memory optimization techniques, parallel programming patterns, and performance optimization strategies. They will also delve into advanced topics like GPU-accelerated libraries and the integration of GPUs with popular data science frameworks. By the end of this course, students will be equipped to leverage GPU parallel computing to significantly enhance the efficiency and performance of data science applications.

Outcomes: On completion of the course, the learner will be able to:
1. Develop a deep understanding of the architecture and capabilities of GPUs, and they will be able to explain the relevance of GPUs in data science.
2. Optimize GPU-based applications and identify and address performance bottlenecks, make efficient use of GPU memory, and apply parallel programming patterns to solve data science problems.
3. Implement GPU-accelerated solutions for data processing and machine learning tasks, ultimately improving the speed and efficiency of data-driven decision-making processes.

High Performance Computing (DJ19DSC802)		
Unit	Description	Duration
1	**Basics of Parallelization:** Data Parallelism, Functional parallelism, Parallel Scalability, Factors that limit parallel execution, Scalability matrices, Refined Performance model, load imbalance.	**05**
2	**Introduction to High-Performance Computing:** Introduction to HPC and its significance in data science, Overview of different hardware architectures (CPU, GPU, FPGA), Understanding parallel computing concepts and terminology, Introduction to programming models (shared memory, distributed memory).	**05**
3	**Introduction to GPUs and CUDA Programming:** Introduction to GPUs and their architecture, Overview of CUDA programming model CUDA programming basics: memory management, thread hierarchy, kernel execution.	**07**
4	**GPU Memory Optimization Techniques:** GPU memory hierarchy and its impact on performance, Memory coalescing and memory access patterns, Shared memory and thread synchronization techniques, Techniques for reducing memory transfers between CPU and GPU.	**08**

5	**Performance Optimization on GPUs:** Profiling and performance analysis tools for GPUs, Techniques for optimizing GPU performance (warp divergence, loop unrolling, vectorization), Memory bandwidth optimization techniques, Advanced GPU programming concepts (shared memory atomics, warp shuffling).	08
6	**Advanced Topics in GPU:** Computing 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, Case studies and real-world applications of GPU computing in data science	06
	Total	**39**

High Performance Computing Laboratory (DJ19DSL802)	
Exp.	**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.

A minimum of eight experiments from the above suggested list or any other experiment or mini project based on syllabus will be included, which would help the learner to apply the concept learnt.
*The Term Work will be calculated based on Laboratory Performance (15m) and Assignments (10m).

Books Recommended:
Textbooks:
1. Georg Hager, Gerhard Wellein, "Introduction to High Performance computing for Scientist and Engineers", CRC press, 2019.
2. Duane Storti and Mete Yurtoglu, "CUDA for Engineers", Addison-Wesley,1st Edition, 2016.

References:

1. David B. Kirk and Wen-mei W. Hwu, 'Programming Massively Parallel Processors: A Hands-on Approach', Morgan Kaufmann, 4th Edition, 2022.
2. Charles Severance and Kevin Dowd, 'High Performance Computing', O'Reilly, 2018.
3. Jason Sanders and Edward Kandrot, 'CUDA by Example: An Introduction to General-Purpose GPU Programming', Addison-Wesley, 1st Edition, 2010.
4. Duane Storti and Mete Yurtoglu, 'CUDA for Engineers: An Introduction to High-Performance Parallel Computing', Addison-Wesley, 1st Edition, 2015.

Web Links:

1. GPU Gems series (1-3) by NVIDIA Corporation:
   https://developer.nvidia.com/gpugems/gpugems/contributors

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII

Course: Introduction to Quantum Computing (DJ19DSC8011)
Course: Introduction to Quantum Computing Laboratory (DJ19DSL8011)

Pre-requisite:
1. System Fundamental
2. Machine Learning
3. Information Security

Objectives:
1. To introduce the basics of Quantum Computing and Quantum state transformation and classical computation versions.
2. To understand advanced Quantum Computation Algorithms and basics of Quantum Machine Learning.

Outcomes: On completion of the course, learner will be able to:
1. To identify and analyse Quantum Building Blocks.
2. Apply advanced quantum computation algorithms for a real-world problem statement.

Introduction to Quantum Computing (DJ19DSC8011)		
Unit	Description	Duration
1	**Complex Numbers, Vector Space, and Dirac Notation:** Complex Numbers, Complex Conjugation, Vector Space, Basic set, Dirac Notation, Ket and Bra, Inner Product, Linearly Dependent and Independent Vectors, Dual Vector Space, Computational Basis, Outer Product, Spin and Qubit.	07
2	**Quantum Computing vs. Classical Computing:** History of quantum computation and quantum information, Quantum State, Bloch sphere, Dense coding, Physical quantum phenomena: Spin, Quantum superposition, Interference and Entanglement. **Logic Gates and Circuits:** Boolean Algebra, Functional Completeness, Gates, Circuits, Universal Gates, Gates and Computation **Quantum Gates and Circuits:** Qubits, The CNOT, Pauli, Hadamard, Toffoli Gates, Quantum Gate, Quantum Gates Acting on one Qubit, No Cloning Theorem, Quantum Computation, Multiple qubit gates, Qubit copying circuit, Example: Bell states, quantum teleportation.	07
3	**Quantum Computing algorithms:** Classical computations on a quantum computer, Quantum parallelism, Quantum key distribution, Superdense coding, quantum teleportation, applications of teleportation, probabilistic versus quantum algorithms, phase kick-back, Quantum phase estimation and quantum Fourier Transform, eigenvalue estimation, Shor's Factorization Algorithm, Grover's Search Algorithm, Quantum algorithms summarized.	06

4	**Quantum Cryptography algorithm:** Cryptography using principles of quantum computing, No-cloning theorem, Quantum key distribution Algorithm, Quantum secret sharing Algorithm.	04
5	**Quantum Machine Learning Basic (QML):** Variational Quantum Circuits, Parameterized quantum circuits, Parameterized quantum circuit properties, Entangling capability, Parameterized quantum circuits for machine learning Data encoding Methods, Basis encoding, Amplitude encoding, Angle encoding, Arbitrary encoding, Supervised learning, Quantum variational classification, Quantum kernel estimation, Variational training, Quantum Support Vector Machine (QSVM).	08
6	**Quantum Deep Learning (QDL):** Basics of Quantum Neural Networks, Finite difference gradients, Analytic gradients, Natural gradients, Simultaneous Perturbation Stochastic Approximation, Training in practice, exponentially vanishing gradients (barren plateaus), Quantum Convolutional Neural Network.	07
	Total	**39**

Introduction to Quantum Computing Laboratory (DJ19DSL8011)	
S No	**Name of Experiment**
1	Implementing Quantum Programs with the Qiskit SDK.
2	Implementing logic of Quantum Gates and Universal Gates with Qiskit.
3	Implementing a Quantum Random Number Generator with Qiskit.
4	Implementation of Quantum Key Distribution Using the BB84 Protocol with Qiskit on a Quantum Computer.
5	Experimentation with Quantum Teleportation Protocols.
6	Implementation and Analysis of Shor's Algorithm Using Qiskit SDK.
7	Implementation of Quantum key distribution Algorithm.
8	Implementation of Grover's Search Algorithm with Qiskit.
9	Implementation and Exploration of Quantum Machine Learning Techniques: Parameterized Circuits, Data Encoding Methods, and Training Strategies in Qiskit.
10	Implementation of Supervised Strategies in Quantum Machine Learning: Exploring Quantum variational classification. SVM.
11	Implementation of Quantum key distribution Algorithm.

Above experiments or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

*The Term Work will be calculated based on Laboratory Performance (15m) and Assignments (10m).

Books Recommended:
Textbooks:
1. Parag K. Lala, 'Quantum Computing', McGraw Hill, 1st Edition, 2020.
2. Chris Bernhardt, 'Quantum Computing for Everyone', MIT Press, 1st Edition, 2020.

Reference Books:
1. Jack D. Hidary, 'Quantum Computing: An Applied Approach', Springer, 2nd Edition, 2021.
2. Johan Vos, 'Quantum Computing in Action', Manning Publications, 1st Edition, 2022.

Web links:

1. https://qiskit.org/learn
2. https://elearn.nptel.ac.in/shop/iit-workshops/completed/quantum-computing/

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: Geo-Spatial Data Science (DJ19DSC8012)		
Course: Geo-Spatial Data Science Laboratory (DJ19DSL8012)		

Pre-requisite:
1. Data Visualization
2. Machine Learning
3. Artificial Intelligence

Course Objectives: This course will introduce students to the field of geospatial data science, covering the fundamental concepts, tools, and techniques used to analyze and visualize geospatial data. Students will gain hands-on experience in working with geospatial data and applying data science methods to solve real-world problems.

Outcomes: Students will be able to

1. Apply tools and techniques used to analyze and visualize geospatial data
2. Applying data science methods to solve real-world problems with geospatial data.
3. Analyze geospatial large data models and ethical issues.

Geo-Spatial Data Science (DJ19DSC8012)		
Unit	**Description**	**Duration**
1	**Introduction to Geospatial Data**: Introduction to Geographic Information Systems (GIS), Data Collection and Sources, Remote sensing and satellite imagery, GPS data and tracking, network, Coordinate systems and projections, Overview of geospatial data: Coordinates, attributes, temporal information; static and dynamic data, Spatial Data Types: vector and raster data, network data, and its GSD applications and Spatial Data Formats: shapefiles, geodatabases, Spatial data structures.	06
2	**Geospatial Data Modeling:** Feature based approach: points, lines, polygon, curve, surface, geometry collection; Algebra and calculi of qualitative spatial relations, topological relations RCC-8, cardinal directions, Field based approach. Spatial regression, clustering, and optimization, Geostatistics and spatial modeling, Predictive modeling with geospatial data, Case study: Predicting property values, Spatial Analysis, Buffer analysis, spatial joins.	08
3	**Linked Geospatial Data:** Visualizing Linked Geospatial Data, Querying Geospatial Data Expressed in RDF, Transforming Geospatial Data into RDF, SPARQL, Interlinking Geospatial Data Sources, Incomplete Geospatial Information, Geospatial RDF stores, Geospatial Knowledge Graphs, Question Answering Engines for Geospatial Knowledge Graphs, choropleth mapping.	09

4	**Geospatial Visualization:** Introduction to data visualization libraries (e.g., Matplotlib, Folium, Plotly), Creating basic maps and charts, customizing geospatial visualizations, creating maps and charts, Customizing geospatial visualizations Python toolkits Geospatial Visualization. Spatial Data, GIS, Geospatial Data, Geospatial Analysis, Data Visualization.	06
5	**Data Ingestion & Big Data:** Web scraping and APIs, work effectively with the geo spatial large datasets. **Spatial Analysis:** Spatial queries and operations.	05
6	**GIS Software:** Introduction to web mapping tools (e.g., Leaflet), Exploring GIS software (e.g., QGIS, ArcGIS), Introduction to geospatial libraries (e.g., Geopandas, Fiona, Shapely), Building interactive web maps, Geospatial big data and distributed computing, Machine learning for geospatial data, Geo Spatial Data Ethics, Ethical considerations in geospatial data analysis.	05
	Total	**39**

Geo-Spatial Data Science Laboratory (DJ19DSL8012)	
Sr. No.	**Suggested Experiments**
1	Apply cyberGIS techniques to analyze and visualize big geospatial data in Python using advanced cyberinfrastructure and high-performance computing.
2	Apply Python tools for developing high-performance geospatial computing solutions. Optimize and speed up geospatial computation using Python libraries like NumPy, SciPy, Numba, and Cython.
3	Implement open-source mapping and visualization libraries such as Leaflet, D3 and Plotly and mash up these libraries to create interactive and dynamic visualization tools and GIS applications.
4	Apply tools to investigate and identify patterns, clusters, classes, and anomalies based on various types of geospatial data and apply these techniques to a variety of geospatial applications.
5	Apply advanced techniques of spatial analysis, including spatial autocorrelation, trend surface analysis, grouping and regionalization procedures, and point pattern analysis to solve geospatial problems.
6	Solve given geospatial problem using ESRI ArcGIS solutions stack.
7	Identify the right tool to interlink dataset to transform unlinked geospatial data into linked data using geospatial semantic technologies (stRDF, stSPARQL, GeoSPARQL, OBDA mappings techniques. thing (e.g., a dataset containing information about roads in Crete can be interlinked with a dataset containing land cover information about Crete).
8	Analyze and visualize the data with the help of appropriate linked data tools using a sequence of GeoSPARQL queries.
9	Geospatial science in forestry and watershed management Geospatial science in urban planning and resource management
10	Use geospatial libraries for Geospatial Data Analysis with Python (e.g., Geopandas, Fiona, Shapely for Analyzing and visualizing geospatial data in Python.

Above experiments or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

*The Term Work will be calculated based on Laboratory Performance (15m) and Quizzes (10m).

Books Recommended:

Textbooks:

1. David S. Jordan, 'Applied Geospatial Data Science with Python', Association of Computing Machinery, 1st Edition, 2023.
2. Manolis Koubarakis, 'Geospatial Data Science: A Hands-on Approach for Building Geospatial Applications Using Linked Data Technologies', Association of Computing Machinery, 1st Edition, 2023.
3. Hassan A. Karimi, Bobak Karimi, 'Geospatial Data Science Techniques and Applications', CRC Press, 1st Edition, 2020.
4. Kang-Tsung Chang, 'Introduction to Geographic Information Systems', McGraw-Hill Education, 4th Edition, 2019.
5. Tyler Mitchell, 'Web Mapping Illustrated', O'Reilly Media, 1st Edition, 2010.
6. Janahan Gnanachandran, 'Geospatial data analysis on AWS', ACM Publisher, 1st Edition, 2023.

Reference Books:

1. Chris Garrard, 'Geoprocessing with Python', Manning Publisher, 1st Edition, 2016.
2. Paul Crickard, 'Leaflet.js Essentials', Packt Publishing Ltd, llustrated edition, 2014.
3. Michael J. de Smith, Michael F. Goodchild, and Paul A. Longley, 'Geospatial Analysis: A Comprehensive Guide', Winchelsea Press, 1st Edition, 2018.

Web Links:

1. The Ultimate Guide to Geospatial Data Science, Geospatial Data Science Explained: A Full Guide - Aya Data

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DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII

Course: Advanced Networking Technology (DJ19DSC8013)

Course: Advanced Networking Technology Laboratory (DJ19DSL8013)

Pre-requisite:
1. IoT Enterprise Network
2. Wireless Communication & Digital Communication

Objectives: The objectives of this course are to:
1. Comprehend & Design a complete Campus/wide network from Access layer to Security.
2. Evaluate Interior & Exterior Routing Algorithms & ensure failsafe design implementations.
3. Introduce concepts of VPN, MPLS & Software Defined Networks for Emerging. Technologies.

Outcomes: On completion of the course, learner will be able to:
1. Evaluate/ Design Small – Medium Scale Networks from access layer to backbone layer.
2. Design for Emerging areas such as Iot and IIoT.
3. Migrate designs to new technologies that are high speed-high security-high QoS Networks.

Advanced Networking Technology (DJ19DSC8013)		
Unit	Description	Duration
1	**Applying a Methodology to Network Design:** The Cisco Service Oriented Network Architecture, Network Design Methodology, Identifying Customer Requirements, Characterizing the Existing Network and Sites, Using the Top Down Approach to Network Design, The Design Implementation Process.	05
2	**Designing Basic Campus and Data Center Networks** Campus Design Considerations, Enterprise Campus Design, Enterprise Data Center Design Considerations.	05
3	**IP Subnets & Network Design:** 1.1 3-Tier Network Design – Access layer, Distribution layer & Backbone layer (User – Service Provider), IP Addressing using IPv4 and IPv6 with Classful & Classless Routing Protocols. 1.2 Design using VLANs – IEEE 802.1Q, ISL(Inter-Switch Link), VLAN Trunking Protocol: VTP ServerClient Mode, VTP Transparent Mode & VTP Pruning.	07
4	**IP Routing Design:** 2.1 Distance Vector Routing (Bellman Ford Algorithm) Vs Link State Routing (Dijikstra's). 2.2 Interior Gateway Routing Protocols - RIP, OSPF & EIGRP & Exterior Routing Protocols- Border Gateway Protocol (BGP). 2.3 IP Routing using FLSM- Fixed Length Subnet Masking and VLSM- Variable Length Subnet Masking, Designing Subnetting using VLSM and	08

	Manual Route Summarization Vs Auto-summarization. 2.4 Spanning Tree Protocol- STP & Rapid STP (IEEE 802.1d & IEEE 802.1w) & STP Configuration with verification. 2.5 IP Access Control Lists – Standard and Extended ACL with Wildcard masks, Named IP ACL.	
5	**Virtual Private Networks & Scaling the IP address space:** 3.1 VPN Fundamentals, IPsec VPNs- IPsec Encryption, IPsec Key Exchange, IPsec Authentication & Message Integrity, IPsec Implementation Considerations, SSL VPNs. 3.2 CIDR - Private Addressing & Route Aggregation. 3.3 Network Address Translation (NAT) – Static NAT & Dynamic NAT & Port Address Translation.	06
6	**Multi-Protocol Label Switching (MPLS) & Software Defined Networking – SDN** 4.1 MPLS Technology & its use, Label Distribution in MPLS, MPLS services- Traffic Engineering using QoS, Configuring MPLS. 4.2 SDN – Benefits & differences from Classical Networking, Models of SDN, SDN Architecture, QoS, Scalability & Security in SDN – Features & Issues.	08
	Total	**39**

Advanced Networking Technology Laboratory (DJ19DSL8013)	
Sr. No	**Suggested Experiments**
1	A Configuring Cisco 2960 Catalyst Switch & 2811 Router using CLI on Cisco packet tracer.
2	Study & evaluation of Routing Protocols – using Riverbed Modeller a. RIP – with route poisoning b. OSPF with load balancing
3	Designing a Campus Network a. Implement VLAN configuration b. Implement STP Pruning c. Troubleshooting LAN Switching & Isolating VLAN Trunking problems
4	Implementing the Spanning Tree Protocol – a. Network Convergence & Security.
5	Implementing Port Security & Access Lists for Firewalls and DMZs.
6	Implementing SNAT- DNAT & PAT Configuration with troubleshooting.
7	Implementing server load threshold limits and latency using Riverbed modeler.
8	Study of IoT gateway.

Above experiments or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

*The Term Work will be calculated based on Laboratory Performance (15m) and Assignments (10m).

Books Recommended:

Textbooks:

1. Wendell Odom/ Lammle Todd, "CCNA ICND1-2: Official Exam Certification Guide", Sybex, 1st Edition, 2020.
2. Beherouz A Forouzan , "TCP /IP Protocol Suite" , Tata McGraw Hill Education ,4th edition, 2018.

Reference Books:

1. Darren L. Spohn, "Data Network Design" , McGraw Hill Education, 3rd Editon, 2002.
2. William Stallings, 'Wireless Communications and Networks', Pearson, 2nd Edition, 2009.
3. Vijay Garg, 'Wireless Communication and networking', Morgan Kaufmann Publishers, 1st Edition, 2008.
4. Carr and Snyder, 'Data communication and network security', McGraw Hill ,1st Edition, 2006.

Web Links:

1. NPTEL Course: https://onlinecourses.nptel.ac.in/noc23_cs35/preview

2. Global Certification Course: https://aws.amazon.com/certification/certified-advanced-networking-specialty/

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: Social Network Analysis (DJ19DSC8014)		
Course: Social Network Analysis Laboratory (DJ19DSL8014)		

Pre-requisite:

1. Probability and Statistics
2. Machine Learning

Objectives: The analysis of massive networks which provide many computational, algorithmic, modeling challenges and research on the structure and analysis of such large networks.

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

1. Analyze a social network using various visualization tools.
2. Illustrate large-scale network data and mechanisms used for network growth models.
3. Examine social networks analysis and prediction using case studies.
4. Apply appropriate anomaly detection and graph representation method on a network.

Social Network Analysis (DJ19DSC8014)		
Unit	Description	Duration
1	**Society & Network:** Introduction, Use of social networks, defining a network, types of network (link-centric, node and link centric, local view, temporal view, generalization, real-world network), levels of social network analysis, graph visualization tools (web-based and standalone), applications. **Network Measures:** Network basics, node centrality, assortativity, transitivity and reciprocity, similarity, degeneracy.	06
2	**Network Growth Models:** Properties of real world networks, Random Network Model: Degree Distribution of Random Network, Binomial to Poisson Distribution, Evolution of a Random Network, Average Path Length, Clustering Coefficient, Random Network vs. Real-world Network, Ring Lattice Network Model, Watts-Strogatz Model: Network Formation, Preferential Attachment Model: Network Formation, Degree Dynamics, Limitations of BA Model.	08
3	**Link Analysis**: Application of link analysis, Signed networks: Balance Theory of Undirected Signed Networks, Status Theory of Signed Networks, Triad Balance vs Status, Strong and Weak Ties: Strength of a Tie, Triadic Closure, Dunbar Number, Local Bridges and Importance of Weak Ties, PageRank, Personalised PageRank, DivRank, SimRank, PathSim.	06
4	**Community Detection:** Application of community detection, types of communities, community detection methods, Disjoint Community Detection: Node-centric community detection, modularity and community detection, Overlapping Community	08

	Detection: Clique Dynamics, Local Community Detection. **Link Prediction:** Applications of link prediction, Evaluating Link Prediction methods, Heuristic models, Probabilistic models, Supervised Random Walk.	
5	**Cascade Behaviours & Network Effects:** Preliminaries and Important Terminologies, Cascade Models, Probabilistic Cascades, Epidemic Models, Independent Cascade Models, Cascade Prediction.	05
6	**Anomaly Detection in Networks:** Anomaly in Static Networks: Plain and attributed networks, relational learning, Anomaly in Dynamic Networks: Preliminaries, feature and decomposition-based approaches. **Graphical Representation Learning:** Criterion of graph representation learning, pipeline, representation learning methods.	06
	Total	**39**

Social Network Analysis Laboratory (DJ19DSL8014)	
Exp.	**Suggested Experiments**
1	Creating and analysing a graph using Social Network and Gephi Tool.
2	Building a network and network measures using NetworkX: a) Degree & Degree Distance b) Clustering c) Node Centrality measure d) Helper FunctionHelper function
3	Implementation of random scale-free network growth model on network science. (Barabasi-Albert).
4	Implementation of clustering network growth model on network science (Watts Strogatz Network).
5	Implementation of link analysis of random walk page rank algorithm.
6	Implementation of link prediction using classification approach.
7	Implementation of local and global link prediction model.
8	Implementation of Mobility on Multi-layer Networks (SIR epidemic model).
9	Implementation of Graph Representation learning. a) DeepWalk b) Node2Vec c) GCN d) GAT
10	Mini Project

Above experiments or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

*The Term Work will be calculated based on Laboratory Performance (15m) and Assignments (10m).

Books Recommended:

Textbooks:
1. Tanmoy Chakraborty, "Social Network Analysis", First Edition, Wiley, 2021.
2. Stephen P Borgatti, Martin G. Everett, Jeffrey C. Johnson ,'Analyzing Social Networks', Sage Publications Ltd, 2nd Edition, 2018.

Reference Books:
1. Xiaoming Fu, Jar-Der Luo, Margarete Boos, 'Social Network Analysis Interdisciplinary Approaches and Case Studies', 1st Edition, CRC Press, 2020.
2. Dr. Krishna Raj P.M., Mr. Ankith Mohan, Dr. Srinivasa K.G, "Practical Social Network Analysis with Python (Computer Communications and Networks)", First Edition, Springer, 2019.
3. John Scott, "Social Network Analysis", Fourth Edition, SAGE Publications Ltd, 2017.
4. Song Yang, Franziska Barbara Keller, Lu Zheng, "Social Network Analysis: Methods and Examples", First Edition, SAGE Publications, 2016.

Web Links:
1. A course on Social Network Analysis:
   https://onlinecourses.nptel.ac.in/noc22_cs117/preview
2. A comprehensive guide to Social Network Analysis:
   https://towardsdatascience.com/how-to-get-started-with-social-network-analysis-6d527685d374
3. Social Network Analysis 101: Ultimate Guide Comprehensive Introduction for Beginners: https://visiblenetworklabs.com/guides/social-network-analysis-101/

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: **Project Management (DJ19ILO8021)**		

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, learner 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.

Project Management (DJ19ILO8021)		
Unit	Description	Duration
1	**Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Introduction to project leadership, ethics in projects, Multicultural and virtual projects, Project management in various 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 bottom up budgeting, Networking and Scheduling techniques, PERT, CPM, crashing project project time, Resource loading and g, 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.	12

4	**Monitoring and Controlling Projects** Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, communication and project meetings. 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.	08
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	42

Books Recommended:

Textbooks:

1. Jack Meredith & Samuel Mantel, Project Management: A managerial approach, 7th Edition, Wiley India.
2. Erik Larson, Clifford Gray, 'Project Management: The Managerial Process', 6th edition, 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.

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: Entrepreneurship Development and Management (DJ19ILO8022)		

Pre-requisites: Basic concepts of Management.

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 the right decisions for starting and running an enterprise.

Outcomes: On completion of the course, 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 aspects of a business.

Entrepreneurship Development and Management (DJ19ILO8022)		
Unit	Description	Duration
1	**Entrepreneur & Entrepreneurship:** 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	06
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.	10
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 - District Industries Centers - Single Window System.	06
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	12
	Total	**42**

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)

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: Corporate Social Responsibility (DJ19ILO8023)		

Objectives:

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

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

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

Corporate Social Responsibility (DJ19ILO8023)		
Unit	Description	Duration
1	**Introduction to CSR** Meaning and Definition, History of CSR, Concepts of Charity, Corporate philanthropy, Corporate Citizenship, Sustainability and Stakeholder Management. Environmental aspect of CSR Chronological evolution and Models of CSR in India Carroll's model Major codes on CSR Initiatives in India.	06
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.	10
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.	10
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	**42**

Books Recommended:

Textbooks:

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 Hittner, IBA Global Business Services, 2008
3. Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, William B. Werther Jr. and David Chandler, 2nd Edition, Sage Publications, 2011.

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: Human Resource Management (DJ19ILO8024)		

Objectives:

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

Human Resource Management (DJ19ILO8024)		
Unit	**Description**	**Duration**
1	**Introduction to HR** Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions. Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, 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.	09
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.	10
	Total	42

Books Recommended:

Reference Books:

1. Stephen Robbins, Organizational Behavior, 16th Ed, 2013
2. V S P Rao, Human Resource Management, 3rd Ed, 2010, Excel publishing
3. Aswathapa, Human resource management: Text & cases, 6th edition, 2011
4. C. B. Mamoria and S V 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.

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: Corporate Finance Management (DJ19ILO8025)		

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.

Corporate Finance Management (DJ19ILO8025)		
Unit	**Description**	**Duration**
1	**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
2	**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	09
3	**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

4	**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)	10
5	**Capital Structure:** Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches— Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure **Dividend Policy:** Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches— Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	09
	Total	42

Books Recommended:

Reference Books:

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 I. 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.

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: Logistics and Supply Chain Management (DJ19ILO8026)		

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. Understand various sustainability aspects of a supply chain.

Logistics and Supply Chain Management (DJ19ILO8026)		
Unit	Description	Duration
1	**Understanding the Supply Chain:** Objective, Importance, Decision Phases, Process Views. **Achieving Strategic Fit and Scope:** Competitive and Supply Chain Strategies, Achieving Strategic Fit, Expanding Strategic Scope, Challenges to Achieving and Maintaining Strategic Fit. **Supply Chain Drivers and Metrics:** Financial Measures of Performance, Drivers of Supply Chain Performance, Framework for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing. **Creating the Responsive Supply Chain:** Product push versus demand pull, The Japanese philosophy, The foundations of agility, A route-map to responsiveness.	08

2	**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.	14
3	**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
4	**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
5	**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.	05

	Introduction to the Supply Chain of the Future: Emerging Megatrends.		
		Total	**42**

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.

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: IPR and Patenting (DJ19ILO8027)		

Objectives:

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

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

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

IPR and Patenting (DJ19ILO8027)

Unit	Description	Duration
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 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	06
2	**Patents and Trademarks** Elements of Patentability: Novelty, Non Obviousness, Industrial Application, Non Patentable Subject Matter, Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties, Patent office and Appellate Board, Case study of existing patents related to software, healthcare, devices Concept of Trademarks, Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks), Non Registrable Trademarks, Registration of Trademarks, Rights of holder and assignment and licensing of marks, Infringement, Remedies & Penalties, Trademarks registry and appellate board	12
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	10

4	**GI, PVP and LDP** Geographical indication: meaning, difference between GI and trademarks, procedure for registration, effect of registration and term of protection Plant variety protection: meaning, benefit sharing, farmers' rights, procedure for registration, effect of registration and term of protection Layout Design protection: meaning, procedure for registration, effect of registration, term of protection	**08**
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	**06**
	Total	**42**

Books Recommended:

Reference 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.Innovation and entrepreneurship by Drucker. F. Peter, Harper business, (2006).

4. Intellectual Property Rights, Deborah. E. Bouchoux, Cengage Learing.

5. Intellectual Property Rights– Unleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,

6. The Design of Business- by Martin Roger, Harvard Business Publishing (2009)

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: Digital Marketing Management (DJ19ILO8028)		

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: On completion of the course, learner will 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.

Digital Marketing Management (DJ19ILO8028)		
Unit	**Description**	**Duration**
1	**Introduction to Digital Marketing** 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	**08**

	channels on IMC.	
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 developing 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.	13
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.	08
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

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, 5th edition, Taylor & Francis.
4. Digital Marketing: Strategy, Implementation and Practice- 6th edition by Dave Chaffey Fiona Ellis-Chadwick, Pearson Education Limited.

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: Environmental Management (DJ19ILO8029)		

Pre-requisite: Knowledge of environmental science.

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

Outcomes: On completion of the course, learner will be able to:
1. Identify Environmental issues and get familiarized to the concept of Ecosystem and environmental management.
2. Know policies and legal aspects and understand EM system standards.
3. Understand Environment Impact assessment.
4. Understand Environment Auditing procedures.
5. Describe Environmental management Techniques.

Environmental Management (DJ19ILO8029)		
Unit	Description	Duration
1	**Principles of Environmental management (EM):** Introduction of EM, Definition, Ecosystem concept, Participants in EM, Ethics and the environment, International Environmental Movement, Environmental issues relevant to India.	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.	10
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.	10
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.	08

Books Recommended:

Text Books:
1. Environmental Management, T V Ramachandra and Vijay Kulkarni, TERI Press
2. Environmental Management: Principles and Practice, C J 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

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Program: B.Tech in Computer Science and Engineering (Data Science)	Final Year. B.Tech	Semester: VIII
Course: Labour and Corporate Law (DJ19ILO8030)		

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

Labour and Corporate Law (DJ19ILO8030)		
Unit	Description	Duration
1	**Trade Unions and Collective Bargaining:** Trade Unionism in India, Definition of Trade Union and Trade Dispute, General and Political Funds of Trade Union, Civil and Criminal Immunities of Registered Trade Unions, Recognition of Trade Union, Collective Bargaining	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.	09
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

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

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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 theylearned 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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