Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

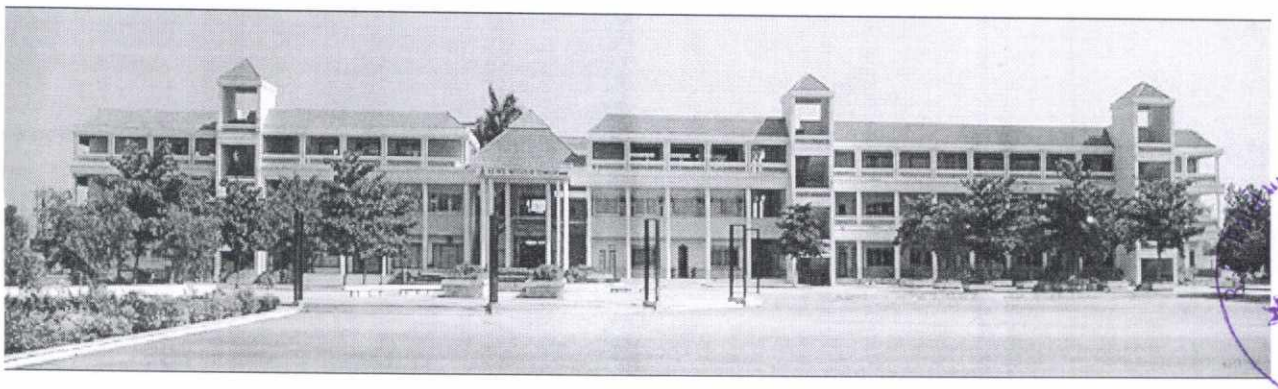
(An Autonomous Institute)

Course Structure and Syllabus

Final Year B. Tech

Artificial Intelligence and Machine Learning

With effect from Year 2025-26



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Final Year B. Tech Artificial Intelligence and Machine Learning Semester-VII (w.e.f. 2025-26)

Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit	
							Continuous Assessment (CA)							
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2)	ESE			
				L	T	P	[A]			[B]	[C]	[A+B+C]		
1	PC	22PCAI7010T	High Performance Computing	3			25	10	10	10	65	100	3	4
	PC	22PCAI7010L	High Performance Computing Laboratory			2	25				25	50	1	
2	PC	22PCAI7020T	Large Language Models	3			25	10	10	10	65	100	3	4
	PC	22PCAI7020L	Large Language Models Laboratory			2	25				25	50	1	
3	PC	22PCAI7030T	Big Data Analytics	2			25	10	10	10	65	100	2	3
	PC	22PCAI7030L	Big Data Analytics Laboratory			2	25				25	50	1	
4@	PE	22PEAI7041T	Robotics	3			25	10	10	10	65	100	3	4
		22PEAI7041L	Robotics Laboratory			2	25				25	50	1	
		22PEAI7042T	Artificial Intelligence in Finance	3			25	10	10	10	65	100	3	
		22PEAI7042L	Artificial Intelligence in Finance Laboratory			2	25				25	50	1	
		22PEAI7043T	Artificial Intelligence in Cyber Security	3			25	10	10	10	65	100	3	
		22PEAI7043L	Artificial Intelligence in Cyber Security Laboratory			2	25				25	50	1	
5#	OE	22OEAI7051T	Product Life Cycle Management	3			25	10	10	10	65	100	3	3
		22OEAI7052T	Management Information System	3			25	10	10	10	65	100	3	
		22OEAI7053T	Operations Research	3			25	10	10	10	65	100	3	
		22OEAI7054T	Cyber Security and Laws	3			25	10	10	10	65	100	3	
		22OEAI7055T	Personal Finance Management	3			25	10	10	10	65	100	3	
		22OEAI7056T	Energy Audit and Management	3			25	10	10	10	65	100	3	
		22OEAI7057T	Disaster Management and Mitigation Measures	3			25	10	10	10	65	100	3	
		22OEAI7058T	Science of Well-being	3			25	10	10	10	65	100	3	
		22OEAI7059T	Research Methodology	3			25	10	10	10	65	100	3	
		22OEAI70510T	Public Systems and Policies	3			25	10	10	10	65	100	3	
6	PJ	22PJAI7060L	Project Stage-II			8	25				25	50	4	4
7	HM	22HMAI7070L	Employability Skill Development Program-III			2	25				25	50	1	1
			Total	14		18	275			50	475	800	23	

@Any 1 Professional Elective Course, #Any 1 Institute Professional Elective Course

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R. C. Patel Institute of Technology, Shirpur
SES
Autonomous

Semester - VII

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
High Performance Computing (22PCAI7010T)		
High Performance Computing Laboratory (22PCAI7010L)		

Prerequisite: System Fundamentals

Course Objective(s):

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, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand different parallel processing approaches and platforms involved in achieving High Performance Computing.	L2	Understand
CO2	Explore GPU and CUDA Programming	L3	Apply
CO3	Understand the principles of Grid and Cloud Computing with practical examples and applications.	L2	Understand
CO4	Analyze the performance measures in high performance computing	L4	Analyze
CO5	Discover the advanced topic in GPU including libraries and framework	L3	Apply

High Performance Computing (22PCAI7010T) Course Contents

Unit-I — 04 Hrs.

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.

Unit-II — 06 Hrs.

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)

Unit-III — 08 Hrs.

GPU and CUDA Programming:

Overview of GPU, evolution of GPU, CPU vs. GPU, overview of CUDA: Features, Benefits, Architecture. Programming Model CUDA: Kernels and kernel launches, Thread and block indexing, CUDA Memory Management: Memory Hierarchy and Memory Management, Case Studies: computational biology, data analytics, and machine learning.

Unit-IV — 07 Hrs.

Grid and Cloud Computing:

Data & Computational Grids, Grid Architectures and its relation to various Distributed Technologies, Examples of The Grid Computing, Cloud Computing, High Performance Cloud Computing (HPC2), Cloud Tensor Processing Units (TPUs).

Unit-V — 08 Hrs.

Performance Optimization:

Speedup, Efficiency and Scalability, Amdahl's Law, Gustafson's Law, Weak vs. Strong Scaling, Performance Bottlenecks, Data Races and Determinism, Data Race Avoidance, Profiling and performance analysis tools for GPUs, Techniques for optimizing GPU performance (warp divergence, loop u

rolling, vectorization), Memory bandwidth optimization techniques, Advanced GPU programming concepts (shared memory atomics, warp shuffling)

Case Studies: Scientific Computing with CUDA/Real-life application

Unit-VI 06 Hrs.

Advanced Topics in GPU:

Introduction to GPU accelerated libraries (cuBLAS, cuDNN, cuGraph), GPU computing frameworks (TensorFlow, PyTorch) and their integration with GPUs, Introduction to GPU clusters and distributed GPU computing, Cluster Setup & its Advantages. Case studies : Real- world applications of GPU computing

High Performance Computing Laboratory (22PCAI7010L)

List of Laboratory Experiments

Suggested Experiments: (Any 08)

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

10. Integrate CUDA-accelerated code with data science frameworks like TensorFlow or PyTorch to develop and run GPU-accelerated machine learning models for practical applications.

11. Perform the Log Analysis-Based Resource and Execution Time Improvement

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

Oral examination will be based on the entire syllabus, including the practicals performed during laboratory sessions.

Text Books:

1. Edson Borin, Lúcia Maria A. Drummond , Jean-Luc Gaudiot, Alba Melo, Maicon Melo Alves, "High Performance Computing in Clouds: Moving HPC Applications to a Scalable and Cost-Effective Environment", Philippe Olivier Alexandre Navaux, Springer, ISBN-13 978- 3031297687, 2023.

2. Alexander Heifetz, "High Performance Computing for Drug Discovery and Biomedicine", Springer Nature, ISBN, 1071634496, 9781071634493, 2023.

3. Richard Ansorge, "Programming in Parallel with CUDA", Cambridge University Press, ISBN-13 978-1108479530, 2022.

4. Robert Robey, Yuliana Zamora, "Parallel and High Performance Computing", Manning publisher, ISBN-13 978-1617296468, 2021.

5. Sergey A. Babkin, "The Practice of Parallel Programming", CreateSpace Publisher ISBN-13: 978-1451536614, Online Edition 2021.

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

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

Reference Books:

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

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

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

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

Web Links:

Parallel Processing:

1. https://hpc.llnl.gov/documentation/tutorials/introduction-parallel-computing-tutorial
2. https://nptel.ac.in/courses/106108055
3. https://nptel.ac.in/courses/112105293

Introduction to high performance computing:

1. https://www.cecam.org/workshop-details/an-introduction-to-high-performance-computing-1270

GPU and CUDA Programming:

1. https://www.cs.cmu.edu/afs/cs/academic/class/15418s18/www/lectures/06_gpuarch.pdf

Grid and Cloud Computing:

1. https://aits-tpt.edu.in/wp-content/uploads/2022/06/GCC-min.pdf

Performance Optimization:

1. https://link.springer.com/chapter/10.1007/978-3-642-03644-6_12

Case Study:

1. https://developer.nvidia.com/blog/a-cuda-dynamic-parallelism-case-study-panda/
2. https://www.researchgate.net/publication/265817932_CUDA-based_scientific_computing_Tools_and_selectec

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Large Language Models (22PCAI7020T)		
Large Language Models Laboratory (22PCAI7020L)		

Prerequisite: Natural Language Processing, Deep Learning

Course Objective(s):

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:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	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).	L2	Understand
CO2	Explore various LLM architectures and techniques like BERT, GPT-3, T5 and Large Reasoning Models.	L2	Understand
CO3	Apply prompt engineering techniques for effective LLM interaction and understand the concept of Retrieval Augmented Generation (RAG) and its role in LLMs.	L3	Apply
CO4	Understand the different data modalities using Multimodal Architectures.	L5	Evaluate

Large Language Models (22PCAI7020T)
Course Contents

Unit-I — 08 Hrs.

Introduction to Generative AI & Transformer Architecture:

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).

Unit-II — 06 Hrs.

Language Models - Unveiling the Power of Words:

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.

Unit-III — 05 Hrs.

Large Reasoning Models:

Deep seek- v2: Multi head Latent Attention, Deep seek MoE, Knowledge Distillation, Mistral 7-B Architecture: sliding Window attention, Grouped Query Attention, Titans: Learning to memorize at test time, Knowledge Distillation, QWQ models.

Unit-IV — 06 Hrs.

Prompt Engineering & Agentic AI:

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.

Unit-V — 08 Hrs.

Retrieval Augmentation & Generation (RAG) and Fine-tuning for LLMs:

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-Finetuning vs LoRA vs QLoRA, Fine-Tuning LLMs for different downstream tasks.

Unit-VI 06 Hrs.

Multimodal Architectures - Beyond Text:

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 .

Large Language Models (22PCAI7020L)

List of Laboratory Experiments

Suggested Experiments: (Any 08)

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

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

Oral examination will be based on the entire syllabus, including the practicals performed during laboratory sessions.

Text Books:

1. Ben Auffarth, "Generative AI with LangChain: Build large language model (LLM) apps with Python, ChatGPT, and other LLMs", Packt Publishing, 2023.

2. Valentina Alto, "Modern Generative AI with ChatGPT and OpenAI Models", Packt Publishing, 2023.

3. Jay Alammar, Maarten Grootendorst, "Hands-On Large Language Models", O'Reilly, 2023.

4. Thushan Ganegedara, "Natural Language Processing with TensorFlow", Packt Publishing, 2nd 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

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Big Data Analytics (22PCAI7030T)		
Big Data Analytics Laboratory (22PCAI7030L)		

Prerequisite: Database Management System

Course Objective(s):

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.

Course Outcomes:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the fundamentals of Big Data and its ecosystem.	L2	Understand
CO2	Illustrate distributed processing techniques using MapReduce and Spark.	L4	Analyze
CO3	Analyze stream data processing and core Spark concepts for efficient data manipulation.	L4	Analyze
CO4	Apply advanced analytics and mining techniques to extract insights from large datasets and real-world Big Data application.	L3	Apply

Big Data Analytics (22PCAI7030T)
Course Contents

Unit-I — 05 Hrs.

Introduction to Big Data Analytics

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.

Unit-II — 05 Hrs.

MapReduce and Distributed Processing

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.

Unit-III — 05 Hrs.

Stream Data Processing and Spark Introduction

The Stream Data Model: Stream-management, sources, queries, issues.

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.

Unit-IV — 05 Hrs.

Advanced Analytics and Mining

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.

Unit-V — 06 Hrs.

Big Data Analytics Applications

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).

Big Data Analytics Laboratory (22PCAI7030L)

List of Laboratory Experiments

Suggested Experiments:

1. One Case Study on Big data in Real life published in IEEE/ACM/Springer or any prominent journal. Objective: Identify and categorize real-world datasets based on the 5 Vs of Big Data (Volume, Velocity, Variety, Veracity, Value).

   Tasks:

   - Collect example datasets (e.g., social media data, sensor data, web logs).
   - Analyze and document how each dataset exemplifies the 5 Vs.
   - 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:

    SDG 13: Climate Change Impact Analysis

    - Analyse temperature and air quality data to identify trends and patterns.
    - Use social media data to assess public sentiment towards climate change.
    - Visualize the impact of climate change on specific regions.

    SDG 3: Healthcare Access Analysis

    - Analyze data on healthcare access, disease prevalence, and mortality rates.
    - Identify disparities in healthcare access across different populations.
    - 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.

Oral examination will be based on the entire syllabus, including the practicals performed during laboratory sessions.

Text Books:

1. Mayank Bhushan, "Big Data and Hadoop: Fundamentals, tools, and techniques for data-driven success", 2nd Edition, 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. Greyson Chesterfield, "Mastering Apache Spark: Real-Time Big Data Analytics: Build Large-Scale Data Processing Pipelines with Apache Spark", 2024.
4. Ganeshkumar Pugalendhi, Anand Paul, Rathinaraja Jeyaraj, "Big Data with Hadoop MapReduce", 2022.
5. Mrs A S R Sulthana, Mr Micheal Yeboah Frimpong, "Demystifying the NoSQL", 2021.
6. Kristina Chodorow, Michael Dirolf, "MongoDB: The Definitive Guide Paperback", O'Reilly Publications, 2020.
7. Radha Shankarmani, M Vijayalakshmi, "Big Data Analytics", Wiley Publications, 2019.

Reference Books:

1. Simhadri Govindappa, "Ultimate Big Data Analytics with Apache Hadoop: Master Big Data Analytics with Apache Hadoop Using Apache Spark, Hive, and Python", 2024.
2. Dr Sudhakar Ranjan (Author), Dr Anurag Bharatwal (Author), Dr Amit Kumar Goel (Author), "Hadoop in Action: Real World Applications and Best Practices for Big Data Processing", Kindle Edition, 2024.
3. Ali Soofastaei, "Advanced Analytics in Mining Engineering: Leverage Advanced Analytics in Mining Industry to Make Better Business Decisions", 2023.
4. Herbert Jones, "Data Analytics: The Ultimate Guide to Big Data Analytics for Business, Data Mining Techniques, Data Collection, and Business Intelligence Concepts", 2020.

Online References:

1. NPTEL Course: https://onlinecourses.nptel.ac.in/noc20_cs92
2. MongoDB:https://www.mongodb.com/developer/products/mongodb/learn-mongodb-univ-online-free-mooc/?msockid=07258624254b619719bf95cb24b36065

3. https://www.youtube.com/watch?v=S2MUhGA3lEw

4. https://www.youtube.com/watch?v=XhjIJGsAMsQlist=PL6UwySlcwEYKiC-EjEmN4f33c5fVpbzha

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Robotics (22PEAI7041T)		
Robotics Laboratory (22PEAI7041L)		

Prerequisite: Basics of Artificial Intelligence

Course Objective(s):

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, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the basics of robot anatomy, movement mechanisms, and classifications, and apply this knowledge to real-world robotic systems.	L2	Understand
CO2	Perform kinematic analysis and solve direct and inverse kinematics problems for various robot configurations, enhancing their problem-solving skills in robotics.	L3	Apply
CO3	Conduct workspace analysis and trajectory planning, and will implement pick-and- place.	L3	Apply
CO4	Capable of using ROS for robot programming, interface sensors and actuators.	L4	Analyze

Robotics (22PEAI7041T)
Course Contents

Unit-I — 08 Hrs.

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.

Unit-II — 06 Hrs.

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.

Unit-III — 08 Hrs.

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.

Unit-IV — 08 Hrs.

Robotics Convergence Technology: Telemetric camera Robotic System, Non- Imaging Sensors

Machine Learning for Robotics: Supervised learning for robot control, Reinforcement learning for robot decision making.

Computer Vision for Robotics: Object recognition, Image segmentation, Visual SLAM (Simultaneous Localization and Mapping),

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.

Unit-V — 04 Hrs.

Robot Operating System: ROS Basics, Supporting ROS, ROS Architecture and Concepts, ROS File system, ROS Computation Graph Level, ROS Community Level, ROS Workspace and Packag

ROS Client Library, ROS Programming Concept: Motion planning, Behavior control, Machine learning integration.

Unit-VI 05 Hrs.

Building the Robots: Introduction to Wheeled Robot, Hardware, Block Diagram and Assembling Robot Hardware, Programming Robot Firmware, path planning.

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.

Robotics Laboratory (22PEAI7041L)

List of Laboratory Experiments

Suggested Experiments: (Any 08)

1. Exploring Robot Anatomy

   Objective: Identify and understand the various parts of a robot (e.g., sensors, actuators, controllers).

   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

   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

   Objective: Create and run basic publisher and subscriber nodes in ROS.
   (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.

Oral examination will be based on the entire syllabus, including the practicals performed

during laboratory sessions.

Text Books:

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

Reference Books:

1. Catherine Régis (Editor), Jean-Louis Denis (Editor), Maria Luciana Axente (Editor), Atsuo Kishimoto (Editor), "Human-Centered AI: A Multidisciplinary Perspective for Policy-Makers, Auditors, and Users", ISBN 13- 978-1032341620, 2024.
2. "Introduction To AI Robotics", 2nd Edition, Bradford Books, ISBN 13- 978- 0262038485, 2019.
3. Mikell P. Groover, "Industrial Robotics", 2nd Edition, McGraw Hill, 2012.
4. John J. Craig, "Introduction to Robotics", 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

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Artificial Intelligence in Finance (22PEAI7042T)		
Artificial Intelligence in Finance Laboratory (22PEAI7042L)		

Course Objective:

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 Outcomes:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate Knowledge of AI Applications and its role in Finance.	L2	Comprehension
CO2	Implement Risk Management Models to assess and manage financial risks.	L4	Analyze
CO3	Optimize financial portfolio strategies that align with given risk profiles and investment goals.	L3	Apply
CO4	Develop AI-driven credit scoring models and compare their performance to traditional scoring systems.	L3	Apply
CO5	Design the fraud detection system that detect and prevent potential fraudulent activities.	L4	Analyze

Artificial Intelligence in Finance (22PEAI7042T) Course Contents

Unit-I — 08 Hrs.

Introduction:

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.

Unit-II — 08 Hrs.

Role of AI in Finance:

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.

Efficient Markets: Market Prediction Based on Returns Data, Market Prediction with More Features, Market Prediction Intraday,

Dense Neural Networks: The Data, Baseline Prediction, Normalization, Dropout, Regularization, Bagging, Optimizers.

Recurrent Neural Networks: Example - Financial Price Series, Financial Return Series, Financial Features, Estimation.

Unit-III — 06 Hrs.

Risk Management using AI and ML Models:

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.

Unit-IV — 05 Hrs.

Portfolio Optimization and Asset Allocation Strategies:

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.

Unit-V — 06 Hrs.

Credit Scoring in Finance:

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.

Unit-VI

06 Hrs.

Fraud Detection in Finance:

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.

Artificial Intelligence in Finance Laboratory (22PEAI7042L)

List of Laboratory Experiments

Suggested Experiments: (Minimum 08)

1. Case Study: Predicting Stock Prices with a Simple Neural Network.
2. Exploratory Data Analysis (EDA) with Financial Data:
   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
   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
   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
   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

   Build a machine learning model to predict the creditworthiness of individuals or companies based on financial and non-financial data.

   Evaluate the model's performance using metrics like precision, recall, and F1-score.

8. Risk Management:

   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

   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

    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.

Oral examination will be based on the entire syllabus, including the practicals performed during laboratory sessions.

Text Books:

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

8. Frank J. Fabozzi, Harry M. Markowitz, and Petter N. Kolm, "Portfolio Construction and Analytics", 2007.

Reference Books:

1. Ila Sweda, "AI In Banking & Finance: How AI Plays A Significant Role In Banking And Financial Services Industry: Artificial Intelligence Definition", ISBN-13 979-8465705233, 2021.

2. Matthew F. Dixon, Igor Halperin, and Paul Bilokon, "Machine Learning in Finance: From Theory to Practice", Springer, ISBN-13 978-3030410674, 2020.

3. Marcos Lopez de Prado, "Machine Learning for Financial Engineering", Cambridge University Press, ISBN-13 978-1108792899, 2018.

4. Marcos Lopez de Prado, "Advances in Financial Machine Learning", Wiley, ISBN-13 978-1119482086, 2018.

5. Mark J. Bennett and Dirk L. Hugen, "Financial Analytics with R: Building a Laptop Laboratory for Data Science", 2016.

Online Resources:

1. What Is Artificial Intelligence in Finance? – IBM
https://www.ibm.com/think/topics/artificial-intelligence-finance

2. How Finance & Banking Professionals Can Capitalize on AI
https://corporatefinanceinstitute.com/resources/datascience/bots-bard-and-chatgpt/

3. AI in Finance: Applications, Examples & Benefits – Google Cloud
https://cloud.google.com/discover/finance-ai

4. 33 Examples of AI in Finance 2024 – Built In
https://builtin.com/artificial-intelligence/ai-finance-banking-applications-companies

5. AI for portfolio management: An overview (leewayhertz.com)
https://www.leewayhertz.com/ai-for-portfolio-management/

6. Generative AI transforming wealth and asset management – EY - US
https://shorturl.at/erLWY

7. Use of Artificial Intelligence (AI) in Investment Management – Infosys BPM
https://www.infosysbpm.com/blogs/financial-services/artificial-intelligence-an-asset-management-perspective.html

8. AI-based credit scoring (leewayhertz.com)
https://www.leewayhertz.com/ai-based-credit-scoring/

9. Responsible AI Credit Scoring – A Lesson from Upstart.com (degruyter.com)
https://www.degruyterbrill.com/document/doi/10.1515/9783110749472-006/html?lang=en

10. How Fraud Detection Using AI in Banking Works? – Infosys BPM
https://www.infosysbpm.com/blogs/bpm-analytics/fraud-detection-with-ai-in-banking-sector.html

11. ow Is AI Used in Fraud Detection? – NVIDIA Blog
https://blogs.nvidia.com/blog/ai-fraud-detection-rapids-triton-tensorrt-nemo/

12. (PDF) - Deep Learning for Time Series Forecasting: A Survey
https://www.researchgate.net/publication/347364694DeepLearningforTimeSeriesForecastingASurvey

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Artificial Intelligence in Cyber Security (22PEAI7043T)		
Artificial Intelligence in Cyber Security Laboratory (22PEAI7043L)		

Prerequisite: Artificial Intelligence, Machine Learning and Computer Network

Course Objective(s):

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, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the various concept of Cyber Security.	L2	Understand
CO2	Apply Machine learning and deep learning techniques to detect intrusions, malware, and anomalous activities in cybersecurity datasets.	L3	Apply
CO3	Evaluate the effectiveness of emerging cybersecurity technologies .	L5	Evaluate
CO4	Describe key ethical considerations in the use of AI in cybersecurity.	L2	Understand

Artificial Intelligence in Cyber Security (22PEAI7043T) Course Contents

Unit-I — 07 Hrs.

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.

Unit-II — 06 Hrs.

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.

Unit-III — 07 Hrs.

Machine Learning in Security:

Introduction to Machine Learning in Security domain, Applications of Machine Learning in Cyber Security Domain, Machine Learning: tasks and Approaches, Anomaly Detection, Privacy Preserving Nearest Neighbor Search, Machine Learning Applied to Intrusion Detection, Online Learning Methods for Detecting Malicious Executables.

Unit-IV — 06 Hrs.

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.

Unit-V — 07 Hrs.

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.

Unit-VI 06 Hrs.

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.

Artificial Intelligence in Cyber Security Laboratory (22PEAI7043L)

List of Laboratory Experiments

Suggested Experiments: (Any 08)

1. Python basics review and introduction of common data analysis libraries.
2. Machine learning pipeline for cybersecurity problems
   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.
   Case study: DDoS network traffic analysis
4. A small step into deep learning and convolutional neural network (CNN).
   Case study: breaking Captchas with neural network.
5. Dimensionality reduction and visualization for Network Anomaly Detection using the KDD Cup 1999 Dataset
   Case study: network anomaly detection and visualization
   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.

Case study: detecting and categorizing network attacks

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.

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.

Oral examination will be based on the entire syllabus, including the practicals performed during laboratory sessions.

Text Books:

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. Kevin P Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press.

7. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

Web Links:

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

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Product Life Cycle Management (22OEAI7051T)		

Prerequisite: Knowledge of basic concepts of Management

Course Objective(s):

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, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.	L2	Understand
CO2	Illustrate various approaches and techniques for designing and developing products.	L3	Apply
CO3	Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.	L3	Apply
CO4	Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant.	L2	Understand

Product Life Cycle Management (22OEAI7051T) Course Contents

Unit-I — 09 Hrs.

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

PLM Strategies: Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM

Unit-II — 08 Hrs.

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.

Unit-III — 08 Hrs.

Product Data Management (PDM): Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation

Virtual Product Development Tools: For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modelling and simulations in Product Design, Examples/Case studies

Unit-IV — 07 Hrs.

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.

Unit-V — 07 Hrs.

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.

Text Books:

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realization", Springer-Verlag, 2004.

2. Guido La Rosa, Antonino Risitano, Taylor & Francis, "Product Design for the environment-A life cycle approach", Fabio Giudice, 2006.

Reference Books:

1. Saaksvuori Antti, Immonen Anselmie, "Product Life Cycle Management", Springer, Dreamtech, 2009.

2. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006.

3. François Villeneuve, Luc Mathieu, Max Giordano, "Product Life-Cycle Management: Geometric Variations", Wiley, 2010.

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Management Information System (22OEAI7052T)		

Course Objective(s):

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:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain how information systems Transform Business.	L2	Understand
CO2	Identify the impact information systems have on an organization.	L3	Apply
CO3	Describe IT infrastructure and its components and its current trends.	L2	Understand
CO4	Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making.	L2	Understand
CO5	Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses.	L3	Apply

Management Information System (22OEAI7052T) Course Contents

Unit-I — 03 Hrs.

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.

Unit-II — 07 Hrs.

Information Technologies: Hardware and Software

Computer Systems: End User and Enterprise Computing

Computer Peripherals: Input, Output, and Storage Technologies

Application Software: End User Applications

System Software: Computer System Management

Data Resource Management: Technical Foundations of Database Management, Managing Data Resources, Big data, Data warehouse and Data Marts, Knowledge Management.

Networks: The Networked Enterprise (Wired and wireless), Pervasive computing, Cloud Computing models.

Unit-III — 08 Hrs.

MIS Tools and applications for Decision making: ERP and ERP support of Business Process Reengineering.

Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Visualization.

Artificial Intelligence Technologies in Business

Unit-IV — 06 Hrs.

Security and Ethical Challenges: Security, Ethical, and Societal Challenges of IT Security Management of Information Technology

Unit-V — 07 Hrs.

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.

Unit-VI

08 Hrs.

Information System within Organization: Acquiring Information Systems and Applications: Various System development life cycle models.

Enterprise and Global Management of Information Technology: Managing Information Technology, Managing Global IT.

Reference Books:

1. James A O'Brien, George M., RameshBehl, "Management Information Systems", 11^{th} Edition.
2. Kelly Rainer, Brad Prince, "Management Information Systems", Wiley.
3. K.C. Laudon and J.P. Laudon, "Management Information Systems: Managing the Digital Firm", 10^{th} Edition, Prentice Hall, 2007.
4. D. Boddy, A. Boonstra, "Managing Information Systems: Strategy and Organization", Prentice Hall, 2008.

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Operations Research (22OEAI7053T)		

Prerequisite: Basic Knowledge of Algebra, Probability and Statistics.

Course Objective(s):

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

Course Outcomes:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Convert a real-world problem in to a Linear Programming Problem and analyse the solution obtained using Simplex method or other algorithms.	L4	Analyze
CO2	Identify real-world problems as Transportation Problem and Assignment Problem and Solve the decision problem by choosing appropriate algorithm.	L3	Apply
CO3	Identify the decision situations which vary with time and analyse them using principle of dynamic programming to real life situations.	L3	Apply
CO4	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.	L2	Understand
CO5	Understand the concept of decision making in situation of competition and recommend strategies in case of two-person zero sum games.	L2	Understand
CO6	Describe concept of simulation and apply Monte Carlo Simulation technique to systems such as inventory, queuing and recommend solutions for them.	L2	Understand
CO7	Understand need for right replacement policy and determine optimal replacement age.	L2	Understand

Operations Research (22OEAI7053T)
Course Contents

Unit-I — 10 Hrs.

Introduction to Operations Research: Concept of decision making. Definition of OR. Formulation of decision problem as OR model, Concept of Optimization,

Linear Programming Problem: Mathematical Formulation. Finding optimal solution - Graphical method, Simplex Method, Big M-method, Two Phase Method. Duality, Primal – Dual construction. Symmetric and Asymmetric Dual. Dual Simplex Method.

Unit-II — 08 Hrs.

Assignment Problems: Mathematical Formulation, Finding optimal solution - Hungarian Method

Transportation problem: Mathematical Formulation, Finding initial basic feasible solution – Northwest corner rule, row minima, column minima, least cost method and Vogel's approximation method.

Optimality test: The stepping stone method and MODI method. Improving the solution.

Unit-III — 05 Hrs.

Dynamic Programming: Bellman's Principle of optimality - Applications of dynamic programming- Employment smoothening problem, capital budgeting problem, shortest path problem, cargo loading problem

Unit-IV — 10 Hrs.

Queuing Models: Characteristics of queuing models.

Single Channel–Single and multi-phase servers, Poisson arrivals, exponential service time - with infinite population and finite population models – with infinite and finite capacity.

Multichannel– Single phase server- Poisson arrivals, exponential service time with infinite population.

Game Theory: Introduction. Minimax & Maximin Criterion and optimal strategy. Solution of games with saddle points, rectangular games without saddle points - 2 x 2 games, dominance principle.

Approximate methods - Iterative method, m x 2 & 2 x n games -Graphical method and method of sub-games. Expressing game as LPP.

Unit-V — 06 Hrs.

Simulation: Definition. Types of simulation models. Monte Carlo simulation technique. Applications of simulation - Inventory and Queuing problems. Simulation Languages.

Replacement Models: Replacement of items that deteriorate with time - when money value

counted and counted, Replacement of items that fail suddenly – individual and group replacement policy

Text Books:

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

Reference Books:

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

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Cyber Security and Laws (22OEAI7054T)		

Course Objective(s):

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, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the different types of cybercrime and security issues E Business.	L2	Understand
CO2	Analyses different types of cyber threats and techniques for security management.	L4	Analyze
CO3	Explore the legal requirements and standards for cyber security in various countries to regulate cyberspace.	L4	Analyze
CO4	Impart the knowledge of Information Technology Act and legal frame work of right to privacy, data security and data protection.	L2	Understand

Cyber Security and Laws (22OEAI7054T)
Course Contents

Unit-I — 10 Hrs.

Introduction to Cybercrime

Cyber Crime, Cyber Law, Cyber Security, History of Cyber Crime, Hacking, Data Theft, Cyber Terrorism, Virus & Worm's, Email Bombing, Pornography, online gambling, Forgery, Web Defacements, Web Jacking, Illegal online Selling, Cyber Defamation, Software Piracy, Electronics/ Digital Signature, Phishing, Password Cracking, Key loggers and Spywares, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Over Flow, Phishing Identity Theft (ID Theft), How criminal plan the attacks, Social Engineering, Cyber stalking.

Unit-II — 06 Hrs.

Cyber Threats Analysis

Knowledge of Dynamic and Deliberate Targeting

Knowledge of Indications and Warning

Knowledge of Internal Tactics to Anticipate and/or, Emulate Threat Capabilities and Actions

Knowledge of Key Cyber Threat Actors and their Equities

Knowledge of Specific Target Identifiers and Their Usage

Unit-III — 06 Hrs.

Electronic Business and legal issues

Evolution and development in Ecommerce, Policy Frameworks for Secure Electronic Business, paper vs paper less contracts, E-Commerce models- B2B, B2C, E security. E- Payment Mechanism; Payment through card system, E- Cheque, E-Cash, E-Payment, Threats & Protections, Security for E-Commerce.

Unit-IV — 08 Hrs.

Indian IT Act

Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments

Security aspect in cyber Law

The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law, The Criminal Aspect in Cyber Law.

Unit-V — 09 Hrs.

Security Industries Standard Compliances

IT Security v/s IT Compliance, Cyber Security Standards, critical security controls for cyber security, GRC (Governance, Risk Management, and Compliance), SOX, GLBA, HIPAA, ISO/IEC 27001, NIST Cyber Security Framework (CSF), PCI- DSS.

OWASP Top Ten Project, GDPR (General Data Protection Regulation), NIST (National Institute of Standards and Technology), CIS Controls (Center for Internet Security Controls).

Reference Books:

1. Nina Godbole, Sunit Belapure, "Cyber Security", Wiley India, New Delhi.
2. Suresh T. Vishwanathan, "The Indian Cyber Law", Bharat Law House New Delhi.
3. "The Information Technology Act", Bare Act- Professional Book Publishers, New Delhi, 2000.
4. Anup K. Ghosh, "E-Commerce Security and Privacy", Springer Science and Business Media, 2012.
5. Izzat Alsmadi, "The NICE Cyber Security Framework Cyber Security Intelligence and Analytics", Springer.
6. Advocate Prashant Mali, "Cyber Law & Cyber Crimes", Snow White Publications, Mumbai.
7. Nina Godbole, "Information Systems Security", Wiley India, New Delhi.
8. Kennetch J. Knapp, "Cyber Security & Global Information Assurance", Information Science Publishing.
9. William Stallings, "Cryptography and Network Security", Pearson Publication.

Web Links:

1. The Information Technology ACT, 2008- TIFR : https://www.tifrh.res.in
2. A Compliance Primer for IT professional:
   https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer- professionals-33538

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Personal Finance Management (22OEAI7055T)		

Prerequisite: Basic Knowledge of Algebra, Probability, and Statistics.

Course objective(s):

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

Course outcomes:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Use a framework for financial planning to understand the overall role finances play in his/her personal life.	L2	Understand
CO2	Compute income from salaries, house property, business/profession, capital gains and income from other sources.	L3	Apply
CO3	Compute the amount of CGST, SGST and IGST payable after considering the eligible input tax credit. .	L3	Apply
CO4	Understand how Microfinance can help in financial inclusion.	L2	Understand

Personal Finance Management
(22OEAI7055T)
Course Contents

Unit-I — 07 Hrs.

Overview of Indian Financial System: Characteristics, Components, and Functions of Financial System. Financial Instruments and Financial Markets, Financial Inclusion.

Introduction to Personal Finance: Personal Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services.

Consumer Credit: Advantages, Disadvantages, Sources and Costs.

Unit-II — 07 Hrs.

Personal Financial Management:

Loans: Home, Car, Education, Personal, Loan against property, and Jewel loan.

Insurance: Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance.

Investment: Investing Basics and Evaluating Bonds, Investing in Stocks and Investing in Mutual Funds, Planning.

Unit-III — 07 Hrs.

Income Tax:

Income Tax Act Basics- Introduction to Income Tax Act, 1961

Heads of Income and Computation of Total Income and Tax Liability- Heads of Income and Computation of Total Income under various heads, Clubbing Provisions, set off and carry forward of Losses, Deductions, Assessment of Income and tax liability of different persons.

Tax Management, Administrative Procedures and ICDS - TDS, TCS and Advance Tax Administrative Procedures, ICDS.

Unit-IV — 09 Hrs.

Goods and Services Tax:

GST Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union & State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST & IGST); GST Council, GST Network, State Compensation Mechanism, Registration.

Levy and Collection of GST:

Taxable event- "Supply" of Goods and Services; Place of Supply: Within state, Interstate, Import & 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

Unit-V

09 Hrs.

Introduction to Micro – finance: Micro-Finance: Definitions, Scope & Assumptions, Types of Microfinances, Customers of Micro-finance, Credit Delivery Methodologies, SHG concept, origin, Formation & Operation of Self-Help Groups (SHGs).

Models in Microfinance: Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements & Challenges.

Institutional Mechanism: Current Challenges for Microfinance, Microfinance Institutions (MFIs): Constraints & Governance Issues, Institutional Structure of Microfinance in India: NGO-MFIs, NBFC- MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand & Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs

Reference Books:

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

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Energy Audit and Management (22OEAI7056T)		

Prerequisite: Nil

Course objective(s):

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

Course outcomes:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	To identify and describe present state of energy security and its importance.	L2, L3	Understand, Apply
CO2	To identify and describe the basic principles and methodologies adopted in energy audit of a utility.	L2, L3	Understand, Apply
CO3	To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.	L2	Understand
CO4	To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities.	L2	Understand
CO5	To analyze the data collected during performance evaluation and recommend energy saving measures.	L4	Analyze

Energy Audit and Management (22OEAI7056T) Course Contents

Unit-I — 05 Hrs.

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.

Unit-II — 09 Hrs.

Energy Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring & targeting, Energy audit instruments. Technical and economic feasibility, Classification of energy conservation measures. Safety considerations during energy audit.

Financial analysis techniques: Simple payback period, NPV, Return on investment (ROI) Internal rate of return (IRR).

Unit-III — 10 Hrs.

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.

Unit-IV — 09 Hrs.

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.

Unit-V — 06 Hrs.

Energy conservation in Buildings:

Energy Conservation Building Codes(ECBC): Green Building, LEED

Application of Non-Conventional and Renewable Energy Sources, Energy sources and energy management in electric vehicles.

Reference Books:

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

Web Links:

1. www.energymanagertraining.com
2. www.bee-india.nic.in

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Disaster Management and Mitigation Measures (22OEAI7056T)		

Prerequisite: Nil

Course Objective(s):

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, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Know natural as well as manmade disaster and their extent and possible effects on the economy.	L2	Understand
CO2	Know the institutional framework and organization structure in India for disaster management and get acquainted with government policies, acts and various emergency laws.	L2	Understand
CO3	Get to know the simple dos and don'ts in such extreme events and build skills to respond accordingly.	L2	Understand
CO4	Understand the importance of disaster prevention and various mitigation measure with the exposure to disasters hotspots across the globe.	L2	Understand

Disaster Management and Mitigation Measures (22OEAI7056T)

Course Contents

Unit I — 09 Hrs.

General Information about Disaster: 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.

Study of Natural disasters: Flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion etc.

Study of Human/Technology Induced Disasters: Chemical, Industrial and Nuclear disasters, Internally displaced persons, road and train accidents Fire Hazards, terrorism, militancy, Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

Unit II — 08 Hrs.

Disaster Management: Brief Introduction, Disaster management cycle, Evolution of Disaster and Disaster management in India, Disaster management acts, policies and guidelines, laws of emergencies etc.

Prior, During and Post disaster management activities: (Preparedness, strengthening emergency centers, Logistics, optimum resource management, emergency response and relief, Training, Public awareness, Research, Reconstruction of essential services and livelihood restoration.

Unit III — 07 Hrs.

Institutional framework and Mechanism for disaster management in India: Institutions in India for dealing with various disasters, Organizational structure, functions and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India, roles and responsibilities of central and state government during and after disaster, NGO's involved in disasters and their task, Jobs carried out by armed forces.

Financial Relief During disaster (State, National and International Disaster Assistance)

Unit IV — 08 Hrs.

Disaster risk reduction and Mitigation Measures: Need of disaster prevention and mitigation, mitigation guiding principles, challenging areas, structural and non-structural measures for disaster risk reduction.

Mitigation measures for flood, earthquake, cyclone monitoring, air quality, water quality, climate change, land use, winter storms and aquatic biology etc.

Use of information management, GIS, GPS and remote sensing Mitigation measure. Do's and don'ts in case of disasters and effective implementation of relief aids.

Unit V — 07 Hrs.

Case studies on disaster (National /International): Case study discussion of Hiroshima – Nagasaki (Japan), India – Tsunami (2004) , Bhopal gas tragedy, Kerala and Uttarakhand flood disaster, Cyclone Phailin (2013), Fukushima Daiichi nuclear disaster (2011), 26th July 2005 Mumbai flood, Chernobyl meltdown and so on.

(Discuss case studies on disaster with respect to reason for the disaster, incidents, effects of disaster, present scenario and safety measures taken)

Reference Books & Reports:

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

12. Ronald Eisler, "The Fukushima 2011 Disaster", Florida, 2013. (Learners are expected to refer reports published at national and international level and updated information available on authentic web sites)

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Science of Well-being (22OEAI7058T)		

Prerequisite: Nil

Course Objective(s):

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 malpractices 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, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe concepts of holistic health and well-being, differentiate between its true meaning and misconceptions and understand the benefits of well-being.	L2	Understand
CO2	Recognize meaning of happiness, practice gratitude and self-compassion and analyze incidents from one's own life.	L4	Analyze
CO3	Understand the causes and effects of stress, identify reasons for stress in one's own surrounding and self.	L2	Understand
CO4	Recognize the importance of physical health and fitness, assess their life style and come up with limitations or effectiveness.	L5	Evaluate
CO5	Inspect one's own coping mechanism, assess its effectiveness, develop and strategize for betterment and execute it.	L4	Analyze

Science of Well-being (22OEAI7058T)
Course Contents

Unit I — 06 Hrs.

Health and well-being: The concept of health, dimensions of health, the notion of well- being, various facets of well-being, relation between health and well-being.

Concept of holistic health, its principles and importance, concept and benefits of holistic care, misconceptions about holistic health approach, the application of a true holistic approach to our well-being.

Unit II — 08 Hrs.

Concepts of happiness: Happiness: what is it and how do we measure it? Philosophical perspectives on happiness, Happiness: Nature or Nurture? Happiness in the modern world: impediments and accelerators, Narrow vs. Broad Band Approaches to Happiness, Benefits of Happiness, Self-Compassion and Gratitude. Misconceptions of happiness.

Unit III — 09 Hrs.

Stress and mental health/well-being: Nature and concept of stress, meaning and definitions of stress, types of stress, meaning of stressors, types of stressors, symptoms of stress, effects of stress, different models of stress.

Sources of stress and how does stress cause illness, various sources of stress, delineate between external and internal sources of stress, differentiate between continuous and discrete stressors, the effects of these stressors on health and well-being, diversity of stressors and their health consequences, relation between stress and illness from different perspectives association between stress related physiological mechanisms and different illnesses.

Unit IV — 08 Hrs.

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.

Unit V — 08 Hrs.

Dealing with Difficult Times / Coping mechanisms: The concept of chronic stress, Health and safety risks of chronic stress, Forms and Treatment of chronic stress, Coping with Acute and Chronic stress, theories of the stress-illness link, role of stress in mental disorders.

Concept of coping, Ways of coping and stress management, basic knowledge about stress management, various techniques of stress management, stress management programs.

Mental strengths and virtues, Hope, Optimism, Resilience – concept, pathways and models, Meditation and Self-introspection.

Text Books:

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

Reference Books:

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

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech.	Semester: VII
Research Methodology (22OEAI7059T)		

Prerequisite: Basic knowledge of Probability and Statistics

Course Objective(s):

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, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Prepare a preliminary research design for projects in their subject matter areas.	L3	Apply
CO2	Accurately collect, analyze and report data.	L4	Analyze
CO3	Present complex data or situations clearly.	L2	Understand
CO4	Review and analyze research findings.	L4	Analyze
CO5	Write report about findings of research carried out.	L3	Apply

Research Methodology (22OEAI7059T)
Course Contents

Unit-I — 07 Hrs.

Basic Research Concepts:

Meaning of research, Objectives of research, Types of research, Significance of research Research process.

Unit-II — 09 Hrs.

Research Methodology:

Identification of research problem, Literature review, Formulation of hypothesis, Formulation of Research design.

Unit-III — 09 Hrs.

Research and Sample Design::

Meaning of research and sample design, Need of research design, Features of good research design, Important concepts, Different research designs, Types of sampling designs

Unit-IV — 09 Hrs.

Data Collection and Data Analysis:

Types of data, Methods for collecting data: Experiments and surveys, Collection of primary and secondary data, Hypothesis testing and interpretation of Data

Unit-V — 05 Hrs.

Interpretation and Report Writing:

Interpretation and drawing conclusions on the research, Preparation of the report, Ethical Issues

Reference Books:

1. Dawson, Catherine, 2002, "Practical Research Methods", UBS Publishers Distributors, New Delhi, 2002.
2. Kothari, C.R., "Research Methodology-Methods and Techniques", Wiley Eastern Limited, New Delhi, 1985.
3. Kumar, Ranjit, "Research Methodology-A Step-by-Step Guide for Beginners", Pearson Education, 2nd Edition, Singapore, 2005.

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Public Systems and Policies (22OEAI70510T)		

Prerequisite: Basic Knowledge of Social Science and Current Affairs

Course Objective(s):

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 society and identify solutions.
4. To explain public policy and its operations, with special focus on policies 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, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Understand the importance of public systems in a fast-changing environment in the global context.	L2	Understand
CO2	Analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.	L4	Analyze
CO3	Explain public policy and its operations with special focus on policy relating to Government finance.	L3	Explain
CO4	Make policies and know about the happenings in the world, in the nation and those in their locality.	L3	Apply
CO5	Analyze and evaluate the impact of the public policy on firms and economy at large and work under various fields as policymakers.	L4	Analyze

Public Systems and Policies (22OEAI70510T)
Course Contents

Unit-I — 09 Hrs.

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.

Unit-II — 06 Hrs.

Public Sector in the Economic Accounts: Public Sector in the circular flow; Public Sector in the National Income Accounts.

Unit-III — 07 Hrs.

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.

Unit-IV — 11 Hrs.

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.

Unit-V — 06 Hrs.

Case Studies in Expenditure Policy: Public Services

A) National Defense B) Highways C) Outdoor Recreation D) Education

Reference Books:

1. Charles Wheelan, "Introduction to Public Policy", W.W. Norton & Company.
2. Thomas R. Dye, "Understanding Public Policy", Prentice Hall.
3. J.E. Anderson, Houghton, "Public Policy-Making: An Introduction".
4. Avasthi & Maheshwari, "Public Administration", Lakshminarayan Agarwal, Agra.
5. Mohit Bhattacharya, "New Horizons of Public Administration", Jawahar Publishers, New Delhi.
6. Nicholas Henry, "Public Administration and Public Affairs", Prentice Hall of India, New Delhi.

7. Harvey S. Rosen and Ted Gayer, "Public Finance", 10^{th} Edition, McGraw-Hill Education, 2013.

8. Musgrave and Musgrave, "Public Finance in Theory and Practice".

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Project Stage-II (22PJAI7060L)		

Course Objectives:

- To implement the solution as per the problem statement.
- To develop the team building, writing, logical reasoning and management skills.
- To provide the connections between the designs and concepts across different disciplinary boundaries.
- To encourage students to become independent personnel, critical thinkers and lifelong learners

Course Outcomes:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply engineering knowledge to produce solution of a problem considering cultural, social, environmental, and economic factors using appropriate tool and method.	L4	Analyze
CO2	Demonstrate project based learning that allows students to transfer existing ideas into new applications.	L2	Understand
CO3	Develop an ability to work in teams and manage the conduct of the research study.	L3	Apply
CO4	Integrate different perspectives from relevant disciplines which help them to get internships, jobs and admission for higher studies.	L3	Apply
CO5	Present the research in the form of technical writing, understand what constitutes to plagiarism and how to use proper referencing styles.	L2	Understand

Syllabus:

Project-I work done in VI semester shall be continued as Project-II in semester VII.

Students should complete remaining implementation of ideas given in synopsis/Abstract of semester VI.

Students / group must plan their execution of project, so that project work should be completed before end of semester.

Project-II involves fabrication, design, experimentation, data analysis within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability. The stage also includes testing, possible results and report writing.

Each project group is required to maintain log book for documenting various activities of Project-II and submit group project report at the end of Semester-VII in the form of Hard bound.

Domain knowledge (any beyond) needed from the various areas in the field of AIML for the effective implementation of the project.

The above areas can be updated based on the technological innovations and development needed for specific project.

Guidelines:

The main purpose of this activity is to improve the students' technical skills, communication skills by integrating writing, presentation and teamwork opportunities.

Each group will be reviewed twice in a semester and marks will be allotted based on the various points mentioned in the evaluation scheme.

In the first review of this semester, each group is expected to complete 70% of project.

In the second review of this semester, each group is expected to complete 100% of project.

The students may use this opportunity to learn different computational techniques towards development of a product.

Interaction with alumni mentor will also be appreciated for the improvement of project.

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).
- The candidate must bring the Project Stage-I report and the final report completed in all respect while appearing for End Semester Examination.
- Oral examination should be conducted by Internal and External examiners. Students have to give presentation and demonstration based on their project.

Prescribed project report guidelines:

Every group should prepare hard bound report (preferrable LaTeX) of about minimum 40 pages on the work carried out by a batch of students in respect of the project work done during semester-VII. Project Report should include appropriate content for:

- Title
- Abstract
- Introduction
- Problem identification and project objectives
- Literature Survey
- Related Theory
- Project design and Implementation details
- Case study/Analysis/Design Methodology
- Project Outcomes
- Result and Conclusion
- Future scope
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Guide will monitor weekly progress and marks allocation will be as per Table 2.

Table 1: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 2: Continuous Assessment Table

Sr	Exam Seat No	Name of Student	Student Attendance	Log Book Maintain	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Each group will be reviewed twice in a semester by faculty guide and faculty coordinator based on the following criteria:

- Project progress
- Documentation/Technical paper writing
- Key findings
- Validation of results
- Product Development

Each review consists of 25 marks. Average of the marks scored in both the two reviews will be considered for final grading. The final certification and acceptance of TW ensures the satisfactory performance on the above aspects.

Table 3: Evaluation Table

Sr	Exam Seat No	Name of Student	Project Selection	Design/ Methodology	Fabrication/ Modeling/ Simulation	Result Verification	Presentation	Total
			5	5	5	5	5	25

Program: Artificial Intelligence and Machine Learning	Final Year B.Tech	Semester: VII
Employability Skill Development Program-III (22HMAI7070L)		

Course Objective(s):

- To build a solid foundation in programming fundamentals.
- To enhance problem-solving abilities through mathematical reasoning.
- To develop algorithmic thinking.
- To provide hands-on experience with essential data structures.

Course Outcomes:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply basic programming skills to write and debug simple programs using conditions, loops, and functions	L3	Apply
CO2	Analyze mathematical problems and use techniques like number theory and modular arithmetic in problem-solving.	L4	Analyze
CO3	Design and implement algorithms to solve real-world problems using methods like recursion, greedy, and sorting.	L6	Create
CO4	Use common data structures such as arrays, strings, sets, and maps effectively in programming tasks.	L3	Apply

Employability Skill Development Program-III (22HMAI7070L) Course Contents

Unit-I — 06 Hrs.

Programming Fundamentals:

- Basic Programming Concepts
- Conditional Statements
- Loops
- Inbuilt functions
- Data Types
- Python

Unit-II — 06 Hrs.

Mathematics:

- Mathematics
- Basic Math
- Arithmetic
- Modular Arithmetic
- Divisibility
- Integer Division
- GCD
- Geometry
- Number System
- Binary

Unit-III — 06 Hrs.

Algorithms:

- Algorithms
- Brute Force
- Greedy

- Constructive
- Sorting
- Simple Algos
- Recursion
- Recurrence Relation
- Observation
- Implementation

Unit-IV 08 Hrs.

Data Structures:

- Data Structures
- Arrays
- 1D Arrays
- String
- Subsequence
- Frequency Arrays
- Maps
- Sets

Reference Books:

1. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", 5th Edition, Career-Monk Publications, 2016.
2. Dr. R. S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", Revised Edition, S. Chand Publishing, 2021.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", 4th Edition, The MIT Press, 2022.