Shri Vile Parle Kelavani
Mandal's

# Dwarkadas J. Sanghvi College of Engineering

*(Autonomous College Affiliated to the University of Mumbai)*

Scheme and detailed syllabus

## Final Year B.Tech

in

## Artificial Intelligence and Machine Learning

(Semester VII)

Academic Year 2025-26

# Proposed Scheme for Final Year Undergraduate Program in Artificial Intelligence and Machine Learning: Semester VII (Autonomous)
## Academic Year(2025-26)

| Sr. No. | Course Code | Course | Teaching Scheme | | | Continuous Assessment (A) | | | | | | Semester End Examination (B) | | | | | | Aggregate (A+B) | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory (hrs.) | Practical (hrs.) | Tutorial (hrs.) | Term Test 1(TT1) -a | Term Test 2(TT2) -b | Assg/CP/GD/Presentation/Quiz) - c | Total (a+b+c) | Term work | CA Total | Duration | Theory | Oral | Pract | Oral & Pract | SEE Total | | |
| 1 | DJS22AMC701 | High Performance Computing | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 3 |
| | DJS22AML701 | High Performance Computing Laboratory | -- | 2 | -- | -- | -- | -- | -- | 25 | 25 | 2 | -- | 25 | -- | -- | 25 | 50 | 1 |
| 2 | DJS22AMC702 | Large Language Models | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 3 |
| | DJS22AML702 | Large Language Models Laboratory | -- | 2 | -- | -- | -- | -- | -- | 25 | 25 | 2 | -- | 25 | -- | -- | 25 | 50 | 1 |
| 3 | DJS22AMC703 | Big Data Analytics | 2 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 2 |
| | DJS22AML703 | Big Data Analytics Laboratory | -- | 2 | -- | -- | -- | -- | -- | 25 | 25 | 2 | -- | 25 | -- | -- | 25 | 50 | 1 |
| 4 | DJS22AEC7011 | Robotics | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 3 |
| | DJS22AEL7011 | Robotics Laboratory | -- | 2 | -- | -- | -- | -- | -- | 25 | 25 | 2 | -- | 25 | -- | -- | 25 | 50 | 1 |
| | DJS22AEC7012 | Artificial Intelligence in Finance | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 3 |
| | DJS22AEL7012 | Artificial Intelligence in Finance Laboratory | -- | 2 | -- | -- | -- | -- | -- | 25 | 25 | 2 | -- | 25 | -- | -- | 25 | 50 | 1 |
| | DJS22AEC7013 | Artificial Intelligence in Cyber Security | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 60 | 100 | 3 |
| | DJS22AEL7013 | Artificial Intelligence in Cyber Security Laboratory | -- | 2 | -- | -- | -- | -- | -- | 25 | 25 | 2 | -- | 25 | -- | -- | 25 | 50 | 1 |
| 5 | DJS22ILO7011 | Product Lifecycle Management | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 66 | 100 | 3 |
| | DJS22ILO7012 | Management Information System | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 3 |
| | DJS22ILO7013 | Operations Research | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 3 |
| | DJS22ILO7014 | Cyber Security and Laws | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 3 |
| | DJS22ILO7015 | Personal Finance Management | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 3 |
| | DJS22ILO7016 | Energy Audit and Management | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 3 |
| | DJS22ILO7017 | Disaster Management and Mitigation Measures | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 3 |
| | DJS22ILO7018 | Science of Well-being | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 3 |
| | DJS22ILO7019 | Research Methodology | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 3 |
| | DJS22ILO7020 | Public Systems and Policies | 3 | -- | -- | 20 | 15 | -- | 35 | -- | 35 | 2 | 65 | -- | -- | -- | 65 | 100 | 3 |
| 6 | DJS22AMP704 | Project Stage I | -- | 4 | -- | -- | -- | -- | -- | 50 | 50 | 2 | -- | -- | -- | 50 | 50 | 100 | 2 |
| | | **Total** | **14** | **12** | **--** | **100** | **75** | **--** | **175** | **150** | **325** | **18** | **325** | **100** | **--** | **50** | **475** | **800** | **20** |

| | | |
|---|---|---|
| Prepared by:<br>Name and Signatures (with date) | Head of Department<br>Dr. Aruna Gawde | Vice-Principal<br>Dr. Narendra Shekokar | Principal<br>Dr. Hari Vasudevan |
| Checked By<br>Name and Signatures (with date) | | | |

***Continuous Assessment (A):***

| Course | Assessment Tools | Marks | Time (hrs.) |
|---|---|---|---|
| Theory | One Term test (based on 40 % syllabus) | 20 | 1 |
| | Second Term test (next 40 % syllabus ) / presentation / assignment / course project / group discussion / any other. | 15 | |
| Audit course | Performance in the assignments / quiz / power point presentation / poster presentation / group project / any other tool. | -- | As applicable |
| Laboratory | Performance in the laboratory and documentation. | 25 | |
| Tutorial | Performance in each tutorial & / assignment. | 25 | |
| Laboratory &Tutorial | Performance in the laboratory and tutorial. | 25 | |

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

***Semester End Assessment (B):***

| Course | Assessment Tools | Marks | Time (hrs.) |
|---|---|---|---|
| Theory / * Computer based | Written paper based on the entire syllabus. | 65 | 2 |
| | * Computer based assessment in the college premises. | | |
| Oral | Questions based on the entire syllabus. | 25 | as applicable |
| Practical | Performance of the practical assigned during the examination and the output / results obtained. | 25 | 2 |
| Oral & Practical | Project based courses - Performance of the practical assigned during the examination and the output / results obtained. Based on the practical performed during the examination and on the entire syllabus. | as per the scheme | 2 |

Prepared by Checked by HoD Vice Principal Principal

| Program: Artificial Intelligence & Machine Learning | B.Tech. | Semester :VII |
|---|---|---|
| Course: High Performance Computing (DJS22AMC701) | | |
| Course: High Performance Computing Laboratory (DJS22AML701) | | |

**Prerequisite:** System Fundamentals.

**Course Objectives:**

1. To learn concepts of parallel processing as it pertains to high-performance computing.
2. To design, develop and analyze parallel programs on high performance computing resources using parallel programming paradigm

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

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

| Detailed Syllabus: High Performance Computing (DJS22AMC701) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| 1 | **Introduction to Parallel Processing:** Parallel processing, Levels of Parallelism, Models (SIMD, MIMD, SIMT, SPMD, Data Flow Models, Demand-driven Computation). Loosely coupled and Tightly coupled. Parallel Architecture (Interconnection network, processor Array, Multiprocessor), Challenges in Parallel Computing, Performance Metrics, Distributed vs. Parallel architectures. | 04 |
| 2 | **Introduction to High Performance Computing:** Principles of HPC, HPC Architectures, HPC vs Parallel Processing, Data partitioning Techniques: Block, cyclic, and block-cyclic partitioning, Domain Decomposition: Spatial, temporal, and functional decomposition, Load balancing, Case Study: Partitioning strategies for matrix multiplication. Communication Models: Shared memory vs. message passing. Point-to-Point Communication: Send/Receive operations in MPI. Collective Communication: Broadcast, scatter, gather, and reduction operations in MPI (MPI_Reduce) | 06 |

| | | |
|---|---|---|
| 3 | **GPU and CUDA Programming:**<br>Overview of GPU, evolution of GPU, CPU vs. GPU, overview of CUDA: Features, Benefits, Architecture. Programming Model CUDA: Kernels and kernel launches, Thread and block indexing, CUDA Memory Management: Memory Hierarchy and Memory Management, Case Studies: computational biology, data analytics, and machine learning. | 08 |
| 4 | **Grid and Cloud Computing**:<br>Data & Computational Grids, Grid Architectures and its relation to various Distributed Technologies, Examples of The Grid Computing, Cloud Computing, High Performance Cloud Computing (HPC2), Cloud Tensor Processing Units (TPUs). | 07 |
| 5 | **Performance Optimization:**<br>Speedup, Efficiency and Scalability, Amdahl's Law, Gustafson's Law, Weak vs. Strong Scaling, Performance Bottlenecks, Data Races and Determinism, Data Race Avoidance, Profiling and performance analysis tools for GPUs, Techniques for optimizing GPU performance (warp divergence, loop unrolling, vectorization), Memory bandwidth optimization techniques, Advanced GPU programming concepts (shared memory atomics, warp shuffling).<br>Case Studies: Scientific Computing with CUDA/Real-life application | 08 |
| 6 | **Advanced Topics in GPU:**<br>Introduction to GPU accelerated libraries (cuBLAS, cuDNN, cuGraph), GPU computing frameworks (TensorFlow, PyTorch) and their integration with GPUs, Introduction to GPU clusters and distributed GPU computing, Cluster Setup & its Advantages. Case studies : Real- world applications of GPU computing. | 06 |
| | **TOTAL** | 39 |

**Books Recommended:**

***Textbooks:***

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

Hager, Gerhard Wellein,, CRC press, 2019.

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

***Reference Books:***

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

***Web Links:***

1. Parallel Processing https://hpc.llnl.gov/documentation/tutorials/introduction-parallel-computing-tutorial
2. https://nptel.ac.in/courses/106108055
3. https://nptel.ac.in/courses/112105293
4. Introduction to high performance computing https://www.cecam.org/workshop-details/an-introduction-to-high-performance-computing-1270
5. GPU and CUDA Programming https://www.cs.cmu.edu/afs/cs/academic/class/15418-s18/www/lectures/06_gpuarch.pdf
6. Grid and Cloud Computing https://aits-tpt.edu.in/wp-content/uploads/2022/06/GCC-min.pdf
7. Performance Optimization https://link.springer.com/chapter/10.1007/978-3-642-03644-6_12
8. Case Study: https://developer.nvidia.com/blog/a-cuda-dynamic-parallelism-case-study-panda/
9. Case Study https://www.researchgate.net/publication/265817932_CUDA-based_scientific_computing_Tools_and_selected_applications

**Suggested Experiments:**

| **High Performance Computing Laboratory (DJS22AML701)** | |
|---|---|
| **Sr. No.** | **Title of Experiment** |
| **1** | Set up the CUDA environment, install the CUDA Toolkit, and write a basic CUDA program to understand the CUDA development environment. |
| **2** | Implement vector addition using CUDA to introduce students to parallelism, thread management, and memory allocation in GPU programming. |
| **3** | Develop a CUDA program for matrix multiplication to understand parallelism and optimization techniques in GPU computing. |
| **4** | Apply CUDA for image processing tasks, like blurring and edge detection, to learn how to process images efficiently using GPU parallelism. |
| **5** | Implement parallel reduction operations (e.g., sum, min, max) to grasp the concept of efficient parallel reduction. |

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|---|---|
| **6** | Explore parallel sorting algorithms using CUDA, comparing their performance with CPU based sorting and optimizing CUDA sorting. |
| **7** | Employ CUDA to perform a Monte Carlo simulation for estimating mathematical constants or solving real-world problems to understand the power of GPU parallelism. |
| **8** | Experiment with CUDA to implement concurrent data structures using locks and atomic operations to learn how to manage data concurrently. |
| **9** | Optimize the reduction step in machine learning algorithms using CUDA, focusing on techniques for efficient large-scale data processing. |
| **10** | Integrate CUDA-accelerated code with data science frameworks like TensorFlow or PyTorch to develop and run GPU-accelerated machine learning models for practical applications. |
| **11** | Perform the Log Analysis-Based Resource and Execution Time Improvement |

Batch wise laboratory work of minimum eight experiments from the above suggested list or any other experiment based on syllabus will be include, which would help the learner to apply the concept learnt.

| Program: Artificial Intelligence & Machine Learning | B. Tech. | Semester: VII |
|---|---|---|
| Course: Large Language Models (DJS22AMC702) | | |
| Course: Large Language Models Laboratory (DJS22AML702) | | |

**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. 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 and Large Reasoning Models.
3. Apply prompt engineering techniques for effective LLM interaction and understand the concept of Retrieval Augmented Generation (RAG) and its role in LLMs.
4. Understand the different data modalities using Multimodal Architectures.

| Large Language Models (DJS22AMC702) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| 1 | **Module 1: Introduction to Generative AI &Transformer Architecture**<br>Domains of Generative AI, Text Generation, Image Generation, Music Generation, Video Generation. Limitations of RNN & LSTM, Tokenization, Transformer Architecture : 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**<br>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 – perplexity, BLEU score, Needle in a Haystack | 6 |
| 3 | **Module 3: Large Reasoning Models**<br>Deep seek- v2: Multi head Latent Attention, Deep seek MoE, Knowledge | 5 |

| | | |
|---|---|---|
| | Distillation, Mistral 7-B Architecture: sliding Window attention, Grouped Query Attention, Titans: Learning to memorize at test time, Knowledge Distillation, QWQ models. | |
| 4 | **Module 4: Prompt Engineering &Agentic AI**<br>Introduction to prompt, examples of prompt, prompt engineering, prompt techniques, zero shot, one shot, few-shot learning, Agentic AI- a chain of thought , ReAct , self-consistency, Tree of thought, Multimodal CoT, Graph prompting, Large Action Models(LAMs), LLM based Agents, Auto Gen | 6 |
| 5 | **Module 5: Retrieval Augmentation & Generation (RAG) and Fine-tuning for LLMs**<br>Understanding Retrieval and vector, vector storage: vector indexing and retrieval Algorithms: Annoy, HSNV, Inverted File System, LSH, vector quantization techniques: Scalar, Product, Binary, 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. | 8 |
| 6 | **Module 6: Multimodal Architectures - Beyond Text**<br>Introduction to Multimodal LLMs, Exploring architectures for Multimodal LLMs: Vision Transformer, Next GPT, Applications of Multimodal LLMs (e.g., image captioning, video summarization), Multi-task LLMs, Empowering Time Series Analysis with Large Language Models | 6 |
| | **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 Alammar, 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(DJS22AML702)** | |
|---|---|
| **Sr. No.** | **Title of the Experiment** |
| **1** | Case study on Applications of Generative AI |
| **2** | Case study on role of Artificial Intelligence in achieving the Sustainable Development Goals |
| **3** | Fine Tuning Pre-trained Model On Custom Dataset (synthetic data) Using Transformer |
| **4** | Build your own LLM from scratch. |
| **5** | Query PDF using Lang Chain and Pine cone |
| **6** | Fine Tune Mistral7-B With Custom Dataset Using LoRA And QLoRA Techniques |
| **7** | Using in-built tools and creating custom tools for ReAct agent in Langchain. |
| **8** | Question Answering Application using LLM based agents. |
| **9** | Understanding various retrievers in Langchain. |
| **10** | Case study on comparison of Large Reasoning Models |
| **11** | Understanding multimodal models like Gemini vision |
| **12** | Build a simple multimodal generative model that combines text and image inputs to generate captions |
| **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: Artificial Intelligence & Machine Learning | Final Year B.Tech. | Semester: VII |
|---|---|---|
| Course: Big Data Analytics ( DJS22AMC703) | | |
| Course: Big Data Analytics Laboratory ( DJS22AML703) | | |

**Pre-requisite**: Database Management System

**Objectives:**

1. To provide an overview of Big Data analytics and discuss the challenges traditional data mining algorithms face when analyzing Big Data.
2. To introduce the tools required to manage and analyze big data like Hadoop, NoSQL MapReduce.
3. To demonstrate the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
4. To introduce to the students several types of big data like social media, web graphs and data streams to solve complex real-world problems in for decision support.

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

1. Understand the fundamentals of Big Data and its ecosystem
2. Illustrate distributed processing techniques using MapReduce and Spark.
3. Analyze stream data processing and core Spark concepts for efficient data manipulation
4. Apply advanced analytics and mining techniques to extract insights from large datasets and real-world Big Data application.

| Big Data Analytics ( DJS22AMC703) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| **1** | **Introduction to Big Data Analytics**<br>Definition and evolution of Big Data. Characteristics and types, Traditional Versus Big Data Approach, Big Data Challenges, Introduction to Hadoop: Core components (HDFS, YARN), Hadoop Ecosystem. Introduction to NoSQL Databases: NoSQL patterns, key-value, document, column-family, graph stores. MongoDB Introduction: Detailed overview and hands-on example. | **05** |
| **2** | **MapReduce and Distributed Processing**<br>MapReduce Fundamentals: Map and Reduce tasks, grouping, combiners, execution. MapReduce Algorithms: Matrix-Vector Multiplication, Relational-Algebra Operations. Joins, grouping, aggregation, matrix multiplication. MapReduce Application: Real-life database and application examples. | **05** |
| **3** | **Stream Data Processing and Spark Introduction**<br>The Stream Data Model: Stream-management, sources, queries, issues. | **05** |

| | | |
|---|---|---|
| | Sampling and Filtering Streams: Techniques, Bloom filter. Counting Distinct Elements and Ones: Flajolet-Martin, DGIM algorithms. Apache Spark Overview: Introduction to Spark and core concepts. | |
| **4** | **Advanced Analytics and Mining**<br>Frequent Pattern Mining: Handling large datasets, basic algorithms. The SON Algorithm and MapReduce: Implementation detail. Clustering Algorithms: CURE, Canopy clustering, MapReduce clustering. Classification Algorithms: Parallel trees, Ensemble methods. Link Analysis: PageRank: Definition, web structure, using PageRank. | **05** |
| **5** | **Big Data Analytics Applications**<br>Link Analysis: PageRank Definition, Structure of the web, Using Page rank in a search engine. Efficient PageRank Computation: Iteration, topic-sensitive, link spam, Hubs and Authorities, Mining Social- Network Graphs: Types, Clustering, Direct Discovery of Communities, counting triangles using Map-Reduce. Real-Time and Streaming Recommendation Engines, Automated Machine Learning (AutoML), Business Intelligence (BI) Dashboards and Reporting, Cloud-based ML platforms (e.g., SageMaker, Vertex AI, Azure ML) | **06** |
| | **TOTAL** | **26** |

**Books Recommended:**

***Textbooks:***

1. Big Data and Hadoop: Fundamentals, tools, and techniques for data-driven success, Mayank Bhushan, Edition 2nd ed. ISBN-13978-9355516664, 2024.
2. Jugnesh Kumar, Anubhav Kumar, Rinku Kumar Big Data and Analytics: The key concepts and practical applications of big data analytics, ISBN-13978-9355516176, 2024.
3. Mastering Apache Spark: Real-Time Big Data Analytics: Build Large-Scale Data Processing Pipelines with Apache Spark, Greyson Chesterfield, 2024
4. Big Data with Hadoop MapReduce, Rathinaraja Jeyaraj (Author), Ganeshkumar Pugalendhi (Author), Anand Paul (Author), 2022.
5. Demystifying the NoSQL, Mrs A S R Sulthana | Mr Micheal Yeboah Frimpong, 2021.
6. MongoDB: The Definitive Guide Paperback, Kristina Chodorow (Author), Michael Dirolf, O'Reilly Publications, 2020.
7. Radha Shankarmani, M Vijayalakshmi, "Big Data Analytics", Wiley Publications, 2019.

***Reference Books:***

1. Ultimate Big Data Analytics with Apache Hadoop: Master Big Data Analytics with Apache Hadoop Using Apache Spark, Hive, and Python, Simhadri Govindappa, 2024.
2. Hadoop in Action: Real World Applications and Best Practices for Big Data Processing Kindle Edition by Dr Sudhakar Ranjan (Author), Dr Anurag Bharatwal (Author), Dr Amit Kumar Goel (Author), 2024.
3. Advanced Analytics in Mining Engineering: Leverage Advanced Analytics in Mining Industry to Make Better Business Decisions, Ali Soofastaei, 2023.

4. Data Analytics: The Ultimate Guide to Big Data Analytics for Business, Data Mining Techniques, Data Collection, and Business Intelligence Concepts, Herbert Jones, 2020.

***Online References:***

1. NPTEL Course: https://onlinecourses.nptel.ac.in/noc20_cs92
2. MongoDB:https://www.mongodb.com/developer/products/mongodb/learn-mongodb-university-online-free-mooc/?msockid=07258624254b619719bf95cb24b36065
3. https://www.youtube.com/watch?v=S2MUhGA3lEw
4. https://www.youtube.com/watch?v=XhjIJGsAMsQ&list=PL6UwySlcwEYKiC-EjEmN4f33c5fVpbzha

***Suggested List of Laboratory Experiments:***

| **Big Data Analytics Laboratory ( DJS22AML703)** | |
|---|---|
| **Sr No** | **Title of Experiment** |
| **1** | One Case Study on Big data in Real life published in IEEE/ACM/Springer or any prominent journal.<br>Objective: Identify and categorize real-world datasets based on the 5 Vs of Big Data (Volume, Velocity, Variety, Veracity, Value).<br>Tasks:<br>• Collect example datasets (e.g., social media data, sensor data, web logs).<br>• Analyze and document how each dataset exemplifies the 5 Vs.<br>• Discuss the challenges associated with analyzing each dataset. |
| **2** | Installation of Hadoop Framework, it's components and study the HADOOP ecosystem. |
| **3** | Implement word count/frequency programs using MapReduce. |
| **4** | Implementing algorithm in MapReduce Matrix multiplication, Aggregates, joins, sort. |
| **5** | Create Hive Databases and Tables, Hive Partitioning and Indexing. |
| **6** | Write Pig Latin Script Operators like Distinct, For-each, Union. |
| **7** | Implement NoSQL Database Operations: CRUD operations, Arrays using MongoDB. |
| **8** | Implement clustering techniques using SPARK. |
| **9** | Implement Page Rank Algorithm using Map-Reduce. |
| **10** | Implement an application that stores big data in MongoDB using Hadoop / R. |
| **11** | Data Visualization with Tableau. |
| **12** | Mini Project:<br>SDG 13: Climate Change Impact Analysis<br>• Analyse temperature and air quality data to identify trends and patterns.<br>• Use social media data to assess public sentiment towards climate change.<br>• Visualize the impact of climate change on specific regions.<br>SDG 3: Healthcare Access Analysis<br>• Analyze data on healthcare access, disease prevalence, and mortality rates. |

| | |
|---|---|
| | • Identify disparities in healthcare access across different populations.<br>• Visualize the impact of healthcare interventions. |

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.

SVKM's DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING Estd. 1994 CREATING WINGINEERS

| Program: Artificial Intelligence & Machine Learning | B.Tech. | Semester: VII |
|---|---|---|
| Course: Robotics (DJS22AEC7011) | | |
| Course: Robotics Laboratory (DJS22AEL7011) | | |

**Course Objectives:**

1. Develop a comprehensive understanding of robot anatomy
2. Gain proficiency in direct and inverse kinematics, coordinate frames, and rotations.
3. Learn the principles of workspace analysis, trajectory planning, and various motion operations to design and implement efficient robotic movements.
4. Integrate and Program Robotic Systems

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

1. Explain the basics of robot anatomy, movement mechanisms, and classifications, and apply this knowledge to real-world robotic systems.
2. Perform kinematic analysis and solve direct and inverse kinematics problems for various robot configurations, enhancing their problem-solving skills in robotics.
3. Conduct workspace analysis and trajectory planning, and will implement pick-and-place.
4. Capable of using ROS for robot programming, interface sensors and actuators.

| Detailed Syllabus: Robotics (DJS22AEC7011) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| 1 | **Robot Fundamentals:** Basic of Robot Anatomy, Robot Movement, Mechanisms and transmission, Classification. **Direct and Inverse Kinematics:** Co-ordinate frames, Rotations, Link Coordination Arm Equation, (Two axis , Three axis, Four-axis robot SCARA, Five-axis only Rhino XR-3 Robot).General properties of solutions Tool configuration Two axis, Three axis planar articulated, Four axis SCARA, Five axis robots only Rhino XR-3 Robot | 08 |
| 2 | **Workspace Analysis and Trajectory Planning:** Introduction to Workspace Analysis and Trajectory Planning, Work Envelop and examples, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion. | 06 |
| 3 | **Robot Sensor, Actuator, Interface & Programming:** Principle of sensors, Sensor types: LiDAR (Light Detection and Ranging, Ultrasonic sensors, Camera. Sensor Input/output (I/O): Analog-to-Digital Converters (ADCs), Sensor Calibration, Interfacing and I2C, Actuator: Direct Control and Speed Control: PWM, Electric Motors, Pneumatic Actuator, Servo Motors. Basic Embedded File system, hex files, Simulators and Emulators, Integrated development environments, commonly used IDE. Python for Robot Programming, Program structure, data types, control structure. | 08 |

| | | |
|---|---|---|
| 4 | **Robotics Convergence Technology:** Telemetric camera Robotic System, Non- Imaging Sensors,<br>Machine Learning for Robotics: Supervised learning for robot control, Reinforcement learning for robot decision making.<br>Computer Vision for Robotics: Object recognition, Image segmentation, Visual SLAM (Simultaneous Localization and Mapping),<br>Sensor Fusion and Perception: Combining data from multiple sensors for robot understanding. Knowledge representation, planning, and task scheduling. Sound and touch sensing, People sensing, Autonomous mobile robot, humanoid robots and simulated humans, human-robot interaction. | 08 |
| 5 | **Robot Operating System** ROS Basics, Supporting ROS, ROS Architecture and Concepts, ROS File system, ROS Computation Graph Level, ROS Community Level, ROS Workspace and Package, ROS Client Library, ROS Programming Concept: Motion planning, Behavior control, Machine learning integration. | 04 |
| 6 | **Building the Robots:** Introduction to Wheeled Robot, Hardware, Block Diagram and Assembling Robot Hardware, Programming Robot Firmware, path planning.<br>Robot Applications in AI (case studies): Exploration of self-driving cars, industrial robots, assistive robots, and other AI-powered robotic applications. Focus on the interplay between hardware and software aspects. Case study: Tetrix , NAO, Ned Niryo , Auto Auto. | 05 |
| | **Total** | **39** |

**Books Recommended:**

***Textbooks:***

1. "Basic concepts of AI and Robotics", Dr. M. Purushotham, T V Sathyanarayana, Dr. Shafqat Nabi Mughal, Dr. Pallavi Sapkale, AG Publishing House, ISBN: 9788119025343, Edition: First Edition, 2023.
2. "Fundamentals of Robot Kinematics and Dynamics", Ishwar Singh, Birinder Pal Kaur, ISBN-13 979-8870762753, 2023.
3. "Robot Operating System (ROS) for Absolute Beginners: Robotics Programming Made Easy," Lentin Joseph, 1st Edition, A Press, 2018.
4. "Mechatronics", W. Bolton, Pearson, 2018.
5. "Mastering ROS for Robotics Programming: Design, build, and simulate complex robots using the Robot Operating System", Jonathan Cacace; Lentin Joseph, 2nd Edition, Packet Publishing, 2018.
6. "Handbook of Modern Sensors", Jacob Fraden, Springer 2016.

***References:***

1. "Human-Centered AI: A Multidisciplinary Perspective for Policy-Makers, Auditors, and Users,", Catherine Régis (Editor), Jean-Louis Denis (Editor), Maria Luciana Axente (Editor), Atsuo Kishimoto (Editor), ISBN 13- 978-1032341620, 2024.

2. "Introduction To AI Robotics", Second Edition, Bradford Books, ISBN 13- 978-0262038485, 2019.
3. "Industrial Robotics", Mikell P. Groover, McGraw Hill, 2nd edition, 2012.
4. "Introduction to Robotics", John J. Craig, 3rd Edition, Addison Wesley, ISE 2008.

***Online Resources:***

1. Robot Anatomy, Movement, Mechanisms, and Transmission https://motion.cs.illinois.edu/RoboticSystems/AnatomyOfARobot.html
2. https://nptel.ac.in/courses/107106090
3. https://nptel.ac.in/courses/112108298
4. robot configurations and joint types https://instrumentationtools.com/robot-anatomy-configuration-reference-frame-characteristics/
5. Workspace Analysis and Trajectory Planning https://motion.cs.illinois.edu/RoboticSystems/AnatomyOfARobot.html
6. Robot Interface & Programming https://www.wevolver.com/article/robot-joint
7. Basic Embedded Systems and Python for Robot Programming https://motion.cs.illinois.edu/RoboticSystems/AnatomyOfARobot.html
8. Robotics Convergence Technology https://www.wevolver.com/article/robot-joint
9. Robot Operating System (ROS) https://instrumentationtools.com/robot-anatomy-configuration-reference-frame-characteristics/
10. Building Robots and Path Planning https://instrumentationtools.com/robot-anatomy-configuration-reference-frame-characteristics/
11. Robot Applications in AI (Case Studies) https://www.wevolver.com/article/robot-joint

**Suggested Experiments**

| **Robotics Laboratory (DJS22AEL7011)** | |
|---|---|
| **Sr. No.** | **Title of Experiment** |
| 1 | **Exploring Robot Anatomy**<br>Objective: Identify and understand the various parts of a robot (e.g., sensors, actuators, controllers).<br>Objective: Study different types of mechanisms (e.g., gears, belts) and transmission systems in robots. |
| 2 | Simulation of Forward and Inverse Kinematics. |
| 3 | **Workspace Analysis of a SCARA Robot**<br>Objective: Analyse the workspace of a four-axis SCARA robot and identify its limitations using simulation software. |
| 4 | Create a Robot structure for pick and place operation |
| 5 | **Basic ROS Node Creation**<br>Objective: Create and run basic publisher and subscriber nodes in ROS.<br>(Write simple nodes in Python/C++ and communicate between them.) |
| 6 | Implement a line following robot using ROS and appropriate sensors. |
| 7 | Interfacing Arduino/ Raspberry Pi with ROS. |
| 8 | Programs of Tetrix and NAO. |
| 9 | Programs on Ned Niryo and Auto Auto. |

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: Artificial Intelligence & Machine Learning | B.Tech | Semester: VII |
|---|---|---|
| Course: Artificial Intelligence in Finance (DJS22AEC7012) | | |
| Course: Artificial Intelligence in Finance Laboratory (DJS22AEL7012) | | |

**Course Objective:** The course objective is to understand the role of AI in finance, learn risk and portfolio management, develop and evaluate the credit scoring models, and investigate the application of AI in detection and prevention of fraud.

**Course Outcome:** On successful completion of this course, learner will be able to:

1. Demonstrate Knowledge of AI Applications and its role in Finance.
2. Implement Risk Management Models to assess and manage financial risks.
3. Optimize financial portfolio strategies that align with given risk profiles and investment goals.
4. Develop AI-driven credit scoring models and compare their performance to traditional scoring systems.
5. Design the fraud detection system that detect and prevent potential fraudulent activities.

| Artificial Intelligence in Finance (DJS22AEC7012) | | |
|---|---|---|
| **Detailed Syllabus** | | |
| **Unit** | **Description** | **Duration** |
| 1 | **Introduction:**<br>Taxonomy for finance- asset, liabilities, income, expenses, revenue, profit, cost of goods sold (COGS), gross margin, net income, balance sheet, income statement, ROI, liquidity, interest, inflation, financial markets (stock, Bond, commodity, forex), Equities, derivatives, Corporate and personal finance, Financial Statements and ratios, financial planning. | 8 |
| 2 | **Role of AI in Finance:**<br>AI and its significance in finance, evolution of AI in finance, AI techniques used in finance, Forecasting and its importance in finance, challenges in financial forecasting, Forecasting Methods: TSA, ML, DL, Semantics Analysis, Applications of AI in Finance: fraud detection, credit scoring, algorithmic trading, risk management.<br>Efficient Markets: Market Prediction Based on Returns Data, Market Prediction with More Features, Market Prediction Intraday,<br>Dense Neural Networks: The Data, Baseline Prediction, Normalization, Dropout, Regularization, Bagging, Optimizers.<br>Recurrent Neural Networks: Example - Financial Price Series, Financial Return Series, Financial Features, Estimation. | 8 |

| | | |
|---|---|---|
| 3 | **Risk Management using AI and ML Models:**<br>Introduction to financial risk management, Types of financial risk (market, credit, operational), AI and ML models for risk management (e.g., Value at Risk, Conditional Value at Risk), Case studies: Implementing risk management strategies using AI and ML. | 6 |
| 4 | **Portfolio Optimization and Asset Allocation Strategies:**<br>Basics of portfolio theory, Portfolio optimization techniques (Markowitz, Black-Litterman, etc.), Application of AI and ML in portfolio optimization, Hands-on: Portfolio optimization using Python libraries. | 5 |
| 5 | **Credit Scoring in Finance:**<br>Credit scoring and its importance in lending decisions, development of credit scoring models, regulation in credit scoring, Data Collection and Preprocessing for Credit Scoring, models for credit scoring-traditional, machine learning and Deep learning, Evaluation and Validation of Credit Scoring Models-ROC, AUC, etc. Case studies of credit scoring model. | 6 |
| 6 | **Fraud Detection in Finance**:<br>Fraud in finance and its impact, Types of financial fraud (e.g., identity theft, payment fraud), Importance of fraud detection in financial institutions, Data Collection and Preprocessing for Fraud Detection, traditional fraud detection methods (e.g., rule-based systems, anomaly detection) and its limitations, machine learning for fraud detection, anomaly detection techniques- supervised and unsupervised, Case studies of fraud detection model. | 6 |
| | **Total** | 39 |

**Books Recommended:**

***Textbooks:***

1. "AI for Finance", Edward P. K. Tsang, CRC Press, ISBN13 978-1032391205, 2023.
2. "Application of AI in Credit Scoring Modeling", Bohdan Popovych, Springer Gabler , ISBN-13 978-3658401795, 2022.
3. "Asset Allocation: From Theory to Practice and Beyond (Wiley Finance)", William Kinlaw , Mark P. Kritzman, David Turkington, Harry M. Markowitz, ISBN-13 978-1119817710, 2021.
4. "Advances in Financial Machine Learning", Marcos López de Prado, Wiley, 2018.
5. "Time Series Analysis and Its Applications: With R Examples" by Robert H. Shumway and David S. Stoffer, 2017.
6. "Python for Finance: Analyze Big Financial Data" by Yves Hilpisch, 2015.
7. "Financial Risk Management: Models, History, and Institutions" by Allan M. Malz, 2011.
8. "Portfolio Construction and Analytics" by Frank J. Fabozzi, Harry M. Markowitz, and Petter N. Kolm, 2007.

***Reference books:***

1. "AI In Banking & Finance: How AI Plays A Significant Role In Banking And Financial Services Industry: Artificial Intelligence Definition", Ila Sweda, ISBN-13 979-8465705233, 2021.
2. "Machine Learning in Finance: From Theory to Practice" by Matthew F. Dixon, Igor Halperin, and Paul Bilokon, Springer, ISBN-13 978-3030410674 2020.
3. "Machine Learning for Financial Engineering" by Marcos Lopez de Prado, Cambridge University Press, ISBN-13 978-1108792899, 2018.
4. "Advances in Financial Machine Learning" by Marcos Lopez de Prado, Wiley, ISBN-13 978-1119482086, 2018.
5. "Financial Analytics with R: Building a Laptop Laboratory for Data Science" by Mark J. Bennett and Dirk L. Hugen, 2016.

***Online Resources:***

1. What Is Artificial Intelligence in Finance? | IBM
2. How Finance & Banking Professionals Can Capitalize on AI (corporatefinanceinstitute.com)
3. AI in Finance: Applications, Examples & Benefits | Google Cloud
4. 33 Examples of AI in Finance 2024 | Built In
5. AI for portfolio management: An overview (leewayhertz.com)
6. Generative AI transforming wealth and asset management | EY - US
7. Use of Artificial Intelligence (AI) in Investment Management | Infosys BPM
8. AI-based credit scoring (leewayhertz.com)
9. Responsible AI Credit Scoring – A Lesson from Upstart.com (degruyter.com)
10. How Fraud Detection Using AI in Banking Works? | Infosys BPM
11. How Is AI Used in Fraud Detection? | NVIDIA Blog
12. (2) (PDF) Deep Learning for Time Series Forecasting: A Survey (researchgate.net)

**Suggested Experiments**

| **Artificial Intelligence in Finance Laboratory (DJS22AEL7012)** | |
|---|---|
| **Sr No.** | **Title of Experiment** |
| 1 | Case Study: Predicting Stock Prices with a Simple Neural Network |
| 2 | Exploratory Data Analysis (EDA) with Financial Data:<br>Use Python libraries like Pandas and Matplotlib to analyze and visualize historical financial data. Identify trends, patterns, and correlations in stock prices, market indices, or other financial indicators. |
| 3 | Predictive Modelling for Stock Prices<br>Build machine learning models (e.g., linear regression, decision trees, or LSTM neural networks) to predict future stock prices based on historical data. Evaluate the performance of the models using metrics like mean squared error (MSE) or accuracy. |
| 4 | Sentiment Analysis of Financial News<br>Use natural language processing (NLP) techniques to analyze the sentiment of news articles or social media posts about specific stocks or companies. Determine the impact of sentiment on stock price movements. |

| | |
|---|---|
| 5 | Case Study: Research a historical example of a financial market crash. Analyze how AI might have influenced the event, for better or worse. |
| 6 | Portfolio Optimization<br>Develop an algorithm to optimize a portfolio of stocks based on risk and return objectives. Use techniques like mean-variance optimization or Monte Carlo simulation. |
| 7 | Credit Risk Assessment<br>Build a machine learning model to predict the creditworthiness of individuals or companies based on financial and non-financial data.<br>Evaluate the model's performance using metrics like precision, recall, and F1-score. |
| 8 | Risk Management:<br>Implement and backtest simple trading strategies (e.g., moving average crossover) using historical stock price data. Use Python libraries like Pandas and NumPy for data manipulation and strategy implementation. |
| 9 | Fraud Detection in Financial Transactions<br>Develop a fraud detection model using machine learning techniques to identify fraudulent transactions in a financial dataset. Evaluate the model's performance using metrics like precision, recall, and ROC-AUC. |
| 10 | Time Series Forecasting for Financial Data<br>Use time series forecasting models (e.g., ARIMA, Prophet) to predict future values of financial indicators like stock prices or exchange rates. Evaluate the accuracy of the forecasts using metrics like mean absolute error (MAE) or mean absolute percentage error (MAPE). |
| 11 | Use of Autotransformers for Long-Term Dependency Modeling in Financial Time Series Data |

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: Artificial Intelligence & Machine Learning | B.Tech. | Semester:VII |
|---|---|---|
| Course: Artificial Intelligence for Cyber Security (DJS22AEC7013) | | |
| Course: Artificial Intelligence for Cyber Security Laboratory (DJS22AEL7013) | | |

**Prerequisite:** Artificial Intelligence, Machine Learning and Computer Network.

**Course Objectives:**

The primary objective of the Artificial Intelligence for Cyber Security subject is to equip students with the knowledge and practical skills to leverage Artificial Intelligence (AI) techniques and tools to enhance cybersecurity efforts. This subject focuses on the integration of AI, machine learning, and deep learning algorithms into cybersecurity applications to detect, prevent, and mitigate cyber threats effectively.

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

1. Understand the various concept of Cyber Security.
2. Apply Machine learning and deep learning techniques to detect intrusions, malware, and anomalous activities in cybersecurity datasets.
3. Evaluate the effectiveness of emerging cybersecurity technologies
4. Describe key ethical considerations in the use of AI in cybersecurity.

| Artificial Intelligence for Cyber Security (DJS22AEC7013) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| **1** | **Introduction to Cyber Security:** Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy. | **07** |
| **2** | **Artificial Intelligence in Cyber Security::** Role of AI in Cyber Security and Security Framework: Artificial Intelligence in Cyber Security, Challenges and Promises, Security Threats of Artificial Intelligence, Use-Cases: Artificial Intelligence Email Observing, Model Stealing & Watermarking, Network Traffic Analysis, Malware Analysis, United Family Healthcare by IBM. | **06** |
| **3** | **Machine Learning in Security:** Introduction Machine Learning in Security domain, Applications of Machine Learning in Cyber Security Domain, Machine Learning: tasks and Approaches, Anomaly Detection, Privacy Preserving Nearest Neighbour Search, Machine | **07** |

| | | |
|---|---|---|
| | Learning Applied to Intrusion Detection, Online Learning Methods for Detecting Malicious Executables. | |
| **4** | **Deep Learning in Security:** Introduction to deep learning in Security domain, Cyber Security Mechanisms Using Deep Learning Algorithms, Applying deep learning in various use cases, Network Cyber threat Detection. Using Deep Learning to Detect DGA-Generated Domains Detecting Non-Malware Threats. | **06** |
| **5** | **Emerging Issues in Cybersecurity:** Evolving Threat Landscape: Advanced Persistent Threats (APTs), Ransomware evolution and double extortion, Cybercrime-as-a-Service (CaaS). Cloud and Hybrid Security: Security risks in multi-cloud environments, Shared responsibility model, Cloud-native security tools and posture management. Emerging Threats and Challenges: Adaptive Honeypots and Honeytokens, Capsule Networks, Threat Intelligence, Security Automation and Orchestration. | **07** |
| **6** | **AI Ethics in Cybersecurity:** Ethical Considerations in AI: Bias and fairness in AI algorithms, Privacy and data protection in AI, Transparency and explainability of AI models, Accountability and responsibility for AI decisions. Ethical Challenges: Bias in AI-powered cybersecurity systems, Privacy implications of AI-driven threat intelligence, Transparency concerns in AI-based security products, Accountability for AI-driven security decisions. | **06** |
| | **TOTAL** | **39** |

***Books Recommended:***

***Textbooks:***

1. Mark Stamp, Artificial Intelligence for Cybersecurity: Techniques, Tools, and Applications, Springer, 2022.
2. Gupta, Brij B., and Quan Z. Sheng, eds. Machine learning for computer and cyber security: principle, algorithms, and practices. CRC Press, 2019.
3. Neeraj Bhargava, Ritu Bhargava, Pramod Singh Rathore, Rashmi Agrawal, Artificial Intelligence and Data Mining Approaches in Security Frameworks Editor(s): 2021.

***Reference Books:***

1. Alessandro Parisi Hands-On Artificial Intelligence for Cybersecurity: Implement smart AI systems for preventing cyber-attacks and detecting threats and network anomalies, Packt Publication, 2019
2. P.W. Singer and Allan Friedman, Cybersecurity and Cyberwar: What Everyone Needs to Know, Oxford University Press,2014
3. Leslie F. Sikos, AI in Cybersecurity, Springer, 2018.
4. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley, 2018

5. Tsai, Jeffrey JP, and S. Yu Philip, eds. Machine learning in cyber trust: security, privacy, and reliability. Springer Science & Business Media, 2009.
6. Machine Learning: A Probabilistic Perspective, Kevin P Murphy, MIT Press.
7. Christopher M. Bishop. Pattern Recognition and Machine Learning. Springer 2006.

***Web Links:***

1. GPU Gen AI in Cybersecurity https://www.coursera.org/learn/gen-ai-in-cybersecurity

**List of Experiments:**

| **Artificial Intelligence for Cyber Security Laboratory (DJSAEL7013)** | |
|---|---|
| **Sr. No.** | **Title of the Experiment** |
| **1** | Python basics review and introduction of common data analysis libraries |
| **2** | Machine learning pipeline for cybersecurity problems<br>Case study: spam email detection |
| **3** | To implement Time Series Analysis techniques to detect anomalies, predict cybersecurity threats, or identify unusual behaviors in network traffic or system logs. The focus will be on using machine learning and statistical models like ARIMA (Auto-Regressive Integrated Moving Average), LSTM (Long Short-Term Memory), and Anomaly Detection techniques to analyze time-dependent data.<br>Case study: DDoS network traffic analysis |
| **4** | A small step into deep learning and convolutional neural network (CNN)<br>Case study: breaking Captchas with neural network |
| **5** | Dimensionality Reduction and Visualization for Network Anomaly Detection using the KDD Cup 1999 Dataset<br>Case study: network anomaly detection and visualization<br>Dataset: KDD Cup 1999 dataset (We will reuse these in lab 6) |
| **6** | To detect anomalies in network traffic data using deep learning-based auto encoders and clustering methods like K-Means, and compare their effectiveness for identifying cyber attacks |
| **7** | To explore the impact of data oversampling techniques on improving the performance of Decision Tree algorithms for intrusion detection in cybersecurity datasets.<br>o Case study: detecting and categorizing network attacks<br>o Dataset: Kaggle credit card fraud detection dataset (We will reuse these in lab 8) |
| **8** | To implement and evaluate ensemble learning algorithms for intrusion detection, and compare their performance against individual classifiers. |
| **9** | To implement and evaluate Machine Learning (ML) and Deep Learning (DL) models for detecting cybersecurity threats (such as intrusion detection, malware, phishing, etc.) in network traffic or datasets. Students will apply supervised learning techniques to classify normal vs. malicious activities based on features extracted from network data. |
| **10** | To apply Cloud AI Solutions (such as Machine Learning, Anomaly Detection, |

| | |
|---|---|
| | and Fraud Detection APIs) to detect fraudulent activities in financial transactions and evaluate the performance of different cloud-based models for fraud prevention. |
| **11** | To develop and evaluate an AI model that detects and analyzes brute force attacks using machine learning techniques on login attempt data. |
| **12** | To use artificial intelligence techniques to analyze cybersecurity incidents, identify patterns, and provide actionable insights for threat detection and response. |

Batch wise laboratory work of minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

SVKM's DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING Estd. 1994 CREATING WINGINEERS

| **Program: B.Tech in Artificial Intelligence and Machine Learning** | **Final Year B.Tech** | **Semester : VII** |
|---|---|---|
| **Course: Product Lifecycle Management** | **Course Code: DJS22ILO7011** | |

| **Teaching Scheme (Hours / week)** | | | | **Evaluation Scheme** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Continuous Assessment Marks (A)** | | | **Semester End Examination Marks (B)** | | | **Total marks (A+B)** |
| **Lectures** | **Practical** | **Tutorial** | **Total Credits** | **Term Test 1** | **Term Test 2** | **Total** | **Theory** | | | |
| | | | | **20** | **15** | **35** | **65** | | | **100** |
| | | | | **Term Work** | | | **Laboratory Examination** | | | |
| **3** | **--** | **--** | **3** | **Laboratory Work** | **Tutorial / Mini project / presentation/ Journal/ Practical** | **Total Term work** | **Oral** | **Practical** | **Oral & Practical** | **--** |
| | | | | **--** | **--** | **--** | **--** | **--** | **--** | |

**Prerequisite:** Knowledge of basic concepts of Management.

**Course Objectives:** The objective of the course is:

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

**Course Outcomes:** On completion of the course, 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

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **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<br>**PLM Strategies:** Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM | **09** |
| **2** | **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 | **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<br>**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. | **07** |
| **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 | **07** |
| | **Total** | **39** |

**Books Recommended:**

**Text books:**

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

**Reference Books:**

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

**Evaluation Scheme:**

**Continuous Assessment (A):**

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project/Group discussion/any other of 15 marks will be conducted during the semester.
2. Total duration allotted for writing Term Test 1 paper is 1 hr.
3. Total duration allotted for writing Term Test 2 paper is 45 minutes.

**Semester End Examination (B):**

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

| Program: B.Tech in Artificial Intelligence and Machine Learning | Final Year B.Tech | Semester : VII |
|---|---|---|
| Course: Management Information System | Course Code: DJS22ILO7012 | |

| Teaching Scheme (Hours / week) | | | | Evaluation Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment Marks (A) | | | Semester End Examination Marks (B) | | | Total marks (A+B) |
| Lectures | Practical | Tutorial | Total Credits | Term Test 1 | Term Test 2 | Total | Theory | | | |
| | | | | 20 | 15 | 35 | 65 | | | 100 |
| | | | | Term Work | | | Laboratory Examination | | | -- |
| 3 | -- | -- | 3 | Laboratory Work | Tutorial / Mini project / presentation/ Journal/ Practical | Total Term work | Oral | Practical | Oral & Practical | |
| | | | | -- | -- | -- | -- | -- | -- | |

**Course Objectives:** The objective of the course is:

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

**Course Outcomes:** Learner will be able t

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

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **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. | **03** |
| **2** | **Information Technologies:** Hardware and Software<br>**Computer Systems:** End User and Enterprise Computing<br>**Computer Peripherals:** Input, Output, and Storage Technologies<br>**Application Software:** End User Applications<br>**System Software:** Computer System Management<br>**Data Resource Management:** Technical Foundations of Database Management, Managing Data Resources, Big data, Data warehouse and Data Marts**,** Knowledge Management<br>**Networks:** The Networked Enterprise (Wired and wireless), Pervasive computing, Cloud Computing models | **07** |
| **3** | **MIS Tools and applications for Decision making:** ERP and ERP support of Business Process Reengineering,<br>**Business intelligence (BI):** Managers and Decision Making, BI for Data analysis and Visualization<br>**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.<br>**Enterprise and Global Management of Information Technology:** Managing Information Technology, Managing Global IT. | **08** |
| | **Total** | **39** |

**Books Recommended:**

**Reference Books:**

1. Management Information Systems, 11th edition by James A O'Brien, George M., RameshBehl.
2. Kelly Rainer, Brad Prince, Management Information Systems, Wiley.
3. K.C. Laudon and J.P. Laudon, Management Information Systems: Managing theDigital Firm, 10th Ed., Prentice Hall, 2007.
4. D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization,Prentice Hall, 2008

**Evaluation Scheme:**

**Continuous Assessment (A):**

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project/Group discussion/any other of 15 marks will be conducted during the semester.
2. Total duration allotted for writing Term Test 1 paper is 1 hr.
3. Total duration allotted for writing Term Test 2 paper is 45 minutes.

**Semester End Examination (B):**

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

| Program: B.Tech in Artificial Intelligence and Machine Learning | Final Year B.Tech | Semester : VII |
|---|---|---|
| Course: Operations Research | Course Code: DJS22ILO7013 | |

| Teaching Scheme (Hours / week) | | | | Evaluation Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment Marks (A) | | | Semester End Examination Marks (B) | | | Total marks (A+B) |
| Lectures | Practical | Tutorial | Total Credits | Term Test 1 | Term Test 2 | Total | Theory | | | |
| | | | | 20 | 15 | 35 | 65 | | | 100 |
| | | | | Term Work | | | Laboratory Examination | | | -- |
| 3 | -- | -- | 3 | Laboratory Work | Tutorial / Mini project / presentation/ Journal/ Practical | Total Term work | Oral | Practical | Oral & Practical | |
| | | | | -- | -- | -- | -- | -- | -- | |

**Prerequisites:** Basic Knowledge of Algebra, Probability and Statistics.

**Course Objectives:** The objective of the course is:

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 programmingmodels.

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

1. Convert a real-world problem in to a Linear Programming Problem and analyse the solutionobtained 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 ofdynamic 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 suchas inventory, queuing and recommend solutions for them.
7. Understand need for right replacement policy and determine optimal replacement age.

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Introduction to Operations Research:** Concept of decision making. Definition of OR. Formulation of decision problem as OR model, Concept of Optimization,<br>**Linear Programming Problem:** Mathematical Formulation. Finding optimal solution - Graphical method, Simplex Method, Big M-method, Two Phase Method.<br>Duality, Primal – Dual construction, Symmetric and Asymmetric Dual.<br>Dual Simplex Method. | **10** |
| **2** | **Assignment Problems:** Mathematical Formulation, Finding optimal solution - Hungarian Method<br>**Transportation problem:** Mathematical Formulation, Finding initial basic feasible solution – Northwest corner rule, row minima, column minima, least cost method and Vogel's approximation method.<br>Optimality test: the stepping stone method and MODI method.<br>Improving the solution. | **08** |
| **3** | **Dynamic Programming**: Bellman's Principle of optimality - Applications of dynamic programming- Employment smoothening problem, capital budgeting problem, shortest path problem, cargo loading problem | **05** |
| **4** | **Queuing Models:** Characteristics of queuing models.<br>Single Channel – Single and multi phase servers, Poisson arrivals, exponential service time - with infinite population and finite population models – with infinite and finite capacity.<br>Multichannel – Single phase server - Poisson arrivals, exponential service time with infinite population.<br>**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.<br>Approximate methods - Iterative method, m x 2 & 2 x n games -Graphical method and method of sub-games.<br>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.<br>**Replacement Models:** Replacement of items that deteriorate with time - when money value is not counted and counted, Replacement of items that fail suddenly – individual and group replacement policy. | **06** |
| | **Total** | **39** |

**Note:** Educator is expected to introduce relevant software available for solving various mathematical models.

**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 Liebermann, 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

**Evaluation Scheme:**

**Continuous Assessment (A):**

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project/Group discussion/any other of 15 marks will be conducted during the semester.
2. Total duration allotted for writing Term Test 1 paper is 1 hr.
3. Total duration allotted for writing Term Test 2 paper is 45 minutes.

**Semester End Examination (B):**

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

| Program: B.Tech in Artificial Intelligence and Machine Learning | Final Year B.Tech | Semester : VII |
|---|---|---|
| Course: Cyber Security and Laws | Course Code: DJS22ILO7014 | |

| Teaching Scheme (Hours / week) | | | | Evaluation Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment Marks (A) | | | Semester End Examination Marks (B) | | | Total marks (A+B) |
| Lectures | Practical | Tutorial | Total Credits | Term Test 1 | Term Test 2 | Total | Theory | | | |
| | | | | 20 | 15 | 35 | 65 | | | 100 |
| | | | | Term Work | | | Laboratory Examination | | | -- |
| 3 | -- | -- | 3 | Laboratory Work | Tutorial / Mini project / presentation/ Journal/ Practical | Total Term work | Oral | Practical | Oral & Practical | |
| | | | | -- | -- | -- | -- | -- | -- | |

**Course Objectives:** The objective of the course is:

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

**Course Outcomes:** On completion of the course, 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 regulatecyberspace.
4. Impart the knowledge of Information Technology Act and legal frame work of right to privacy,data security and data protection.

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **Introduction to Cybercrime**:<br>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,, Phishing Identity Theft (ID Theft) ,How criminal plan the attacks, Social Engineering, Cyber stalking . | **10** |
| **2** | **Cyber Threats Analysis**<br>Knowledge of Dynamic and Deliberate Targeting<br>Knowledge of Indications and Warning<br>Knowledge of Internal Tactics to Anticipate and/or, Emulate Threat Capabilities and Actions<br>Knowledge of Key Cyber Threat Actors and their EquitiesKnowledge of Specific Target Identifiers and Their Usage | **06** |
| **3** | **Electronic Business and legal issues**<br>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-Payment Threats & Protections, Security for E-Commerce. | **06** |
| **4** | **Indian IT Act**<br>Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments<br>**Security aspect in cyber Law**<br>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**<br>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.<br>OWASP Top Ten Project, GDPR (General Data Protection Regulation), NIST (National Institute of Standards and Technology), CIS Controls (Center for Internet Security Controls) | **09** |
| | **Total** | **39** |

**Books Recommended:**

**Reference Books and Material:**

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 andAnalytics, Springer
6. Cyber Law & Cyber Crimes, Advocate Prashant Mali; Snow White Publications, Mumbai
7. Nina Godbole, Information Systems Security, Wiley India, New Delhi
8. Kennetch J. Knapp, Cyber Security &Global Information Assurance Information SciencePublishing.
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

**Evaluation Scheme:**

**Continuous Assessment (A):**

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project/Group discussion/any other of 15 marks will be conducted during the semester.
2. Total duration allotted for writing Term Test 1 paper is 1 hr.
3. Total duration allotted for writing Term Test 2 paper is 45 minutes.

**Semester End Examination (B):**

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

| Program: B.Tech in Artificial Intelligence and Machine Learning | Final Year B.Tech | Semester : VII |
|---|---|---|
| Course: Personal Finance Management | Course Code: DJS22ILO7015 | |

| Teaching Scheme (Hours / week) | | | | Evaluation Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment Marks (A) | | | Semester End Examination Marks (B) | | | Total marks (A+B) |
| Lectures | Practical | Tutorial | Total Credits | Term Test 1 | Term Test 2 | Total | Theory | | | |
| | | | | 20 | 15 | 35 | 65 | | | 100 |
| | | | | Term Work | | | Laboratory Examination | | | -- |
| 3 | -- | -- | 3 | Laboratory Work | Tutorial / Mini project / presentation/ Journal/ Practical | Total Term work | Oral | Practical | Oral & Practical | |
| | | | | -- | -- | -- | -- | -- | -- | |

**Prerequisites:** Basic Knowledge of Algebra, Probability and Statistics.

**Course Objectives:** The objective of the course is:

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 familiarize the students with microfinance for accelerating the expansion of local microbusinesses.

**Course Outcomes:** On completion of the course, 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.

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| 1 | **Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial inclusion.<br>**Introduction to Personal Finance**<br>Person Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services.<br>Consumer Credit: Advantages, Disadvantages, Sources and Costs. | **07** |
| 2 | **Personal Financial Management**<br>**Loans:** Home, Car, Education, Personal, Loan against property and Jewel loan.<br>**Insurance:** Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance.<br>**Investment:** Investing Basics and Evaluating Bonds, Investing in Stocks and Investing in Mutual Funds, Planning for the Future. | **07** |
| 3 | **Income Tax**<br>**Income Tax Act Basics**- Introduction to Income Tax Act, 1961<br>**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.<br>**Tax Management, Administrative Procedures and ICDS** - TDS, TCS and Advance Tax Administrative Procedures, ICDS. | **07** |
| 4 | **Goods and Services Tax**<br>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.<br>**Levy and Collection of GST**<br>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 | **09** |
| 5 | **Introduction to Micro – finance**<br>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).<br>**Models in Microfinance** - Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements & Challenges,<br>**Institutional Mechanism**<br>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. | **09** |
| | **Total** | **39** |

**Books Recommended:**

**Reference Books:**

1. Banking and Financial Sector Reforms in India , by Asha Singh, M.S. Gupta, SerialsPublication.
2. Indian Banking Sector: Essays and Issues (1st) , by M.S. Gupta & J.B. Singh, SerialsPublication.
3. Basics Of Banking & Finance , by K.M. Bhattacharya O.P. Agarwal , Himalaya PublishingHouse
4. Agricultural Finance And Management, by S. Subba Reddy , P. Raghu Ram .
5. The Indian Financial System And Development , by Dr.Vasant Desai, Himalaya PublishingHouse; Fourth Edition
6. Income Tax Management , Simple Way of Tax Management, Tax Planning and Tax Saving , By Sanjay Kumar Satapathy
7. Direct Tax System Income Tax by Dr. R. K. Jain, SBPD Publications.
8. Simplified Approach to GST Goods and Services Tax, By S K Mishra , EducreationPublishing.
9. Introduction To Microfinance , By Todd A Watkins , World Scientific Publishing Company

**Evaluation Scheme:**

**Continuous Assessment (A):**

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project/Group discussion/any other of 15 marks will be conducted during the semester.
2. Total duration allotted for writing Term Test 1 paper is 1 hr.
3. Total duration allotted for writing Term Test 2 paper is 45 minutes.

**Semester End Examination (B):**

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Prepared by Checked by Head of the Department Vice Principal Principal

| Program: B.Tech in Artificial Intelligence and Machine Learning | Final Year B.Tech | Semester : VII |
|---|---|---|
| Course: Energy Audit and Management | Course Code: DJS22ILO7016 | |

| Teaching Scheme (Hours / week) | | | | Evaluation Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment Marks (A) | | | Semester End Examination Marks (B) | | | Total marks (A+B) |
| Lectures | Practical | Tutorial | Total Credits | Term Test 1 | Term Test 2 | Total | Theory | | | |
| | | | | 20 | 15 | 35 | 65 | | | 100 |
| | | | | Term Work | | | Laboratory Examination | | | -- |
| 3 | -- | -- | 3 | Laboratory Work | Tutorial / Mini project / presentation/ Journal/ Practical | Total Term work | Oral | Practical | Oral & Practical | |
| | | | | -- | -- | -- | -- | -- | -- | |

**Course Objectives:** The objective of the course is:

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 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.

**Course Outcomes:** On completion of the course, 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.

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **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.<br>**Financial analysis techniques:** Simple payback period, NPV, Return on investment (ROI) Internal rate of return (IRR). | **09** |
| **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 water pumps, compressor, fan and blower. industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives. | **10** |
| **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. | **09** |
| **5** | **Energy conservation in Buildings**: Energy Conservation Building Codes (ECBC):Green Building, LEED rating,<br>Application of Non-Conventional and Renewable Energy Sources, Energy sources and energy management in electric vehicles. | **06** |
| | **Total** | **39** |

**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*

**Evaluation Scheme:**

**Continuous Assessment (A):**

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project/Group discussion/any other of 15 marks will be conducted during the semester.
2. Total duration allotted for writing Term Test 1 paper is 1 hr.
3. Total duration allotted for writing Term Test 2 paper is 45 minutes.

**Semester End Examination (B):**

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

| Program: B.Tech in Artificial Intelligence and Machine Learning | Final Year B.Tech | Semester : VII |
|---|---|---|
| Course: Disaster Management and Mitigation Measures | Course Code: DJS22ILO7017 | |

| Teaching Scheme (Hours / week) | | | | Evaluation Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment Marks (A) | | | Semester End Examination Marks (B) | | | Total marks (A+B) |
| Lectures | Practical | Tutorial | Total Credits | Term Test 1 | Term Test 2 | Total | Theory | | | |
| | | | | 20 | 15 | 35 | 65 | | | 100 |
| | | | | Term Work | | | Laboratory Examination | | | -- |
| 3 | -- | -- | 3 | Laboratory Work | Tutorial / Mini project / presentation/ Journal/ Practical | Total Term work | Oral | Practical | Oral & Practical | |
| | | | | -- | -- | -- | -- | -- | -- | |

**Course Objectives:** The objective of the course is:

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.

**Course Outcomes:** On completion of the course, 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.

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **1** | **General Information about Disaster:**<br>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.<br>Study of Natural disasters:<br>Flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion etc.<br>Study of Human/Technology Induced Disasters:<br>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. | **09** |
| **2** | **Disaster Management:**<br>Brief Introduction, Disaster management cycle, Evolution of Disaster and Disaster management in India, Disaster management acts, policies and guidelines, laws of emergencies etc.<br>Prior, During and Post disaster management activities:<br>(Preparedness, strengthening emergency centers, Logistics, optimum resource management, emergency response and relief, Training, Public awareness, Research, Reconstruction of essential services and livelihood restoration. | **08** |
| **3** | **Institutional framework and Mechanism for disaster management in India:**<br>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.<br>Financial Relief During disaster (State, National and International Disaster Assistance) | **07** |
| **4** | **Disaster risk reduction and Mitigation Measures:**<br>Need of disaster prevention and mitigation, mitigation guiding principles, challenging areas, structural and non-structural measures for disaster risk reduction.<br>Mitigation measures for flood, earthquake, cyclone monitoring, air quality, water quality, climate change, land use, winter storms and aquatic biology etc.<br>Use of information management, GIS, GPS and remote sensing Mitigation measure.<br>Do's and don'ts in case of disasters and effective implementation of relief aids. | **08** |
| **5** | **Case studies on disaster (National /International):**<br>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), 26th July 2005 Mumbai flood, Chernobyl meltdown and so on.<br>(Discuss case studies on disaster with respect to reason for the disaster, incidents, effects of disaster, present scenario and safety measures taken) | **07** |
| | **Total** | **39** |

**Books Recommended:**
**Reference Books and Reports:**

1. Disaster Management, by Harsh K.Gupta, Universities Press Publications (2003).
2. Disaster Management: An Appraisal of Institutional Mechanisms in India, by O.S.Dagur, published by Centre for land warfare studies, New Delhi, 2011.
3. Introduction to International Disaster Management, by Damon Copolla, Butterworth Heinemann Elsevier Publications (2015).
4. Disaster Management Handbook, by Jack Pinkowski, CRC Press, Taylor and Francis group (2008).
5. Disaster management & rehabilitation, by Rajdeep Dasgupta, Mittal Publications, New Delhi (2007).
6. Natural Hazards and Disaster Management, Vulnerability and Mitigation, by R B Singh, Rawat Publications (2006).
7. Concepts and Techniques of GIS, by C.P.Lo Albert, K.W. Yonng, Prentice Hall (India) Publications(2006).
8. Risk management of natural disasters, by Claudia G. Flores Gonzales, KIT Scientific Publishing (2010).
9. Disaster Management – a disaster manger's handbook, by W. Nick Carter, Asian Development Bank (2008).
10. Disaster Management in India, by R. K. Srivastava, Ministry of Home Affairs, GoI, New Delhi(2011)
11. The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy, by Wil Mara,Marshall Cavendish Corporation, New York, 2011.
12. The Fukushima 2011 Disaster, by Ronald Eisler, Taylor & Francis, Florida, 2013.
(Learners are expected to refer reports published at national and international level and updated information available on authentic web sites)

**Evaluation Scheme:**

**Continuous Assessment (A):**

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project/Group discussion/any other of 15 marks will be conducted during the semester.
2. Total duration allotted for writing Term Test 1 paper is 1 hr.
3. Total duration allotted for writing Term Test 2 paper is 45 minutes.

**Semester End Examination (B):**

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

| Program: B.Tech in Artificial Intelligence and Machine Learning | Final Year B.Tech | Semester : VII |
|---|---|---|
| Course: Science of Well-being | Course Code: DJS22ILO7018 | |

| Teaching Scheme (Hours / week) | | | | Evaluation Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment Marks (A) | | | Semester End Examination Marks (B) | | | Total marks (A+B) | |
| Lectures | Practical | Tutorial | Total Credits | Term Test 1 | Term Test 2 | Total | Theory | | | | |
| | | | | 20 | 15 | 35 | 65 | | | 100 | |
| | | | | Term Work | | | Laboratory Examination | | | -- | |
| 3 | -- | -- | 3 | Laboratory Work | Tutorial / Mini project / presentation/ Journal/ Practical | Total Term work | Oral | Practical | Oral & Practical | | |
| | | | | -- | -- | -- | -- | -- | -- | | |

**Course Objectives:** The objective of the course is:

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.

**Course Outcomes:** On completion of the course, 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.

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **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.<br>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:**<br>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.<br>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 stressors and their health consequences, relation between stress and illness from different perspectives association between stress related physiological mechanisms and different illnesses. | **09** |
| **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. | **08** |
| **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.<br>Concept of coping, Ways of coping and stress management, basic knowledge about stress management, various techniques of stress management, stress management programs.<br>Mental strengths and virtues, Hope, Optimism, Resilience – concept, pathways and models, Meditation and Self-introspection. | **08** |
| | **Total** | **39** |

**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 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.

**Evaluation Scheme:**

**Continuous Assessment (A):**

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project/Group discussion/any other of 15 marks will be conducted during the semester.
2. Total duration allotted for writing Term Test 1 paper is 1 hr.
3. Total duration allotted for writing Term Test 2 paper is 45 minutes.

**Semester End Examination (B):**

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

| Program: B.Tech in Artificial Intelligence and Machine Learning | Final Year B.Tech | Semester : VII |
|---|---|---|
| Course: Research Methodology | Course Code: DJS22ILO7019 | |

| Teaching Scheme (Hours / week) | | | | Evaluation Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment Marks (A) | | | Semester End Examination Marks (B) | | | Total marks (A+B) |
| Lectures | Practical | Tutorial | Total Credits | Term Test 1 | Term Test 2 | Total | Theory | | | |
| | | | | 20 | 15 | 35 | 65 | | | 100 |
| | | | | Term Work | | | Laboratory Examination | | | |
| 3 | -- | -- | 3 | Laboratory Work | Tutorial / Mini project / presentation/ Journal/ Practical | Total Term work | Oral | Practical | Oral & Practical | -- |
| | | | | -- | -- | -- | -- | -- | -- | |

**Prerequisites:** Basic Knowledge of Probability and Statistics.

**Course Objectives:** The objective of the course is:

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

**Course Outcomes:** On completion of the course, 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

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| 1 | **Basic Research Concepts**<br>Meaning of research, Objectives of research, Types of research, Significance of research Research process | **07** |
| 2 | **Research Methodology:**<br>Identification of research problem, Literature review, Formulation of hypothesis, Formulation of Research design. | **09** |
| 3 | **Research and Sample Design:**<br>Meaning of research and sample design, Need of research design, Features of good research design, Important concepts, Different research designs, Types of sampling designs | **09** |
| 4 | **Data Collection and Data Analysis:**<br>Types of data, Methods for collecting data: Experiments and surveys, Collection of primary and secondary data, Hypothesis testing and interpretation of Data | **09** |
| 5 | **Interpretation and Report Writing:**<br>Interpretation and drawing conclusions on the research, Preparation of the report, Ethical Issues | **05** |
| | **Total** | **39** |

**Books Recommended:**

***Reference Books:***

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

**Evaluation Scheme:**

**Continuous Assessment (A):**

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project/Group discussion/any other of 15 marks will be conducted during the semester.
2. Total duration allotted for writing Term Test 1 paper is 1 hr.
3. Total duration allotted for writing Term Test 2 paper is 45 minutes.

**Semester End Examination (B):**

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

| Program: B.Tech in Artificial Intelligence and Machine Learning | Final Year B.Tech | Semester : VII |
|---|---|---|
| Course: Public Systems and Policies | Course Code: DJS22ILO7020 | |

| Teaching Scheme (Hours / week) | | | | Evaluation Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment Marks (A) | | | Semester End Examination Marks (B) | | | Total marks (A+B) |
| Lectures | Practical | Tutorial | Total Credits | Term Test 1 | Term Test 2 | Total | Theory | | | |
| | | | | 20 | 15 | 35 | 65 | | | 100 |
| | | | | Term Work | | | Laboratory Examination | | | |
| 3 | -- | -- | 3 | Laboratory Work | Tutorial / Mini project / presentation/ Journal/ Practical | Total Term work | Oral | Practical | Oral & Practical | -- |
| | | | | -- | -- | -- | -- | -- | -- | |

**Prerequisites:** Basic Knowledge of Social science and Current affairs

**Course Objectives:** The objective of the course is:

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.

**Course Outcomes:** On completion of the course, 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.

| Detailed Syllabus (Unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration in Hours** |
| **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. | **09** |
| **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. | **07** |
| **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 and Externalities, Taxation Policy and its impact, Income distribution, redistribution and social security issues Fiscal & Budgetary Policy, Fiscal Federalism in India. | **11** |
| **5** | **Case Studies in Expenditure Policy: Public Services**<br>A) National Defense B) Highways C) Outdoor Recreation D) Education | **06** |
| | **Total** | **39** |

**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, NewDelhi.
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.

**Evaluation Scheme:**

**Continuous Assessment (A):**

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project/Group discussion/any other of 15 marks will be conducted during the semester.
2. Total duration allotted for writing Term Test 1 paper is 1 hr.
3. Total duration allotted for writing Term Test 2 paper is 45 minutes.

**Semester End Examination (B):**

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

| Program: Artificial Intelligence & Machine Learning | B. Tech | Semester: VII |
|---|---|---|
| Course: Project Stage I (DJS22AMP704) | | |

**Course Objectives:**

The Project work enables students to develop further skills and knowledge gained during the program by applying them to the analysis of a specific problem or issue, via a substantial piece of work carried out over an extended period. For students to demonstrate proficiency in the design of a research project, application of appropriate research methods, collection and analysis of data and presentation of results.

**Guidelines:**

**1. Project Topic:**

- To proceed with the project work it is very important to select a right topic. Project can be undertaken on any subject addressing the programme. Research and development projects on problems of practical and theoretical interest should be encouraged.
- Project work must be carried out by the group of at least two students and maximum three and must be original.
- Students can certainly take ideas from anywhere, but be sure that they should evolve them in the uniqueway to suit their project requirements.
- The project work can be undertaken in a research institute or organization/company/any business establishment.
- Student must consult internal guide along with external guide (if any) in selection of topic.
- Head of department and senior staff in the department will take decision regarding selection of projects.

Student has to submit weekly progress report to the internal guide and whereas internal guide has to keep track on the progress of the project and also has to maintain attendance report. This progress report can beused for awarding term work marks.

- In case of industry projects, visit by internal guide will be preferred.

**2. Project Report Format:**

At the end of semester, a project report should preferably contain at least following details: -

- Abstract
- Introduction
- Literature Survey
  - Survey Existing system
  - Limitation Existing system or research gap
  - Problem Statement and Objective

- Scope
- Proposed System
  - Analysis/Framework/ Algorithm
  - Details of Hardware & Software
  - Design details
  - Methodology (your approach to solve the problem)
- Implementation Plan for next semester
- Conclusion
- References

**Evaluation Scheme:**

***Semester End Examination (A):***

*Laboratory:*

- Oral examination of Project Stage-I should be conducted by Internal and External examiners.
- Students have to give presentation and demonstration on the Project

***Continuous Assessment (B):***

*Laboratory: (Term work)*

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

1. Weekly Attendance on Project Day
2. Project work contribute
3. Mid-Sem Review
4. Project Report
5. Term End Presentation

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