



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)



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 VII)



Proposed scheme for Second Year B.Tech Program for Department of Artificial Intelligence & Data Science
Semester VII
(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	DJ19ADC701	Large Language Models	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	150	3	4
	DJ19ADL701	Large Language Models Laboratory	--	2	--	1	--	--	25	--	--	--	--	--	--	25	50		1	
2	DJ19ADC702	Time Series Analysis and Forecasting	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	150	3	4
	DJ19ADL702	Time Series Analysis and Forecasting Laboratory	--	2	--	1	--	--	25	--	--	--	--	--	--	25	50		1	
3	DJ19ADL703	Semantic Web Laboratory	--	2	--	1	--	--	25	--	--	--	--	--	--	25	25	50	1	1
4@	DJ19ADE7011	Security Operations	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	150	3	4
	DJ19ADL7011	Security Operations Laboratory	--	2	--	1	--	--	25	--	--	--	--	--	--	25	50		1	
	DJ19ADE7012	Recommendation Systems	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	150	3	
	DJ19ADL7012	Recommendation Systems Laboratory	--	2	--	1	--	--	25	--	--	--	--	--	--	25	50		1	
	DJ19ADE7013	Probabilistic Graph Models	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	150	3	
	DJ19ADL7013	Probabilistic Graph Models Laboratory	--	2	--	1	--	--	25	--	--	--	--	--	--	25	50		1	
	DJ19ADE7014	Computational Finance-I	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	150	3	
	DJ19ADL7014	Computational Finance-I Laboratory	--	2	--	1	--	--	25	--	--	--	--	--	--	25	50		1	
5#	DJ19ILO7011	Product Life Cycle Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	3
	DJ19ILO7012	Management Information System	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7013	Operations Research	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7014	Cyber Security and Laws	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7015	Personal Finance Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7016	Energy Audit and Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7017	Disaster Management and Mitigation Measures	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7018	Science of Well-being	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7019	Research Methodology	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7020	Public Systems and Policies	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
6	DJ19DSP704	Project Stage - I	--	4	--	2	2	--	50	--	--	50	--	--	--	50	50	100	2	2
Total			48	18	0	57	50	1200	225	0	0	1250	400	400	400	225	775	2050	57	18

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 / 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: Final Year B.Tech. in Artificial Intelligence(AI) & Data Science								Semester : VII		
Course: Large Language Models								Course Code: DJ19ADC701		
Course : Large Language Models Laboratory								Course Code: DJ19ADL701		
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	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presenta		
				25	--	--	15	10	25	

Pre-requisite: Natural Language Processing, Deep Learning.

Course Objectives:

1. Introduce the fundamental concepts and applications of Generative AI.
2. Provide in-depth understanding of Transformer architecture, the core building block of most Large Language Models (LLMs).
3. Explore various LLM architectures and techniques like BERT, prompt engineering, and fine-tuning.
4. Equip students with the ability to evaluate LLM performance and identify potential biases.
5. Introduce students to Multimodal LLMs that can process and understand different data modalities.

Course Outcomes: Students will be able to

1. Introduce the fundamental concepts and applications of Generative AI and to provide in-depth understanding of Transformer architecture, the core building block of Large Language Models (LLMs).
2. Explore various LLM architectures and techniques like BERT, GPT-3, T5.
3. Apply prompt engineering techniques for effective LLM interaction and understand the concept of Retrieval Augmented Generation (RAG) and its role in LLMs.
4. Evaluate LLM performance and identify potential biases and understand multimodal LLMs that can process and understand different data modalities.



Large Language Models (DJ19ADC701)		
Unit	Description	Duration
1	Module 1: Introduction to Generative AI & Transformer Architecture - The Engine of LLMs Domains of Generative AI, Text Generation, Image Generation, Music Generation, Video Generation. Limitations of RNN & LSTM, Understanding the core building block of most LLMs - the Transformer model, Tokenization, Decoding the Transformer's components: encoders, decoders, attention mechanisms - types, Self-attention vs Flash Attention, feed-forward layer, Reinforcement Learning with AI Feedback (RLAIF), Reinforcement Learning from Human Feedback (RLHF)	8
2	Module 2: Language Models - Unveiling the Power of Words Diving into different LLM architectures: BERT (Bidirectional Encoder Representations from Transformers) and its applications, exploring other notable LLM architectures (e.g. GPT-3, T5), Mixture of Experts (MoE), various benchmarks to evaluate LLMs	8
3	Module 3: Prompt Engineering Introduction to prompt, examples of prompt, prompt engineering, prompt techniques, zero shot, one shot, few-shot learning, a chain of thought prompting, ReAct Prompting, self-consistency, Tree of thought, LLM based Agents, Large Action Models (LAMs).	7
4	Module 4: Retrieval Augmentation & Generation (RAG) and Fine-tuning for LLMs Understanding Retrieval and vector, vector storage: vector indexing, vector libraries, vector databases, Loading and retrieving in Lang Chain, Document loaders, Retrievers in Lang Chain. Fine-tuning: Quantization, PEFT, Full-Fine-tuning vs LoRA vs QLoRA, Fine-Tuning LLMs for different downstream tasks.	6
5	Module 5: Evaluating LLMs - Measuring Performance and Biases Learning about common metrics for evaluating LLM performance (e.g., perplexity, BLEU score). Understanding the challenges of bias and fairness in LLMs. Exploring techniques for mitigating bias in LLM development and evaluation, considering prompt design and data selection for RAG models: RAGAS	6
6	Module 6: Multimodal Architectures - Beyond Text Introduction to Multimodal LLMs: processing and understanding different data types (text, images, audio). Exploring architectures for Multimodal LLMs: separate encoders, joint embedding spaces. Applications of Multimodal LLMs (e.g., image captioning, video summarization), Multi-task LLMs, Empowering Time Series Analysis with Large Language Models	4
TOTAL		39



Books Recommended:

Text Books:

1. Ben Auffarth, "Generative AI with LangChain: Build large language model (LLM) apps with Python, ChatGPT, and other LLMs" by Packt Publishing, 2023.
2. Valentina Alto, "Modern Generative AI with ChatGPT and OpenAI Models", by Packt Publishing, 2023.
3. Jay Alamar, Maarten Grootendorst, "Hands-On Large Language Models", by O'Reilly, 2023
4. Thushan Ganegedara, "Natural Language Processing with TensorFlow", by Packt Publishing, Second Edition, 2022.

Reference Books:

1. David Foster, "Generative Deep Learning", O'Reilly, 2020.
2. Lewis Tunstall, Leandro von Werra & Thomas Wolf, "Natural Language Processing with Transformers", 2022.
3. Sebastian Raschka, "Build a Large Language Model (From Scratch)", ISBN 9781633437166

Web Resources Blogs and Websites:

1. Mixture of Experts: Mixture of Experts Explained (huggingface.co)
2. PEFT:Efficient Model Fine-Tuning for LLMs: Understanding PEFT by Implementation | by Shivansh Kaushik | Medium
3. Various benchmarks to evaluate LLMs: LLM Benchmarks: Understanding Language Model Performance (humanloop.com)
4. Types of attention mechanism: Understanding and Coding the Self-Attention Mechanism of Large Language Models From Scratch (sebastianraschka.com)
5. Agents| RAG: Intro to LLM Agents with Langchain: When RAG is Not Enough | by Alex Honchar | Mar, 2024 | Towards Data Science
6. React| Agent: Teaching LLMs to Think and Act: ReAct Prompt Engineering | by Bryan McKenney | Medium
7. LLM based Agents : Superpower LLMs with Conversational Agents | Pinecone
8. RAGAS: Evaluating RAG pipelines with Ragas + LangSmith (langchain.dev)
9. Model distillation: LLM distillation demystified: a complete guide | Snorkel AI
10. Sentence classifier |BERT: Classify text with BERT | Text | TensorFlow

Suggested List of Experiments:

Large Language Models Laboratory(DJ19ADL701)	
Sr. No.	Title of the Experiment
1	Build your own simple LLM Application using Lang Chain.
2	Query PDF using Lang Chain and Pine cone
3	Fine Tuning Pre-trained Model On Custom Dataset Using Transformer
4	Fine Tune LLAMA 2 With Custom Dataset Using LoRA And QLoRA Techniques
5	Text classification using BERT and Tensorflow
6	Question Answering Application using LLM based agents
7	Using in-built tools and creating custom tools for ReAct agent in Langchain.
8	Monitoring RAG applications using Langsmith and evaluating using ragas
9	Build a simple multimodal generative model that combines text and image inputs to generate captions



10	Understanding multimodal models like Gemini vision.
11	Understanding various retrievers in Langchain.
12	Open-sourced LLMs for function calling.
13	Mini project

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



Program: Third Year B.Tech. in Artificial Intelligence (AI) and Data Science								Semester: VII	
Course: Time Series Analysis and Forecasting								Course Code: DJ19ADC702	
Course: Time Series Analysis and Forecasting Laboratory								Course Code: DJ19ADL702	
Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)		
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.
				75			25	25	25
				Laboratory Examination			Term work		
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work
				25	--	--	15	10	25
50									

Prerequisite: - Statistics for Data Science, Deep Learning

Course Objectives:

1. Learn basic analysis of time series data.
2. Auto regressive and model averaging models.
3. Learn basic concepts of forecasting.
4. To understand the detection of outliers in time series data

Course Outcomes:

On completion of the course, learner will be able to

1. To understand the basics of Time series Analysis.
2. To apply statistical smoothening methods for the time series data
3. To forecast the time series data using traditional methods
4. To analyse and explore the deep learning techniques for forecasting the time series data

Time Series analysis and forecasting (DJ19ADC702)		
Unit	Description	Duration
1.	Introduction to Time Series Introduction to Time Series and Forecasting, Different types of data, Internal structures of time series, Models for time series analysis, trends in time series (Parametric trends, differencing,	05

	non-parametric methods, noise), properties of time series, Autocorrelation and Partial autocorrelation. Examples of Time series Nature	
2.	Exploratory Data Analysis & Visualizations for Time Series Analysis: Handling time series data: working with Date and Time, Handling Missing values: Understanding missing data, performing data quality checks, handling missing data with univariate imputation Plotting Time series data with interactive Visualizations, Decomposing Time series data.	07
3.	Time Series Using Stochastic Models Stationarity Analysis Understanding Stationarity, Techniques for achieving stationarity (differencing, seasonal differencing), Naïve forecasting methods (simple, seasonal), Moving Average Smoothing, Time series analysis using Linear/logistic Regression, Autocorrelation (ACF) and Partial Autocorrelation (PACF) analysis , Auto Regression (AR), ARIMA Model, SARIMA, Box – Jenkins Model Selection, Machine Learning methods- windowing	08
4.	Forecasting: Forecasting in time series models, forecasting for autoregressive processes, One-step ahead predictors based on the finite past: Durbin-Levinson algorithm	06
5.	Deep Learning for Time Series Forecasting: Understanding Artificial Neural Networks, CNN for Time Series Forecasting, forecasting with an RNN, forecasting with LSTM, forecasting with a GRU, Performance metrics for time series forecasting (MAE, RMSE, MAPE), Cross-validation techniques for evaluating model performance, Model selection strategies (e.g., GridSearchCV)	08
6.	Multivariate Time Series: Multivariate time series regression: Conditional independence, Partial correlation and coherency between time series, Vector AR (VAR) Models Univariate volatility models: Univariate ARCH, GARCH (financial volatility modelling)	05
	TOTAL	39

Books Recommended:

Textbooks:

1. Daniel Garfield (Author) Time Series Analysis for Beginners: Comprehensive Introduction Kindle Edition
2. Douglas C. Montgomery, Cheryl L. Jennings and Nurat Kulahci, “Introduction to Time Series Analysis and Forecasting,” Second Edition, Wiley, 2015. Wilfredo Palma ,TIME SERIES ANALYSIS, Wiley

1. B. V. Vishwas and Ashish Patel, "Hands-on Time Series Analysis with Python," First Edition, Apress, 2020
2. James D. Hamilton, "TIME SERIES ANALYSIS", Levant Books, 2012.
3. 4. Ted Dunning and Ellen Friedman, "Time Series Databases: New Ways to Store and Access Data", First Edition, O'Reilly, 2019.

Reference Books:

1. Time Series Analysis with Python Cookbook: Practical recipes for exploratory data analysis, data preparation, forecasting, and model evaluation , Packt Publishing, 2022
2. Marc S. Paoletta, Linear Models and Time-Series Analysis, Wiley publications
3. Walter Enders, "Applied Econometric Time Series," Fourth Edition, Wiley, 2014.
4. Chris Chatfield, "Time- Series Forecasting," First Edition, Chapman & Hall/CRC, 2001.
5. Aileen Nielsen, "Practical Time Series Analysis," O'Reilly, 2019.
6. Robert H. Shumway and David S. Stoffer, "Time Series Analysis and Its Applications," Springer, 2000.

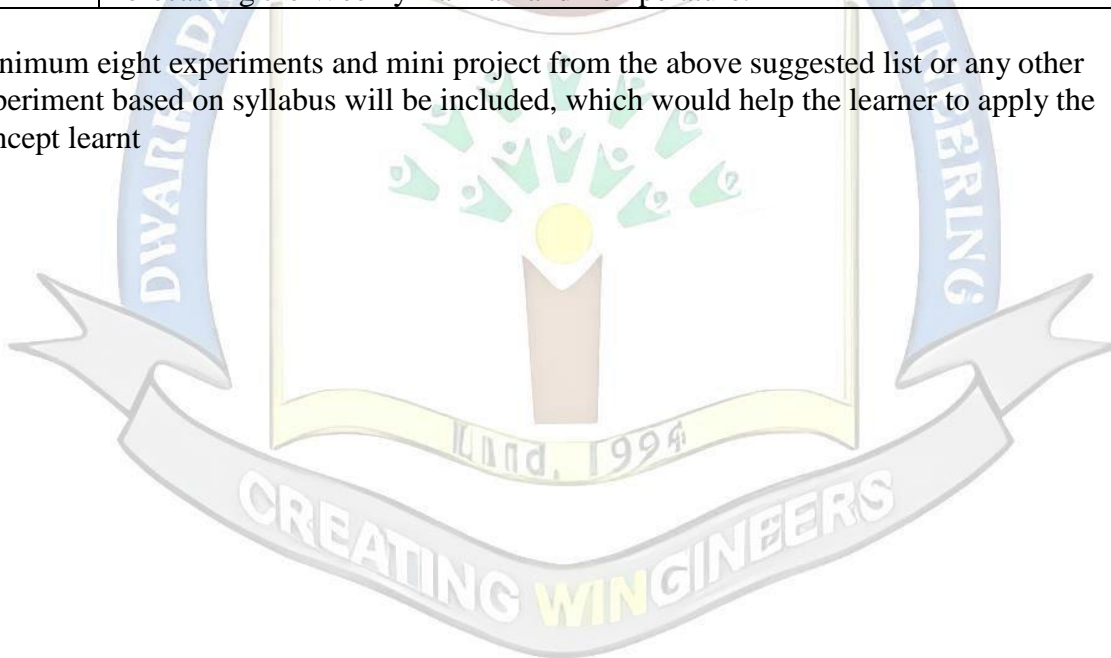
Web Links:

1. Kevin Kotzé (economodel.com)
2. A course on Time Series Analysis.
https://web.stat.tamu.edu/~suhasini/teaching673/time_series.pdf
3. A comprehensive guide to Time Series Analysis.
<https://www.analyticsvidhya.com/blog/2021/10/acomprehensive-guide-to-time-series-analysis/>
4. The Complete Guide to Time Series Analysis and Forecasting.
<https://towardsdatascience.com/the-completeguide-to-time-series-analysis-and-forecasting-70d476bfe77>
5. Energy consumption time series forecasting with python and LSTM deep learning model | by Eligijus Bujokas | Towards Data Science
6. Autoregression Models for Time Series Forecasting With Python - MachineLearningMastery.com
7. Python | ARIMA Model for Time Series Forecasting - GeeksforGeeks
8. Weekly Rainfall and Temperature Forecasting (kaggle.com)
9. Air Passenger Forecast : ARIMA - SARIMA (kaggle.com)
10. LSTM for Time Series Prediction in PyTorch - MachineLearningMastery.com

Suggested List of Experiments

Time Series analysis and forecasting Laboratory (DJ19ADL702)	
Sr. No.	Title of Experiment
1	Data Preprocessing: Clean and preprocess a given time series dataset, handling missing values , Outlier Detection using statistical methods.
2	Data Exploration: Use Pandas to explore and visualize various time series dataset
3	Autoregression Models for Time Series Forecasting with Python
4	Apply ARIMA - SARIMA models to predict / forecast the number of passengers travelling using aeroplanes based on time series data
5	Exploratory Data Analysis for Time Series
6	Implementing Basic RNN: Develop an RNN model for stock price prediction using historical data
7	Time Series Prediction with LSTM Recurrent Neural Networks in Python
8	Gated Recurrent Unit (GRU) With PyTorch
9	Implement a multivariate time series regression model.
10	Implement GARCH on a financial time series dataset.
11	Implement Anomaly detection using Time series data
12	Compare and contrast on Statistical methods and Deep Learning methods by forecasting the Weekly Rainfall and Temperature.

Minimum eight 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



Prepared by

Checked by

Head of the Department

Vice Principal

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**Syllabus for Final Year B.Tech. Program in Artificial Intelligence (AI) and Data Science- Semester VII
(Autonomous) (Academic Year 2024-25)**

Program: Final Year B.Tech. in Artificial Intelligence(AI) & Data Science								Semester : VII		
Course: Semantic Web Laboratory								Course Code: DJ19ADL703		
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	
				--			--	--	--	--
				Laboratory Examination			Term work		Total Term work	50
--	2	--	1	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presenta		
				25	--	--	15	10	25	

Prerequisite: DBMS

Course Objectives:

The course will help students to build a strong foundation in Semantic Web concepts and their application in real-world scenarios.

Course Outcomes:

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

1. Demonstrate proficiency in creating, querying, and manipulating RDF datasets using RDFlib in Python.
2. Design and develop ontologies using the Web Ontology Language (OWL),
3. Integrate heterogeneous datasets using semantic technologies and understand the role of graph databases in managing semantic data
4. Apply semantic querying principles to extract meaningful insights from semantic datasets
5. Deploy a Semantic Web application on a cloud platform using Neo4j for data storage and retrieval.

**Syllabus for Final Year B.Tech. Program in Artificial Intelligence (AI) and Data Science- Semester VII
(Autonomous) (Academic Year 2024-25)**

Syllabus:

Semantic Web Laboratory (DJ19ADL703)		
Experiment No.	Title/Content	Hours
1	Introduction to Semantic Web and RDF: Set up a Python environment with RDFlib installed. Generate RDF triples representing sample data (e.g., persons, relationships). Write Python scripts to serialize RDF data into different RDF formats (RDF/XML, Turtle). Use RDFlib to query and retrieve information from the generated RDF dataset.	4
2	Ontology Modeling with OWL: Install and configure Protégé on local machines. Create a domain-specific ontology with classes, properties, and individuals. Define class hierarchies, property restrictions, and relationships in the ontology. Use Protégé's reasoning capabilities to infer new knowledge based on ontology axioms.	4
3	Semantic Data Integration: Identify and collect diverse datasets from different sources (e.g., CSV files, JSON data). Transform and map datasets into RDF triples using semantic mapping techniques. Combine RDF graphs into a single, integrated semantic graph representing unified knowledge. Validate and visualize the integrated RDF graph using RDF visualization tools.	4
4	Building a Knowledge Graph: Create a knowledge graph using RDF triples to represent entities and their relationships within a specific domain (e.g., movies, books, or academic publications). Define classes, properties, instances, and relationships, ensuring adherence to Semantic Web standards and best practices. Emphasis to be placed on ontology reuse, modularity, and expressiveness in capturing domain knowledge.	4
5	SPARQL Querying for RDF Data: Set up a SPARQL endpoint using an RDF triple store (e.g., Apache Jena Fuseki). Write basic SPARQL queries to query RDF data based on specific criteria (e.g., class membership, property values). Incorporate advanced SPARQL features (e.g., graph patterns, OPTIONAL clauses) to perform complex queries. Execute federated SPARQL queries to integrate data from multiple RDF sources.	4
6	Semantic Web Application Development: Choose a web framework (e.g., Flask, Django) and set up a development environment. Integrate with the chosen web framework to enable CRUD operations on the knowledge graph. Develop frontend interfaces for interacting with the Semantic Web application (e.g., search, visualization). Deploy the Semantic Web application locally or on a cloud platform for testing and demonstration.	6
TOTAL		26

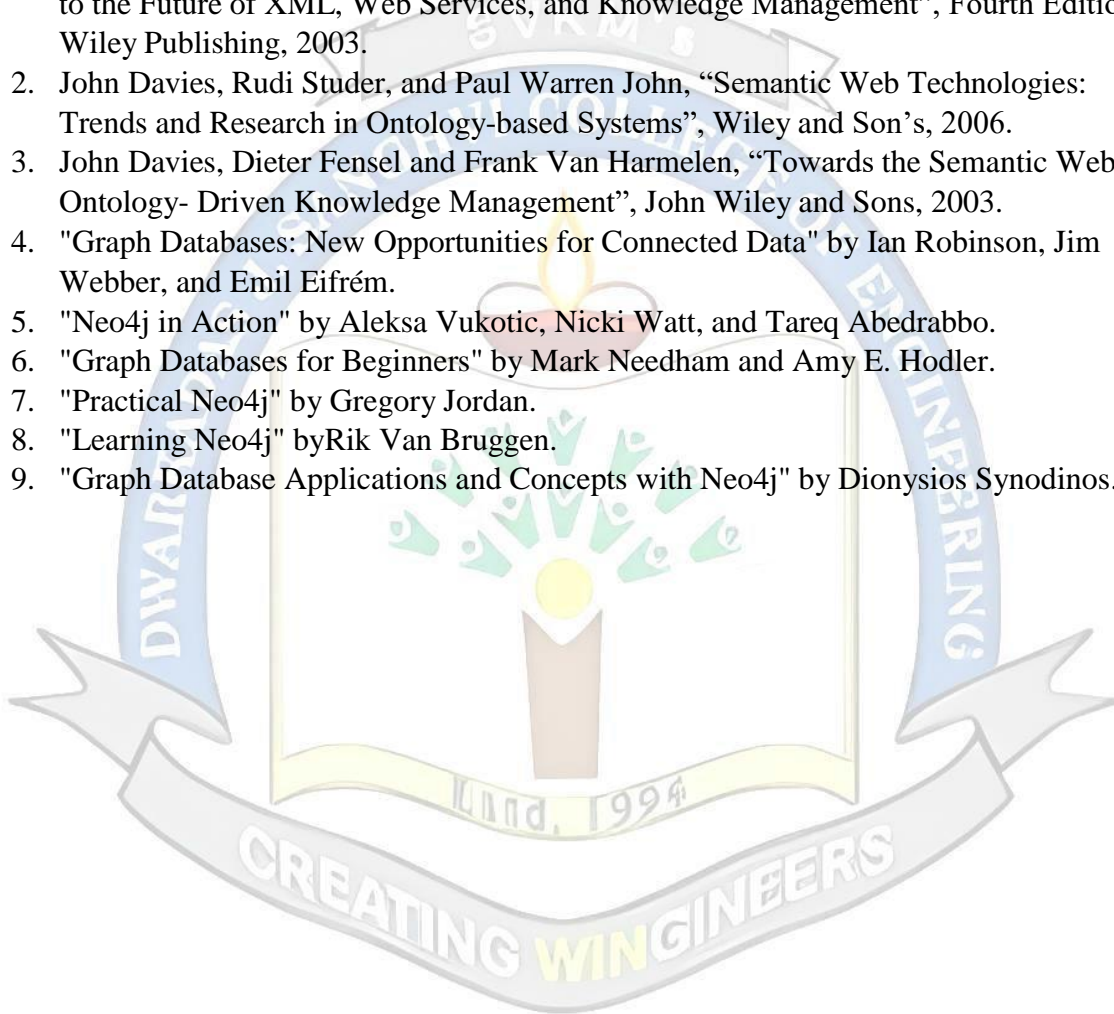
Books Recommended:

Textbooks:

1. Introduction to Graph Theory Fourth edition, Robin J. Wilson
2. Daphne Koller and Nir Friedman, "Probabilistic Graphical Models: Principles and Techniques", Cambridge, MA: The MIT Press, 2009 (ISBN 978-0-262-0139- 2).
3. Graph databases, Ian Robinson, Jim Webber & Emil Eifrem

Reference Books

1. Michael C. Daconta, Leo J. Obrst, and Kevin T. Smith, "The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management", Fourth Edition, Wiley Publishing, 2003.
2. John Davies, Rudi Studer, and Paul Warren John, "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley and Son's, 2006.
3. John Davies, Dieter Fensel and Frank Van Harmelen, "Towards the Semantic Web: Ontology- Driven Knowledge Management", John Wiley and Sons, 2003.
4. "Graph Databases: New Opportunities for Connected Data" by Ian Robinson, Jim Webber, and Emil Eifrem.
5. "Neo4j in Action" by Aleksa Vukotic, Nicki Watt, and Tareq Abedrabbo.
6. "Graph Databases for Beginners" by Mark Needham and Amy E. Hodler.
7. "Practical Neo4j" by Gregory Jordan.
8. "Learning Neo4j" by Rik Van Bruggen.
9. "Graph Database Applications and Concepts with Neo4j" by Dionysios Synodinos.



Program: Final Year B.Tech. in Artificial Intelligence(AI) & Data Science								Semester : VII		
Course: Security Operations								Course Code: DJ19ADC7011		
Course : Security Operations Laboratory								Course Code: DJ19ADL7011		
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	
				Laboratory Examination			Term work		Total Term work	
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presenta		
				25	--	--	15	10	25	
									50	

Prerequisite: - Basic understanding of computer networks, operating systems, and cybersecurity concepts, Basic understanding of DevOps, MLOps, Familiarity with cloud computing platforms and services, Experience with version control systems like Git.

Course Objectives:

1. To understand the principles and practices of Security Operations (SecOps) in modern IT environments.
2. To learn how to integrate security into DevOps processes and workflows.
3. To gain hands-on experience with security tools and technologies for threat detection, incident response, and vulnerability management.
4. To develop skills in automating security tasks and implementing security best practices throughout the software development lifecycle.
5. To cultivate a proactive approach to security monitoring, incident handling, and risk management.

Course Outcomes:

On completion of the course, learner will be able to

1. Understanding cyber threats and attack methodologies empowers organizations to better defend against cyberattacks.
2. Ability to design, implement, and manage security controls in dynamic and distributed IT infrastructures.
3. Proficiency in using security tools and technologies for threat intelligence, monitoring, and response.

4. Understanding of security automation frameworks and techniques for streamlining security operations.
5. Skill in identifying, analysing, and mitigating security risks and vulnerabilities.

Syllabus:

Security OPS (DJ19ADC7011)		
Unit	Description	Duration
1.	Understanding Cyber Threats and Attack Methodology Cyber Threats: Tactics-Techniques-Procedures (TTPs), Opportunity-Vulnerability-Weakness, Network Level Attack, Application Level Attacks, SQL Injection Attacks, Email Security Threats	07
2.	Introduction of Security Operations and Management Overview of SecOps: principles, concepts, and objectives. Evolution of SecOps and its role in modern IT environments. Key challenges and considerations in implementing SecOps practices. Security Operations Center (SOC): Need of SOC,SOC, Capabilities,SOC Operations SOC report, Security Management and Security Operations: Security Automation and Orchestration Automation of routine security tasks and processes. Integration of security tools and technologies for orchestration and workflow automation	10
3.	Incidents, Events, and Logging What is the mean of Log, What is incidents and event, Local Logging : windows and Linux logs, How to get Router and Web Server Logs, What is Centralized Logging Why we need a logs, Deeply log analysis, Alerting and reporting	07
4.	Incident Detection with Securing cloud Environments: Information and Event Management (SIEM), Security Information and Event Management(SIEM), Need of SIEM, Typical SIEM Capabilities, SIEM Architecture and Its Components, plunk Enterprise Security, Nessus, SIEM Deployment, Incident Detection with SIEM, Handling Alert Triaging and Analysis, Vulnerability scanning tools and techniques., Patch management strategies and practices, Securing Cloud and Container Environments, Best practices for securing cloud infrastructure, platforms, and services.	08
5.	Incident Detection and Incident Response with Threat Intelligence Understanding Cyber Threat Intelligence, How can Threat Intelligence Help Organizations? Threat Intelligence Strategy, Threat Intelligence Sources: OSINT Incident Response (IR) Process Overview,SOC and IRT collaboration. Responding to Network Security Incident, Responding to Application Security Incidents Responding to Email Security Incidents, Responding to an Insider Incidents	07
	TOTAL	39

Security OPS Laboratory (DJ19ADL7011)	
Sr. No.	Title of Experiment
1	Setting up a Security Operations Centre (SOC) environment.
2	Implementing automated security scans in CI/CD pipelines.
3	Configuring and deploying a Security Information and Event Management (SIEM) system
4	Conducting threat hunting exercises using security analytics tools.
5	Developing incident response playbooks for common security incidents.
6	Performing vulnerability assessments and prioritizing remediation efforts.
7	Automating security policy enforcement using infrastructure as code (IaC) tools.
8	Simulating and responding to security incidents in a controlled environment.
9	Analysing security logs and alerts to identify potential threats and vulnerabilities.
10	Implementing container security measures such as image scanning and runtime protection.

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

Books Recommended:

Textbooks:

1. Mike Sheward , "Security Operations in Practice" Released February 2020
Publisher(s): BCS
2. Joey Muniz, Gary McIntyre, Nadhem Aladdin "Security Operations Center: Building, Operating and Maintaining your SOC" Released November 2015 Publisher(s): Cisco Press
3. Dan Borges, Adversarial Tradecraft in Cybersecurity, Released June 2021, Publisher(s): Packt Publishing
4. Barry L. Williams "Information Security Policy Development for Compliance "Released April 2016 Publisher(s): Auerbach Publications
5. Perry Carpenter "Transformational Security Awareness" by Perry Carpenter Released May 2019 Publisher(s): Wiley

Reference Books:

1. Don Murdoch "Blue Team Handbook: SOC, SIEM, and Threat Hunting" - Publisher: CreateSpace Independent Publishing Platform - Year: 2017
2. Gregory Brown "SOC as a Service: A Comprehensive Framework for the Security Operations Centre" Publisher: Apress - Year: 2019
3. Gerard Blokdijs "Security Operations Center - Simple Steps to Win, Insights and Opportunities for Maxing Out Success" Publisher: CreateSpace Independent Publishing Platform - Year: 2015
4. Joe Sullivan "Building a Security Operations Center" Publisher: Syngress - Year: 2014
5. Gregory Jarpey and R. Scott McCoy "Security Operations Center Guidebook"

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Program: Final Year B.Tech. in Artificial Intelligence(AI) & Data Science								Semester : VII		
Course: Recommendation Systems								Course Code: DJ19ADC7012		
Course : Recommendation Systems Laboratory								Course Code: DJ19ADL7012		
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	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presenta		
				25	--	--	15	10	25	

Prerequisite: Statistics for Data Science, Machine learning

Course Objectives:

To provide students with the basic concepts of Recommender Systems, design space, trade-offs and its application in various domain.

Course Outcomes:

On completion of the course, learner will be able to

1. Compare different types of Recommender Systems.
2. Understand various issues related to recommender system development.
3. Design a recommender system for a given problem.
4. Relate data collected from a recommender system to understand user preferences and/or behaviour.
5. Describe system evaluation methods from both algorithmic and users' perspectives

Syllabus:

Recommendation Systems (DJ19ADC7012)		
Unit	Description	Duration
1.	Introduction to recommendation system: Introduction and basic taxonomy of recommender systems – Traditional and non-personalized Recommender Systems, framework of recommendation system, Domain, Purpose, Context, Personalization: Personalized vs. Non-Personalized, Semi/Segment - Personalized, Privacy: user's data and trustworthiness Recommender Systems Function and Techniques, Conversational Systems, Issues working with RSs data sets: The cold-start problem, attack-resistant recommender system	08

2.	Collaborative Filtering Recommender System Understanding ratings and rating data, User-based nearest neighbour recommendation, Item-based nearest neighbour recommendation, Model based and pre-processing based approaches, Comparing User-Based and Item-Based recommendations, data drift and concept drift., Attacks on collaborative recommender systems	06
3.	Content-based and knowledge based Recommender System High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, discovering features of documents, obtaining item features from tags, representing item profiles, Methods for learning user profiles and filtering, Similarity based retrieval, Classification algorithms. Knowledge based recommendation: Knowledge representation and reasoning, Constraint-based Recommendation System User Guidance in Recommendation Processes, Calculating Recommendations, Case based recommenders.	06
4.	Neighbourhood-based Recommendation System: Neighbourhood-based Recommendation, advantages, User-based Rating Prediction, User-based Classification, Item-based Recommendation, Rating Normalization, Similarity Weight Computation, Neighbourhood Selection	05
5.	Context-Aware Recommender Systems Trust Context in Recommender Systems, Modeling Contextual Information in Recommender Systems. Paradigms for Incorporating Context in Recommender Systems: Contextual Pre-Filtering, Contextual Post-Filtering, Contextual Modeling, Combining Multiple Approaches, Issues in Context-Aware Recommender Systems. Opportunities for hybridization, Types of hybridization	08
6.	Evaluating Recommender System Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Online Recommender evaluation techniques, Case Study of the Netflix Prize Data Set, Segmenting the Ratings for Training and Testing, Hold-Out, Cross Validation, Concept of Bandit Algorithm to balance exploration and exploitation. Accuracy Metrics Evaluation: RMSE versus MAE, Impact of the Long Tail, Evaluating Ranking via Correlation, Evaluating Ranking via Utility, Evaluating Ranking via Receiver Operating Characteristic	06
	TOTAL	39

Suggested List of Experiments:

Recommendation Systems Laboratory (DJ19ADL7012)	
Sr. No.	Title of Experiment
1	Processing and analysis of public recommender systems datasets, and performance evaluation and comparison / Master spreadsheet-based tools.
2	Build a Recommendation Engine with Item-Based Collaborative Filtering
3	Implement Recommendation System using K-Nearest Neighbors and evaluate its performance on different dataset.
4	Compare and analyze performance of Content-based recommendation engine on different datasets for Book, Movie, Song, product Recommendation
5	Build a Recommendation Engine with Item-Based Collaborative Filtering.
6	Build project-association recommenders using association rule mining.
7	Implement Context-Aware Recommender Systems Trust.
8	Build Constraint-based Recommenders to provide valuable support for users searching for products and services in e-commerce environments.
9	Implement Hacker News algorithm /Subreddit User Recommendation System based on Netflix's Algorithm.
10	Implement Bayesian personalized ranking using matrix factorization algorithm.
11	Implement Google PageRank algorithm for recommendation.
12	Implement knowledge-based recommender system.
13	Evaluate the recommendation system with evaluation matrix.
14	Miniproject

Minimum eight 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. C.C. Aggarwal, "Recommender Systems: The Textbook", Springer, 1 st Edition, 2016.
2. Jannach D., Zanker M. and Felfering A., "Recommender Systems: An Introduction", Cambridge University Press, 1st Edition, 2011.
3. Kim Falk, "Practical Recommender Systems", Manning, 1st Edition, 2019
4. "Hands-On Recommendation Systems with Python: Start building powerful and personalized, recommendation engines with Python" by Rounak Banik , 2018.
4. Collaborative Recommendations: Algorithms, Practical Challenges And Applications by Shlomo Berkovsky (Author), Ivan Cantador (Author), Domonkos Tikk (Author)
5. Recommender System and Its Applications by Nandini Sethi (Author)
6. Building Recommender Systems: A Practical Approach by Vivek Murugesan (Author)

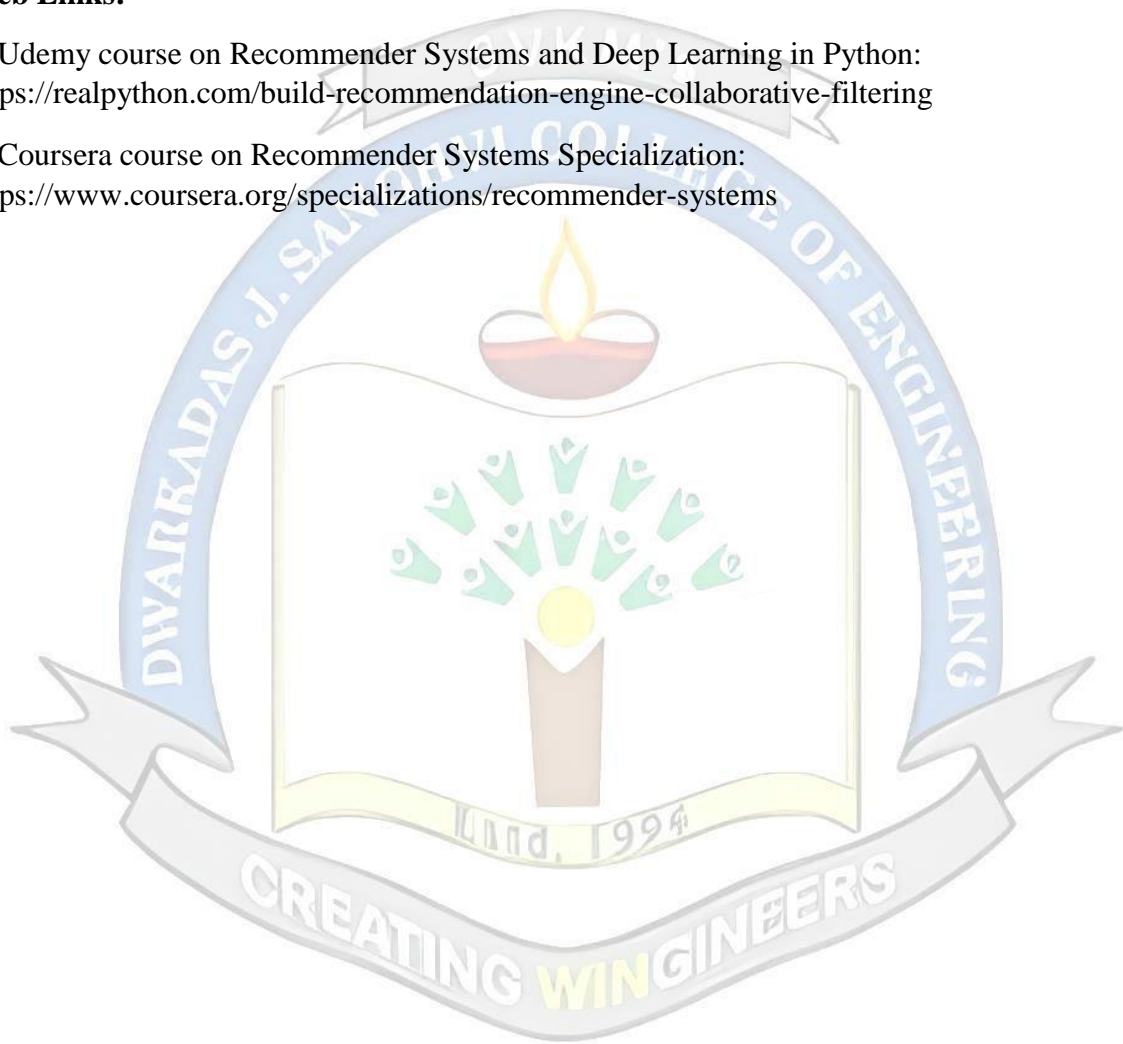
Reference Books:

1. M.D. Ekstrand, J.T. Riedl, J.A. Konstan, "Collaborative filtering recommender systems", Now publishers, 1 st Edition, 2011.

2. J. Leskovec, A. Rajaraman and J. Ullman, “Mining of massive datasets”, Cambridge, 2 nd Edition, 2012.
3. Rounak Banik, “Hands-On Recommendation Systems with Python: Start building”, Ingram short title, 2018
4. P. Pavan Kumar, S. Vairachilai, Sirisha Potluri, “Recommender Systems: Algorithms and Applications”, CRC Press, 1st edition, 2021.

Web Links:

1. Udemy course on Recommender Systems and Deep Learning in Python:
<https://realpython.com/build-recommendation-engine-collaborative-filtering>
2. Coursera course on Recommender Systems Specialization:
<https://www.coursera.org/specializations/recommender-systems>



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Program: Final Year B.Tech. in Artificial Intelligence(AI) & Data Science								Semester : VII		
Course: Probabilistic Graph Models								Course Code: DJ19ADC7013		
Course : Probabilistic Graph Models Laboratory								Course Code: DJ19ADL7013		
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	
				Laboratory Examination			Term work		Total Term work	
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presenta		
				25	--	--	15	10	25	

Prerequisite: Machine learning, Probability

Course Objectives:

The objective of this course intends to model problems using graphical models; design inference algorithms; and learn the structure of the graphical model from data.

Course Outcomes:

On completion of the course, learner will be able to

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

Syllabus:

Probabilistic Graph Models (DJ19ADC7013)		
Unit	Description	Duration
1.	Fundamentals: Structured Probabilistic Models: probabilistic graphical model, Representation, Inference, Learning and, Marginal and Joint Distributions, Independence and Conditional Independence. Bayesian Networks: Independence and Separation, from distribution to graphs, Markov properties and minimalism, Examples (Markov chain: HMM, diagnostic system, etc.)	06
2.	Markov Networks: Boltzmann machine and Ising models, Markov random field, Parameterization, Cliques and potentials, Markov Network Independencies, Factor graphs. Gaussian Network Models and Exponential Family: Multivariate Gaussians, Gaussian Bayesian network, Gaussian random feilds, Exponential families, Entropy and Relative Entropy, Projections.	06

3.	Inference: Exact inference: Variable elimination Analysis of Complexity, Variable elimination, Belief propagation (message passing) on trees, Sum- and Max-product algorithms, Clique tree, Variable Elimination in a Clique Tree	07
4.	Sampling Methods: MCMC method, Gibbs sampling Algorithm, Importance sampling, Particle filtering. Approximate inference: Loopy belief propagation, Variational inference and optimization view of inference, Mean field approach	07
5.	Parameter learning: Parameterizing graphical models, Parameter estimation in fully observed Bayesian networks: (Maximum likelihood estimation, Bayesian parameter estimation, Example: HMM), Parameter estimation in fully observed Markov networks: Maximum likelihood estimation (Iterative Proportional Fitting (IPF), Generalized Iterative Scaling (GIS)), Parameter estimation in partially observed graphical models (Expectation-Maximization (EM) - Example: HMM), Learning Conditional Random Fields. Nonparametric Learning: Gaussian processes, Dirichlet processes, Indian Buffet processes	08
6.	Structure learning: Score based approach, Chow-Liu algorithm for Bayesian networks, l1-regularized convex optimization for Markov random fields, Low-rank regularized learning of latent variable models.	05
	TOTAL	39

Suggested List of Experiments:

Probabilistic Graph Models Laboratory(DJ19ADL7013)	
Sr. No.	Title of Experiment
1	Implement Discrete Bayesian Networks
2	Implementation of Alarm Bayesian Network
3	Implementation of Linear Gaussian Bayesian Networks (GBNs).
4	Implementation of Monty Hall Problem using Bayesian Network
5	Implementation of Exact inference in Bayesian Networks.
6	Implementation of Inference in Discrete Bayesian Network
7	Implementation of Causal Inference
8	Implementation of Parameter Learning in Discrete Bayesian Network
9	Implementation of Learning using Chow-Liu Algorithm
10	Implementation of learning Tree-augmented Naive Bayes (TAN).

Minimum eight 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:

Text Books:

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

Reference Books:

1. Jensen, F. V. and Nielsen, T. D. "Bayesian Networks and Decision Graphs. Information Science and Statistics," 2nd edition, Springer, 2002.
2. Luis Enrique Sucar, "Probabilistic Graphical Models Principles and Application", Advances in Computer Vision and Pattern Recognition, Second Edition, Springer
3. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective," 4th Printing. MIT Press, 2013.
4. Barber, D. "Bayesian Reasoning and Machine Learning," 1st edition, Cambridge University Press, 2011.
5. Bishop, C. M. "Pattern Recognition and Machine Learning (Information Science and Statistics)". 2nd printing, Springer, 2011.
6. Wainwright, M. and Jordan, M. "Graphical Models, Exponential Families, and Variational Inference," Foundations and Trends in Machine Learning, 2008. Web Links:
7. Ankur Ankan, Abinash Panda Mastering Probabilistic Graphical Models with Python Packt Publishing



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Program: Final Year B.Tech. in Artificial Intelligence(AI) & Data Science								Semester : VII		
Course: Computational Finance-I								Course Code: DJ19ADC7014		
Course : Computational Finance-I Laboratory								Course Code: DJ19ADL7014		
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	
				Laboratory Examination			Term work		Total Term work	
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presenta		
				25	--	--	15	10	25	
				50						

Prerequisite: - Knowledge of Probability and Statistics & Calculus

Course Objectives:

To build the strong foundation in finance which can be applied to analyze real time financial data

Course Outcomes:

On completion of the course, learner will be able to

1. Apply the knowledge of time value of money, debt and leasing on real time financial data.
2. Measure the Capital Budgeting and Depreciation.
3. Apply the knowledge of Break-Even Point and Leverage on real time financial data.
4. Apply the knowledge of various investment methods and measuring and managing various types of financial risks.
5. Apply the knowledge of Insurance and its types on real time financial data

Syllabus:

Computational Finance-I (DJ19ADC7014)		
Unit	Description	Duration
1.	Time Value of Money Simple Interest, Bank Discount, Compound Interest, Annuities. Debt and Leasing Credit and Loans, Mortgage Debt, Leasing	06

2.	<p>Capital Budgeting and Depreciation Capital Budgeting: Net Present Value, Internal Rate of Return, Profitability Index, Capitalization and Capitalized Cost, Other Capital Budgeting Methods. Depreciation and Depletion: The Straight-Line Method, The Fixed-Proportion Method, The Sum-of-Digits Method, The Amortization Method, The Sinking Fund Method, Composite Rate and Composite Life, Depletion.</p>	05
3.	<p>Break-Even Point and Leverage Break-Even Analysis: Deriving BEQ and BER, BEQ and BER Variables, Cash Break-Even Technique, The Break-even Point and the Target Profit, Algebraic Approach to the Break-Even Point, The Break-Even Point When Borrowing, Dual Break-Even Points, Other Applications of the Break-Even Point, BEQ and BER Sensitivity to their Variables, Uses and Limitations of Break-Even Analysis. Leverage: Operating Leverage, Fixed Cost, and Business Risk, Financial Leverage, Total or Combined Leverage.</p>	06
4.	<p>Investment Stocks: Buying and Selling Stocks, Common Stock Valuation, Cost of New Issues of Common Stock, Stock Value with Two-Stage Dividend Growth, Cost of Stock Through the CAPM, Other Methods for Common Stock Valuation, Valuation of Preferred Stock, Cost of Preferred Stock. Bonds: Bond Valuation, Premium and Discount Prices, Premium Amortization, Discount Accumulation, Bond Purchase Price Between Interest Days, Estimating the Yield Rate, Duration. Mutual Funds: Fund Evaluation, Loads, Performance Measures, The Effect of Systematic Risk (β), Dollar-Cost Averaging. Options: Dynamics of Making Profits With Options, Intrinsic Value of Calls and Puts, Time Value of Calls and Puts, The Delta Ratio, Determinants of Option Value, Option Valuation, Combined Intrinsic Values of Options. Cost of Capital and Ratio Analysis: Before-Tax and After-Tax Cost of Capital, Weighted-Average Cost of Capital, Ratio Analysis, The DuPont Model, A Final Word About Ratios.</p>	11
5.	<p>Return and Risk Measuring Return and Risk: Expected Rate of Return, Measuring the Risk, Risk Aversion and Risk Premium, Return and Risk at the Portfolio Level, Markowitz's Two-Asset Portfolio, Lending and Borrowing at a Risk-Free Rate of Return, Types of Risk. The Capital Asset Pricing Model (CAPM): The Financial Beta (β), The CAPM Equation, The Security Market Line, SML Swing by Risk Aversion.</p>	05
6	<p>Insurance: Life Annuities: Mortality Table, Commutation Terms, Pure Endowment, Types of Life Annuities. Life Insurance: Whole Life Insurance Policy, Annual Premium: Whole Life Basis, Annual Premium: m-Payment Basis, Deferred Whole Life Policy, Deferred Annual Premium: Whole Life Basis, Deferred Annual Premium: m-Payment Basis, Term Life Insurance Policy, Endowment Insurance Policy, Annual Premium for the Endowment Policy, Less than Annual Premiums, Natural Premium vs. the Level Premium, Reserve and Terminal Reserve Funds, Benefits of the Terminal Reserve, How Much Life Insurance Should You Buy? Property and Casualty Insurance: Deductibles and Co-Insurance, Health Care Insurance, Policy Limit.</p>	06

	TOTAL	39
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Suggested List of Experiments

Computational Finance-I Laboratory(DJ19ADL7014)	
Sr. No.	Title of Experiment
1	Working with financial market data: data import, charting and basic analysis
2	Financial data: statistical analysis and simulation
3	Volatility estimation
4	The Amortization method
5	The Sinking Fund method
6	Break-Even Analysis
7	Option pricing models and analysis
8	Interest rate modelling and sensitivity analysis
9	Portfolio analysis
10	Risk estimation
11	Capital Asset Pricing Model: Minimum 10 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.

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

Books Recommended:

Textbooks:

1. Paul Wilmott, Paul Wilmott on Quantitative Finance, 3 Volume Set, 2013, 2nd edition, Wiley
2. Joerg Kienitz and Daniel Wetterau, Financial Modelling: Theory, Implementation and Practice with MATLAB, 2012, 1st edition, Wiley Finance Series.

Reference Books:

1. Dan Stefanica., A Primer for the Mathematics of Financial Engineering, 2011, 2nd Edition FE Press, New York.
2. John C. Hull and Sankarshan Basu, Options, futures & other derivatives, 2018, 10th edition, Pearson India.
3. Tsay, Ruey S. Analysis of Financial Time Series, 2011, 3rd edition, John Wiley & Sons.
4. R. Seydel: Tools for Computational Finance, 2017, 6th edition, Springer.
5. David Ruppert, Statistics and Data Analysis for Financial Engineering, 2011, Springer

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Program: B.Tech in Artificial Intelligence and Data Science	Final Year. B.Tech	Semester: VII
Course: Product Life Cycle Management (DJ19ILO7011)		

Pre-requisite:

1. Knowledge of basic concepts of Management

Objectives:

1. To familiarize the students with the need, benefits and components of PLM
2. To acquaint students with Product Data Management & PLM strategies
3. To give insights into new product development program and guidelines for designing and developing a product
4. To familiarize the students with Virtual Product Development

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

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
4. Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant

Product Life Cycle Management (DJ19ILO7011)		
Unit	Description	Duration
1	<p>Introduction to Product Lifecycle Management (PLM): Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications</p> <p>PLM Strategies: Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM</p>	10
2	<p>Product Design: Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process</p>	08



3	Product Data Management (PDM): Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation Virtual Product Development Tools: For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modelling and simulations in Product Design, Examples/Case studies	08
4	Integration of Environmental Aspects in Product Design: Sustainable Development Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design.	08
5	Life Cycle Assessment and Life Cycle Cost Analysis: Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis.	08
	Total	42

Books Recommended:*Text books:*

1. John Stark, Product Lifecycle Management: Paradigm for 21st Century Product Realization, Springer-Verlag, 2004.
2. Guido La Rosa, Antonino Risitano, Taylor & Francis, Product Design for the environment-A life cycle approach, Fabio Giudice, 2006.

Reference Books:

1. Saaksvuori Antti, Immonen Anselmie, Product Life Cycle Management, Springer, Dreamtech, 2009.
2. Michael Grieve, Product Lifecycle Management: Driving the next generation of lean thinking, Tata McGraw Hill, 2006.
3. François Villeneuve, Luc Mathieu, Max Giordano, Product Life-Cycle Management: Geometric Variations Wiley, 2010.



Program: B.Tech in Artificial Intelligence and Data Science	Final Year. B.Tech	Semester: VII
Course: Management Information System (DJ19ILO7012)		

Objectives:

1. The course is blend of Management and Technical field.
2. Discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built.
3. Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage.
4. Identify the basic steps in systems development.

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

1. Explain how information systems Transform Business.
2. Identify the impact information systems have on an organization.
3. Describe IT infrastructure and its components and its current trends.
4. Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making.
5. Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses.

Management Information System (DJ19ILO7012)		
Unit	Description	Duration
1	Foundation Concepts: Information Systems in Business, Functional Area Information System, The Components of Information Systems, Impact of IT on organizations and society, Organizational Strategy, Information systems for strategic advantage.	05
2	Information Technologies: Hardware and Software Computer Systems: End User and Enterprise Computing Computer Peripherals: Input, Output, and Storage Technologies Application Software: End User Applications System Software: Computer System Management Data Resource Management: Technical Foundations of Database Management, Managing Data Resources, Big data, Data warehouse and Data Marts, Knowledge Management Networks: The Networked Enterprise (Wired and wireless), Pervasive computing, Cloud Computing models	08
3	MIS Tools and applications for Decision making: ERP and ERP support of Business Process Reengineering, Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Visualization Artificial Intelligence Technologies in Business	08
4	Security and Ethical Challenges: Security, Ethical, and Societal Challenges of IT Security Management of Information Technology.	06



5	Social Computing (SC): Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C, Mobile commerce.	07
6	Information System within Organization: Acquiring Information Systems and Applications: Various System development life cycle models. Enterprise and Global Management of Information Technology: Managing Information Technology, Managing Global IT.	08
	Total	42

Books Recommended:*Reference Books:*

1. James A O'Brien, George M., Ramesh Behl, Management Information Systems, 11th Edition, Tata McGraw Hill, 2019.
2. Kelly Rainer, Brad Prince, Management Information Systems, 2nd Edition, Wiley, 2013.
3. K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the Digital Firm, 10th Edition, Prentice Hall, 2007.
4. D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization, Prentice Hall, 2008.





Program: B.Tech in Artificial Intelligence and Data Science	Final Year. B.Tech	Semester: VII
Course: Operations Research (DJ19ILO7013)		

Pre-requisite:

1. Basic Knowledge of Algebra
2. Probability and Statistics

Objectives:

1. To formulate a real-world decision problem as a mathematical programming model.
2. To learn the mathematical tools that are employed to solve mathematical programming models.

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

1. **Convert** a real-world problem in to a Linear Programming Problem and analyse the solution obtained using Simplex method or other algorithms.
2. **Identify** real-world problems as Transportation Problem and Assignment Problem and Solve the decision problem by choosing appropriate algorithm.
3. **Identify** the decision situations which vary with time and analyse them using principle of dynamic programming to real life situations.
4. **Explain** reasons of formation of queues, classify various queuing systems and apply parameters defined for various queuing systems for decision making in real life situations.
5. **Understand** the concept of decision making in situation of competition and recommend strategies in case of two-person zero sum games.
6. **Describe** concept of simulation and apply Monte Carlo Simulation technique to systems such as inventory, queuing and recommend solutions for them.
7. **Understand** need for right replacement policy and determine optimal replacement age.

Operations Research (DJ19ILO7013)		
Unit	Description	Duration
1	Introduction to Operations Research: Concept of decision making. Definition of OR. Formulation of decision problem as OR model, Concept of Optimization, Linear Programming Problem: Mathematical Formulation. Finding optimal solution - Graphical method, Simplex Method, Big M-method, Two Phase Method. Duality, Primal – Dual construction, Symmetric and Asymmetric Dual. Dual Simplex Method.	10
2	Assignment Problems: Mathematical Formulation, Finding optimal solution - Hungarian Method Transportation problem: Mathematical Formulation, Finding initial basic feasible solution – Northwest corner rule, row minima, column minima, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method. Improving the solution.	08



3	Dynamic Programming: Bellman's Principle of optimality - Applications of dynamic programming- Employment smoothening problem, capital budgeting problem, shortestpath problem, cargo loading problem	06
4	Queuing Models: Characteristics of queuing models. Single Channel – Single and multi phase servers, Poisson arrivals, exponential service time - with infinite population and finite population models – with infinite and finite capacity. Multichannel – Single phase server - Poisson arrivals, exponential service time with infinite population. Game Theory: Introduction. Minimax & Maximin Criterion and optimal strategy. Solution of games with saddle points, rectangular games without saddle points - 2 x 2 games, dominance principle. Approximate methods - Iterative method, m x 2 & 2 x n games -Graphical method and method of sub-games. Expressing game as LPP.	10
5	Simulation: Definition. Types of simulation models. Monte Carlo simulation technique. Applications of simulation - Inventory and Queuing problems. Simulation Languages. Replacement Models: Replacement of items that deteriorate with time - when money value is not counted and counted, Replacement of items that fail suddenly – individualand group replacement policy.	08
Total		42

Books Recommended:*Text books:*

1. Operations Research, Sharma J. K., Trinity Press.
2. Operations Research, Gupta P. K., Hira D. S., S. Chand Limited.

Reference Books:

1. Operations Research - An Introduction; Taha, H.A.; Prentice Hall
2. Operations Research: Principles and Practice; Ravindran, A, Phillips, D. T and Solberg, J. J.; John Willey and Sons
3. Introduction to Operations Research; Hiller, F. S. and Lieberman, G. J.; Tata McGraw Hill
4. Operations Research Principles and Practice; Pradeep Prabhakar Pai; Oxford University Press
5. Operations Research, R. Panneerselvam, PHI Publications.
6. Operations Research, A. M. Natarajan, P. Balasubramani, A. Tamilarasi, Pearson Education.
7. Operations Research; Kanti Swarup, P. K. Gupta and Man Mohan; Sultan Chand & Sons.



Program: B.Tech in Artificial Intelligence and Data Science	Final Year. B.Tech	Semester: VII
Course: Cyber Security and Laws (DJ19ILO7014)		

Objectives:

1. To understand and identify different types cybercrime and cyber offences.
2. To recognized Indian IT Act 2008 and its latest amendments
3. To learn various types of security standards compliances

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

1. Understand the different types of cybercrime and security issues E Business.
2. Analyses different types of cyber threats and techniques for security management.
3. Explore the legal requirements and standards for cyber security in various countries to regulate cyberspace.
4. Impart the knowledge of Information Technology Act and legal frame work of right to privacy, data security and data protection.

Cyber Security and Laws (DJ19ILO7014)		
Unit	Description	Duration
1	Introduction to Cybercrime: Cyber Crime, Cyber Law, Cyber Security, History of Cyber Crime, Hacking, Data Theft, Cyber Terrorism, Virus & Worm's, Email Bombing, Pornography, online gambling, Forgery, Web Defacements, Web Jacking, Illegal online Selling, Cyber Defamation, Software Piracy, Electronics/ Digital Signature, Phishing, Password Cracking, Key loggers and Spywares, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing Identity Theft (ID Theft) Cyber offenses: How criminal plan the attacks, Social Engineering, Cyber stalking, Cyber café and Cybercrimes, Botnets, Attack vector	12
2	Cyber Threats Analysis: Knowledge of Dynamic and Deliberate Targeting Knowledge of Indications and Warning Knowledge of Internal Tactics to Anticipate and/or, Emulate Threat Capabilities and Actions Knowledge of Key Cyber Threat Actors and their Equities Knowledge of Specific Target Identifiers and Their Usage Cyber Security Management: Knowledge of Emerging Security Issues, Risks, and Vulnerabilities	08
3	Electronic Business and legal issues: Evolution and development in Ecommerce, Policy Frameworks for Secure Electronic Business, paper vs paper less contracts, E-Commerce models- B2B, B2C, E security. E-Payment Mechanism; Payment through card system, E-Cheque, E-Cash, E-PaymentThreats & Protections, Security for E-Commerce.	06



4	Indian IT Act: Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments Security aspect in cyber Law: The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law, The Criminal Aspect in Cyber Law	08
5	Security Industries Standard Compliances: IT Security v/s IT Compliance, Cyber Security Standards, critical security controls for cyber security, GRC (Governance, Risk Management, and Compliance), SOX, GLBA, HIPAA, ISO/IEC 27001, NIST Cyber Security Framework (CSF), PCI-DSS. OWASP Top Ten Project, GDPR (General Data Protection Regulation), NIST (National Institute of Standards and Technology), CIS Controls (Center for Internet Security Controls)	08
	Total	42

Books Recommended:*Reference Books:*

1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi.
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi.
3. The Information Technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
4. E-Commerce Security and Privacy", Anup K. Ghosh, Springer Science and Business Media, 2012.
5. Izzat Alsmadi, The NICE Cyber Security Framework Cyber Security Intelligence and Analytics, Springer.
6. Cyber Law & Cyber Crimes, Advocate Prashant Mali; Snow White Publications, Mumbai
7. Nina Godbole, Information Systems Security, Wiley India, New Delhi.
8. Kenneth J. Knapp, Cyber Security & Global Information Assurance Information Science Publishing.
9. William Stallings, Cryptography and Network Security, Pearson Publication
10. Websites for more information is available on: The Information Technology ACT, 2008- TIFR : <https://www.tifrh.res.in>
11. Website for more information, A Compliance Primer for IT professional: <https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538>



Program: B.Tech in Artificial Intelligence and Data Science	Final Year. B.Tech	Semester: VII
Course: Personal Finance Management (DJ19ILO7015)		

Pre-requisite:

1. Basic Knowledge of Algebra
2. Probability and Statistics

Objectives:

1. To create awareness and educate consumers on access to financial services.
2. To make the students understand the basic concepts, definitions and terms related to direct taxation.
3. To help the students compute the Goods and Service Tax (GST) payable by a supplier after considering the eligible input tax credit.
4. To familiarise the students with microfinance for accelerating the expansion of local microbusinesses.

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

1. Use a framework for financial planning to understand the overall role finances play in his/her personal life.
2. Compute income from salaries, house property, business/profession, capital gains and income from other sources.
3. Compute the amount of CGST, SGST and IGST payable after considering the eligible input tax credit.
4. Understand how Microfinance can help in financial inclusion.

Personal Finance Management (DJ19ILO7015)		
Unit	Description	Duration
1	Overview of Indian Financial System: Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial inclusion. Introduction to Personal Finance Person Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services. Consumer Credit: Advantages, Disadvantages, Sources and Costs.	07
2	Personal Financial Management: Loans: Home, Car, Education, Personal, Loan against property and Jewel loan. Insurance: Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance. Investment: Investing Basics and Evaluating Bonds, Investing in Stocks and Investing in Mutual Funds, Planning for the Future.	07
3	Income Tax: Income Tax Act Basics- Introduction to Income Tax Act, 1961	



	Heads of Income and Computation of Total Income and Tax Liability- Heads of Income and Computation of Total Income under various heads, Clubbing Provisions, Set off and Carry forward of Losses, Deductions, Assessment of Income and tax liability of different persons. Tax Management, Administrative Procedures and ICDS - TDS, TCS and Advance Tax Administrative Procedures, ICDS.	08
4	Goods and Services Tax: GST Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union & State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST & IGST); GST Council, GST Network, State Compensation Mechanism, Registration. Levy and Collection of GST: Taxable event- "Supply" of Goods and Services; Place of Supply: Within state, Interstate, Import and Export; Time of supply: Valuation for GST- Valuation rules, taxability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme: Classification of Goods and Services	10
5	Introduction to Micro – finance: Micro-Finance: Definitions, Scope & Assumptions, Types of Microfinance, Customers of Micro-finance, Credit Delivery Methodologies, SHG concept, origin, Formation & Operation of Self Help Groups (SHGs). Models in Microfinance - Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements & Challenges, Institutional Mechanism: Current Challenges for Microfinance, Microfinance Institutions (MFIs): Constraints & Governance Issues, Institutional Structure of Microfinance in India: NGO-MFIs, NBFC-MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand & Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs,	10
	Total	42

Books Recommended:*Reference Books:*

1. Banking and Financial Sector Reforms in India , by Asha Singh, M.S. Gupta, Serials Publication.
2. Indian Banking Sector: Essays and Issues (1st) , by M.S. Gupta & J.B. Singh, Serials Publication.
3. Basics Of Banking & Finance , by K.M. Bhattacharya O.P. Agarwal , Himalaya Publishing House
4. Agricultural Finance And Management, by S. Subba Reddy , P. Raghu Ram .
5. The Indian Financial System And Development , by Dr.Vasant Desai, Himalaya Publishing House; Fourth Edition
6. Income Tax Management , Simple Way of Tax Management, Tax Planning and Tax Saving
7. , By Sanjay Kumar Satapathy



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8. Direct Tax System Income Tax by Dr. R. K. Jain, SBPD Publications.
9. Simplified Approach to GST Goods and Services Tax, By S K Mishra , Educreation Publishing.
10. Introduction To Microfinance , By Todd A Watkins , World Scientific Publishing Company



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Program: B.Tech in Artificial Intelligence and Data Science	Final Year. B.Tech	Semester: VII
Course: Energy Audit and Management (DJ19ILO7016)		

Objectives:

1. To understand the importance of energy security for sustainable development and the fundamentals of energy conservation.
2. To identify and describe the basic principles and methodologies adopted in energy audit of a utility
3. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management.
4. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

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

1. To identify and describe present state of energy security and its importance.
2. To identify and describe the basic principles and methodologies adopted in energy audit of a utility.
3. To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.
4. To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities.
5. To analyze the data collected during performance evaluation and recommend energy saving measures.

Energy Audit and Management (DJ19ILO7016)		
Unit	Description	Duration
1	Energy Scenario: Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act-2001 and its Features. Basics of Energy and its various forms, Material and Energy balance.	05
2	Energy Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring & targeting, Energy audit instruments. Technical and economic feasibility, Classification of energy conservation measures. Safety considerations during energy audit. Financial analysis techniques: Simple payback period, NPV, Return on investment (ROI) Internal rate of return (IRR).	10
3	Energy Management and Energy Conservation in Electrical System: Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings. Energy efficiency measures in lighting system, lighting control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in waterpumps, compressor, fan	10



	and blower. industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.	
4	Energy Management and Energy Conservation in Thermal Systems: Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Steam leakages, Steam trapping, Condensate and flash steam recovery system. Waste heat recovery, use of insulation- types and application. Energy conservation opportunities in: Boiler system. Refrigeration system and HVAC system.	10
5	Energy conservation in Buildings: Energy Conservation Building Codes (ECBC):Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources, Energy sources and energy management in electric vehicles.	07
	Total	42

Books Recommended:*Reference Books:*

1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science.
2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System.
3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons.
4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI).
5. Energy Management Principles, C.B. Smith, Pergamon Press.
6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press.
7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press.
8. www.energymanagertraining.com
9. www.bee-india.nic.in



Program: B.Tech in Artificial Intelligence and Data Science	Final Year. B.Tech	Semester: VII
Course: Disaster Management and Mitigation Measures (DJ19ILO7017)		

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

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

1. Know natural as well as manmade disaster and their extent and possible effects on the economy.
2. Know the institutional framework and organization structure in India for disaster management and get acquainted with government policies, acts and various emergency laws.
3. Get to know the simple dos and don'ts in such extreme events and build skills to respond accordingly.
4. Understand the importance of disaster prevention and various mitigation measure with the exposure to disasters hotspots across the globe.

Disaster Management and Mitigation Measures (DJ19ILO7017)		
Unit	Description	Duration
1	<p>General Information about Disaster:</p> <p>Brief concept of Hazards, definition and types of Disasters – Natural, Man-made, and hybrid, Groups of Disasters- Natural and Technological, global Scenario, Significance of studying various aspects of disasters, effects of disasters, India's vulnerability to disasters, Impact of disaster on National development.</p> <p>Study of Natural disasters:</p> <p>Flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion etc.</p> <p>Study of Human/Technology Induced Disasters:</p> <p>Chemical, Industrial and Nuclear disasters, Internally displaced persons, road and train accidents Fire Hazards, terrorism, militancy, Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.</p>	10
2	<p>Disaster Management:</p> <p>Brief Introduction, Disaster management cycle, Evolution of Disaster and Disaster management in India, Disaster management acts, policies and guidelines, laws of emergencies etc.</p>	08



	Prior, During and Post disaster management activities: (Preparedness, strengthening emergency centers, Logistics, optimum resource management, emergency response and relief, Training, Public awareness, Research, Reconstruction of essential services and livelihood restoration.	
3	Institutional framework and Mechanism for disaster management in India: Institutions in India for dealing with various disasters, Organizational structure, functions and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India, roles and responsibilities of central and state government during and after disaster, NGO's involved in disasters and their task, Jobs carried out by armed forces. Financial Relief During disaster (State, National and International Disaster Assistance)	08
4	Disaster risk reduction and Mitigation Measures: Need of disaster prevention and mitigation, mitigation guiding principles, challenging areas, structural and non-structural measures for disaster risk reduction. Mitigation measures for flood, earthquake, cyclone monitoring, air quality, water quality, climate change, land use, winter storms and aquatic biology etc. Use of information management, GIS, GPS and remote sensing Mitigation measure. Do's and don'ts in case of disasters and effective implementation of relief aids.	08
5	Case studies on disaster (National /International): Case study discussion of Hiroshima – Nagasaki (Japan), India – Tsunami (2004) , Bhopal gas tragedy, Kerala and Uttarakhand flood disaster, Cyclone Phailin (2013), Fukushima Daiichi nuclear disaster (2011), 26 th July 2005 Mumbai flood, Chernobyl meltdown and so on. (Discuss case studies on disaster with respect to reason for the disaster, incidents, effects of disaster, present scenario and safety measures taken)	08
	Total	42

Books Recommended:*Reference Books:*

1. Disaster Management, by Harsh K.Gupta, Universities Press Publications (2003).
2. Disaster Management: An Appraisal of Institutional Mechanisms in India, by O.S.Dagur, published by Centre for land warfare studies, New Delhi, 2011.
3. Introduction to International Disaster Management, by Damon Copolla, Butterworth Heinemann Elsevier Publications (2015).
4. Disaster Management Handbook, by Jack Pinkowski, CRC Press, Taylor and Francis group (2008).
5. Disaster management & rehabilitation, by Rajdeep Dasgupta, Mittal Publications, New Delhi (2007).
6. Natural Hazards and Disaster Management, Vulnerability and Mitigation, by R B Singh, Rawat Publications (2006).
7. Concepts and Techniques of GIS, by C.P.Lo Albert, K.W. Yonng, Prentice Hall (India) Publications (2006).
8. Risk management of natural disasters, by Claudia G. Flores Gonzales, KIT Scientific Publishing (2010).



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9. Disaster Management – a disaster manager's handbook, by W. Nick Carter, Asian Development Bank (2008).
10. Disaster Management in India, by R. K. Srivastava, Ministry of Home Affairs, GoI, New Delhi (2011)
11. The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy, by Wil Mara, Marshall Cavendish Corporation, New York, 2011.
12. The Fukushima 2011 Disaster, by Ronald Eisler, Taylor & Francis, Florida, 2013.
13. (Learners are expected to refer reports published at national and international level and updated information available on authentic web sites)



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Program: B.Tech in Artificial Intelligence and Data Science	Final Year. B.Tech	Semester: VII
Course: Science of Well-being (DJ19ILO7018)		

Objectives:

1. To create consciousness about importance of holistic health and physical as well as mental well-being.
2. To make learners aware of the concepts of Happiness, Gratitude, Self-Compassion, Empathy etc.
3. To introduce the learners to the means of mental and physical well-being, ill effects of mal-practices like alcoholism, smoking etc.
4. To equip the learners to manage and cope up with stress in their daily living.

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

1. Describe concepts of holistic health and well-being, differentiate between its true meaning and misconceptions and understand the benefits of well-being.
2. Recognize meaning of happiness, practice gratitude and self-compassion and analyze incidents from one's own life.
3. Understand the causes and effects of stress, identify reasons for stress in one's own surrounding and self.
4. Recognize the importance of physical health and fitness, assess their life style and come up with limitations or effectiveness.
5. Inspect one's own coping mechanism, assess its effectiveness, develop and strategize for betterment and execute it.

Science of Well-being (DJ19ILO7018)		
Unit	Description	Duration
1	Health and well-being: The concept of health, dimensions of health, the notion of well-being, various facets of well-being, relation between health and well-being. Concept of holistic health, its principles and importance, concept and benefits of holistic care, misconceptions about holistic health approach, the application of a true holistic approach to our well-being.	06
2	Concepts of happiness: Happiness: what is it and how do we measure it? Philosophical perspectives on happiness, Happiness: Nature or Nurture? Happiness in the modern world: impediments and accelerators, Narrow vs. Broad Band Approaches to Happiness, Benefits of Happiness, Self-Compassion and Gratitude. Misconceptions of happiness.	08
3	Stress and mental health/well-being: Nature and concept of stress, meaning and definitions of stress, types of stress, meaning of stressors, types of stressors, symptoms of stress, effects of stress, different models of stress. Sources of stress and how does stress cause illness, various sources of stress, delineate between external and internal sources of stress, differentiate between continuous and discrete stressors, the effects of these stressors on health and well-being, diversity of	10



	stressors and their health consequences, relation between stress and illness from different perspectives association between stress related physiological mechanisms and different illnesses.	
4	Physical Well-being / Health management: concept of health behaviours, dimensions of health behaviours. Health enhancing behaviors: Exercise and Weight control, application and importance of these health enhancing behaviours. Health protective behaviors and illness management: concept of illness management, effectiveness of illness management. Concept of Nutrition, Role of Nutrition, Components of Nutrition, concept of Malnutrition, Health compromising behaviours: Alcoholism, Smoking and its effects on health.	10
5	Dealing with Difficult Times / Coping mechanisms: The concept of chronic stress, Health and safety risks of chronic stress, Forms and Treatment of chronic stress, Coping with Acute and Chronic stress, theories of the stress-illness link, role of stress in mental disorders. Concept of coping, Ways of coping and stress management, basic knowledge about stress management, various techniques of stress management, stress management programs. Mental strengths and virtues, Hope, Optimism, Resilience – concept, pathways and models, Meditation and Self-introspection.	08
	Total	42

Books Recommended:*Textbooks:*

1. The Science of well-being by Felicia Huppert, Nick Baylis, Barry Keverne; Oxford University Press
2. Health and Well-Being: Emerging Trends by S. Ojha, U. Rani Srivastava, Shobhna Joshi, Global Vision Publishing House
3. Positive psychology: The scientific and practical explorations of human strengths by Shane
4. J. Lopez, Jennifer Teramoto Pedrotti, Charles Richard Snyder; Sage Publications.

Reference Books:

1. The pursuit of happiness and the realization of sympathy: Cultural patterns of self, social relations, and well-being by Kitayama, S., & Markus, H. R, Culture and subjective well-being, The MIT Press.
2. Man Adapting by Dubos, R; New Haven: Yale University Press.
3. Happiness a history by McMahon D. M., Atlantic Monthly Press.
4. Well-being: The foundations of hedonic psychology by D. Kahneman & E. Diener & N. Schwarz, New York: Russell Sage
5. Selye H. The Stress of Life. New York; McGraw-Hill; 1984.



Program: B.Tech in Artificial Intelligence and Data Science	Final Year. B.Tech	Semester: VII
Course: Research Methodology (DJ19ILO7019)		

Pre-requisites:

1. Basic Knowledge of Probability and Statistics.

Objectives:

1. To understand Research and Research Process
2. To acquaint learners with identifying problems for research and develop research strategies
3. To familiarize learners with the techniques of data collection, analysis of data and interpretation

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

1. Prepare a preliminary research design for projects in their subject matter areas
2. Accurately collect, analyze and report data
3. Present complex data or situations clearly
4. Review and analyze research findings
5. Write report about findings of research carried out

Research Methodology (DJ19ILO7019)		
Unit	Description	Duration
1	Basic Research Concepts Meaning of research, Objectives of research, Types of research, Significance of research Research process	07
2	Research Methodology: Identification of research problem, Literature review, Formulation of hypothesis, Formulation of Research design.	10
3	Research and Sample Design: Meaning of research and sample design, Need of research design, Features of good research design, Important concepts, Different research designs, Types of sampling designs	10
4	Data Collection and Data Analysis: Types of data, Methods for collecting data: Experiments and surveys, Collection of primary and secondary data, Hypothesis testing and interpretation of Data	10
5	Interpretation and Report Writing: Interpretation and drawing conclusions on the research, Preparation of the report, Ethical Issues	05
	Total	42

Books Recommended:*Reference Books:*

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.



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2. Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nd Edition), Singapore, Pearson Education



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Program: B.Tech in Artificial Intelligence and Data Science	Final Year. B.Tech	Semester: VII
Course: Public Systems and Policies (DJ19ILO7020)		

Pre-requisites:

1. Basic Knowledge of Social science and Current affairs.

Objectives:

1. To analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.
2. To understand public systems in a fast-changing environment in the global context.
3. To provide an in-depth understanding of the ills prevailing in the society and aids to identify the solutions for them.
4. To explain public policy and its operations with special focus on policy relating to Government finance.
5. To analyze and evaluate the impact of the public policy on firms and economy at large.

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

1. Understand the importance of public systems in a fast-changing environment in the global context.
2. Analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.
3. Explain public policy and its operations with special focus on policy relating to Government finance.
4. Make policies and know about the happenings in the world, in the nation and those in their locality.
5. Analyze and evaluate the impact of the public policy on firms and economy at large and work under various fields as policymakers.

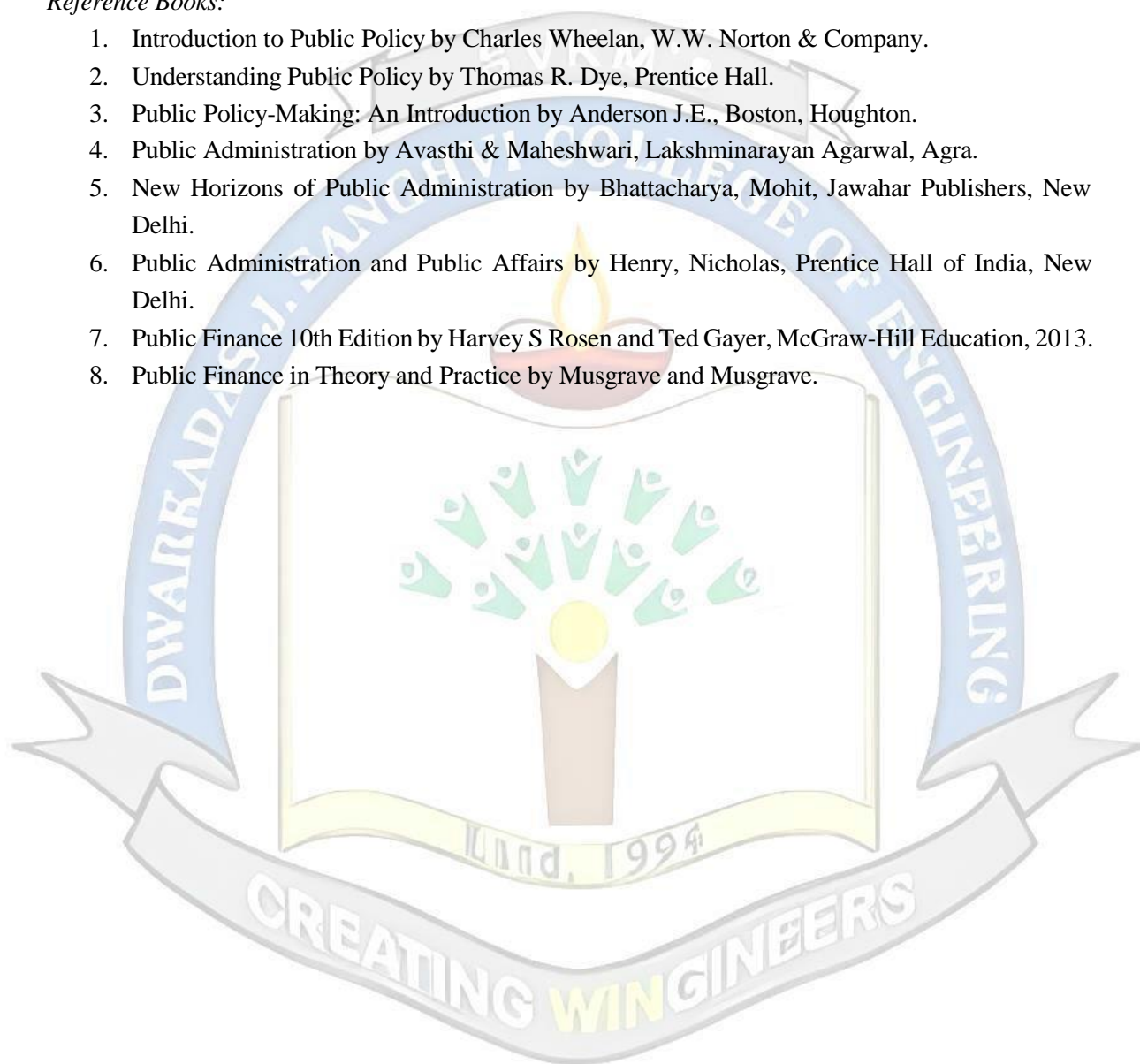
Public Systems and Policies (DJ19ILO7020)		
Unit	Description	Duration
1	Introduction and Overview of Public Systems: Ideology of Public Systems; Mechanistic and Organic view of Society and Individuals, The Legal Framework; Federal Government; State and Local Governments, Government growth; The size of Government.	10
2	Public Sector in the Economics Accounts: Public Sector in the circular flow; Public Sector in the National Income Accounts.	06
3	Public Choice and Fiscal Politics: Direct Democracy; Representative Democracy; The Allocation Function; The Distribution Function; The Stabilization Function; Coordination of Budget Functions; The Leviathan Hypothesis.	08
4	Introduction and Overview of Public Policy: Markets and Government; Social goods and Market failure, Public expenditure and its evaluation; Cost Benefit Analysis, Public policy	12



	and Externalities, Taxation Policy and its impact, Income distribution, redistribution and social security issues Fiscal & Budgetary Policy, Fiscal Federalism in India.	
5	Case Studies in Expenditure Policy: Public Services A) National Defense B) Highways C) Outdoor Recreation D) Education	06
	Total	42

Books Recommended:*Reference Books:*

1. Introduction to Public Policy by Charles Wheelan, W.W. Norton & Company.
2. Understanding Public Policy by Thomas R. Dye, Prentice Hall.
3. Public Policy-Making: An Introduction by Anderson J.E., Boston, Houghton.
4. Public Administration by Avasthi & Maheshwari, Lakshminarayan Agarwal, Agra.
5. New Horizons of Public Administration by Bhattacharya, Mohit, Jawahar Publishers, New Delhi.
6. Public Administration and Public Affairs by Henry, Nicholas, Prentice Hall of India, New Delhi.
7. Public Finance 10th Edition by Harvey S Rosen and Ted Gayer, McGraw-Hill Education, 2013.
8. Public Finance in Theory and Practice by Musgrave and Musgrave.





Program: B.Tech in Artificial Intelligence and Data Science	Final Year. B.Tech	Semester: VII
Course: Project Stage - I (DJ19DSP704)		

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 Outcome:

Learner will be able to:

1. Discover potential research areas in the field of IT.
2. Survey several available literatures in the related field of study.
3. Compare the several existing solutions for research challenges.
4. Design the solution for the research plan.
5. Summarize the findings of the study conducted.
6. Work effectively as a member of the team.

Guidelines:

1. The department must allocate 1 day in the VII semester every week.
2. The project work is to be conducted by a group of 3-4 students.
3. Each group shall identify a potential research area/problem domain, on which the study is to be conducted and submit three proposals to the department.
4. Department will evaluate all the proposals and select the best proposal from each group. Every group will be associated with a project mentor/guide. The group should meet with the project mentor/guide periodically and record of the meetings and work discussed must be documented.
5. Students will do a rigorous literature survey of the problem domain by reading and understanding at least 10-12 research papers from current superior quality national/international journals/conferences. (Papers selected must be indexed by Scopus/IEEE/Springer/ACM etc.). The list of papers surveyed must be clearly documented and research gaps should be identified.
6. Students will design and implement (30-40%) the system in Semester VII.
7. Students will have to regularly submit their project completion tasks given by the department. Each task will be having weightage in the term work.
8. The project assessment for term work will be done based on regular submission of project tasks and presentation at the department level. The Head of the department of respective Program will give the presentation to the panel members, which consist of at least three (3) members as internal examiners (including the project guide/mentor) appointed.
9. A report is to be prepared summarizing the findings of the literature survey. A comparative evaluation of the different techniques surveyed is also to be done.



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10. The term work calculation will be based on plan of data collection (10m), analysis of literature survey (15m), proposed design (15m), documentation and presentation (10m).



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