



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2023-24

ARTIFICIAL INTELLIGENCE

SEMESTER VI

Sr No	Course Category	CourseCode	Course Title	Hours per Week			Credits	Maximum Marks				No of Hours in ESE
				L	T	P		Mid Semester Examination	Continual Assessment	End Sem Examination	Total	
1	PCC	23AI601T	Artificial Neural Networks & Deep learning	3	-	-	3	15	15	70	100	3
2	PCC	23AI601P	Artificial Neural Networks & Deep learning Lab	-	-	2	1	-	25	25	50	-
3	PCC	23AI602T	Software Engineering & Project Management	3	-	-	3	15	15	70	100	3
4	PCC	23AI602P	Software Engineering & Project management Lab	-	-	2	1	-	25	25	50	-
5	PEC	23AI603T	Program Elective – II	3	-	-	3	15	15	70	100	3
6	PEC	23AI604T	Program Elective – III	3	-	-	3	15	15	70	100	3
7	AEC	23AS601T	Economics and Management	2			2	7.5	7.5	35	50	1.5
8	OE	23AI661O	Open Elective – III	3	-	-	3	15	15	70	100	3
9	ELC	23AI606P	Project - I	-	-	4	2	-	50	50	100	-
10	SEC	23AI641P	Career Development - VI	-	-	2	1	-	50	-	50	-
11	MDM	23AI631M	MDM – IV AI for Engineering System	3	-	-	3	15	15	70	100	3
Total				20	0	10	25	97.5	247.5	555	900	

Program Elective – II	
23AI603T(i)	Augmented Reality & Virtual Reality
23AI603T(ii)	Information Retrieval
23AI603T(iii)	Computer Vision

Open Elective-III	
23AI661O(i)	Introduction to cloud computing with ML
23AI661O (ii)	Ethical Hacking

Program Elective – III	
23AI604T(i)	Big Data Analytics
23AI604T(ii)	Optimization Techniques in ML
23AI604T(iii)	Reinforcement Learning

MDM Basket	
24AI631M	AI in Engineering Systems

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ARTIFICIAL INTELLIGENCE

SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI601T	Artificial Neural Network & Deep Learning	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to provide</p> <ul style="list-style-type: none"> Fundamental knowledge of artificial neural networks, deep learning architectures and training mechanisms. The ability to design, implement and analyze deep learning models for real-world applications. 	<p>Students will be able to</p> <ul style="list-style-type: none"> Interpret the concepts of artificial neurons, activation functions and basic neural network models Apply gradient descent and optimization techniques to train deep neural networks. Design and evaluate CNN and RNN based models for image and sequence data. Analyze the use of encoder-decoder, attention mechanism and transformer models. Implement deep learning applications using appropriate tools and frameworks.

Unit I: Foundations of Neural Networks:	[9Hrs]
Biological neuron and artificial neuron, perceptron model, multilayer perceptron, activation functions (ReLU, sigmoid, tanh, softmax), loss functions (MSE, cross-entropy), overfitting and underfitting, regularization techniques (L1, L2, dropout).	
Unit II Deep Neural Networks and Gradient Descent:	[9Hrs]
Introduction to Deep Neural Network, deep neural network architecture, forward propagation, back propagation,, Gradient descent methods (batch, stochastic, mini-batch), advanced optimizers (momentum, NAG, Adagrad, RMSProp, Adam), backpropagation overview, vanishing and exploding gradients, batch normalization, layer normalization, weight initialization (Xavier, He), hyperparameter tuning, model evaluation metrics (accuracy, precision, recall, F1-score, ROC-AUC).	
Unit III Convolutional Neural Networks	[9Hrs]
Convolution operation, padding, stride, pooling, CNN architecture concepts, popular models (LeNet, AlexNet, VGG, ResNet), transfer learning, Max Pooling, Flattening, Full Connection.	
Unit IV Recurrent Neural Networks and Sequence Models	[9Hrs]
RNN basics, backpropagation through time, LSTM, GRU, bidirectional RNNs, encoder-decoder concept, introduction to attention in sequence models, applications in NLP, time-series analysis and speech processing.	
Unit V: Encoder-Decoder Models and Transformers:	[9Hrs]
Linear encoder model, linear decoder model, basic autoencoder, additive attention, dot-product attention, transformer architecture basics, self-attention, multi-head attention, positional encoding, applications of transformers in NLP and vision.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Deep learning: A Practitioner's Approach	Josh Patterson and Adam Gibson	2 ND	O'Reilly, 2017
2	Deep Learning	Ian Goodfellow, Y. Bengio and A. Courville	4 TH	MIT Press, 2016
3	Python Deep Learning by Daniel Slater	Gianmario Spacagna and Peter Roelants	2 ND	Packt Publication

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Deep Learning: Methods and Applications	Li Deng and Dong Yu	4 TH	2013
2	Neural Networks and Deep Learning	Michael A. Nielsen	2 ND	Determination

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SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI601P	Artificial Neural Network & Deep Learning Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
<p>This course is intended to provide</p> <ul style="list-style-type: none">Design and evaluate the DL models through python in built functions.Evaluate the DL models pre-processed through various feature engineering algorithms by python programming.Design and apply various neural network techniques to solve real time complex problems.Develop the code for recommender system using Natural Language processingUnderstand the basic concepts of deep neural network models and design the same.	<p>Students will be able to</p> <ul style="list-style-type: none">Implement simple neural network algorithmsApply and evaluate deep learning on real data setsDemonstrate the basic principles of NLP DomainApply simple neural network techniques.Develop a project based on deep learning.

Expt. No.	Title of the experiment
1	Handwritten Digit Recognition.
2	Programs will be based on Recurrent Neural Network.
3	Programs will be based on Back propagation.
4	Programs will be based on Natural Language Processing.
5	Programs will be based on Data Analysis.
6	Programs will be based on Gradient Descent (GD).
7	Programs will be based on applications of Deep Learning.
8	Macro project will be based on the syllabus.

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Learning deep architectures for AI	Bengio, Yoshua	3 rd Edition	Foundations and trends in Machine Learning 2.1, Now Publishers.
2	Python Deep Learning by Daniel Slater	Gianmario Spacagna and Peter Roelants	2 nd Edition	Packt Publication

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI602T	Software Engineering and Project Management	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to provide</p> <ul style="list-style-type: none">• General idea of software engineering• Skills to design various software process models• Learning of software testing and various risk strategies	<p>Students will be able to</p> <ul style="list-style-type: none">• Learn the basic knowledge of software engineering and its process models• Identify measure, metrics and indicators and learn various Modeling Approach• Analyze and extract requirements for the product and translate these into a documented design using different modeling techniques.• Apply various software testing methods and debugging concepts for real time applications.• Comprehend project management, software risks and principles of quality management

Unit I: Introduction to Software Engineering	[9Hrs]
Basics: Introduction to Software Engineering, Software Myths, Software Engineering -A Layered Technology. Software Process Models: The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, Agile Process Models	
Unit II: Software Requirement Engineering	[9Hrs]
Measures Metrics and Indicator, Metrics for process & projects: Software measurement, metrics for software quality. System Engineering: Hierarchy, Business Process Engineering, Product Engineering, System Modeling, Requirements Engineering: Requirements Analysis, Analysis Modeling Approaches, Data Modeling, Object -Oriented Analysis, Scenario -Based Modeling, Flow-Oriented Modeling, Class -based Modeling, Behavioral Model.	
Unit III: Design Engineering	[9Hrs]
Design Engineering Concepts, Design Model, Pattern -Based Software Design, Architectural Design, Mapping data flow into software architecture, Cohesion, Coupling, User interface analysis and Design	
Unit IV: Software Testing	[9Hrs]
Unit Testing, Integration Testing, Validation Testing, System Testing, Art of Debugging, Software Testing Fundamentals, Black -Box Testing, White-Box Testing, Metrics for Source Code.	
Unit V: Risk & Quality Management	[9Hrs]
Risk Management: Risk strategies, Software risks, Risk identification, Risk refinement, RMMM Quality Management: Quality Concepts, Software Quality Assurance, Software Reviews, Formal Technical Review, Software Reliability, Change Management: Software Configuration Management, SCM Repository, SCM Process, Reengineering: Software reengineering, Reverse Engineering, Restructuring, Forward Engineering.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Software Engineering: A Practitioner's Approach	Roger Pressman (TMH)	6th Edition	TMH
2	Software Engineering for students	Douglas Bell	4th Edition	Pearson

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Software Engineering	K. K. Aggarwal and Yogesh Singh	3rd Edition	New age International Publishers
2	Software Engineering	Pfleeger, Atlee	4th Edition	Pearson

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI602P	Software Engineering and Project Management Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
<p>This course is intended to provide</p> <ul style="list-style-type: none">Understand and apply different software process modelsPerform effective requirements engineering and analysis modelingDesign software architecture and user interfaces using structured methodsApply testing techniques to improve software qualityUse software engineering tools for measurement, metrics, version control, and quality assurance	<p>Students will be able to</p> <ul style="list-style-type: none">Choose and justify an appropriate software process model for a given AI projectCreate SRS and develop UML analysis modelsDesign architecture, components, and user interfaces for a software systemPerform software testing using black-box, white-box, unit, and integration testing techniquesApply metrics, maintain versions using Git, and follow principles of SCM and quality assurance

Expt. No.	Title of the experiment
1	Assignment on software process models.
2	Software Requirement Specification (SRS)
3	Analysis Modeling
4	Software Design – Architectural & Component Level Design
5	User Interface Design Prototype
6	Software Quality Metrics and Code Metrics Calculation
7	Unit Testing & Integration Testing
8	Black-Box and White-Box Test Case Design
9	Project Management Tools
10	Micro Project on the syllabus of SEPM course

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Software Engineering: A Practitioner's Approach	Roger Pressman (TMH)	Sixth Edition	(TMH)
2	Software Engineering for students	Douglas Bell	4th Edition	Pearson

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI603T(i)	PE – II Augmented Reality & Virtual Reality	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to:</p> <ul style="list-style-type: none"> Understand the fundamental principles, concepts, components, and historical evolution of Augmented and Virtual Reality, including displays, tracking systems, sensors, and computer vision techniques. Develop the ability to design and construct AR/VR applications using interaction models, modeling and annotation methods, calibration procedures, and visual coherence techniques. Apply AR/VR technologies to real-world scenarios by evaluating virtual environments, human perception, rendering processes, system performance, and overall user experience. 	<p>Students will be able to:</p> <ul style="list-style-type: none"> Describe the foundations, scope, and display technologies used in Augmented Reality. Explain computer vision techniques such as marker tracking, SLAM, calibration, and visual coherence for AR systems. Apply interaction techniques, modeling methods, and authoring tools to AR/VR application development. Analyze the principles of Virtual Reality, including geometry, human vision, and rendering methods. Evaluate AR/VR system performance based on tracking, interaction, motion, audio, and user experience.

Unit I: Introduction to Augmented Reality	[8 Hrs]
Definition and Scope, A Brief History of Augmented Reality, Examples. Displays: Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays, Tracking: Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion	
Unit II: Computer Vision for Augmented Reality and Visual Coherence	[10 Hrs]
Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Incremental Tracking, Simultaneous Localization and Mapping, Outdoor Tracking. Calibration and Registration: Camera Calibration, Display Calibration, Registration. Visual Coherence: Registration, Occlusion, Photometric Registration, Common Illumination, Diminished Reality, Camera Simulation, Stylized Augmented Reality, Situated Visualization: Challenges, Visualization Registration, Annotations and Labeling, X-Ray Visualization, Spatial Manipulation, Information Filtering.	
Unit III: Interaction, Modeling and Annotation and Authoring	[10 Hrs]
Interaction: Input Modalities, Output Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Multi-view Interfaces, Haptic Interaction, Multimodal Interaction, Modeling and Annotation: Specifying Geometry, Specifying Appearance, Semi-automatic Reconstruction, Free-Form Modeling, Annotation, Authoring: Requirements of AR Authoring, Elements of Authoring, Stand-Alone Authoring Solutions, Plug-In Approaches, Web Technology	
Unit IV: Introduction to Virtual Reality	[8 Hrs]
Definition, Bird's-Eye View, The Geometry of Virtual Worlds: Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations Light and Optics, The Physiology of Human Vision, Visual Perception: Visual Rendering.	
Unit V: Virtual Reality in Action	[9 Hrs]
Motion in Real and Virtual Worlds, Tracking, Tracking 2D Orientation, Tracking 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies, 3D Scanning of Environments, Interaction: Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction, Additional Interaction Mechanisms, Audio, Evaluating VR Systems and Experiences, Frontiers.	

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Augmented Reality Principles and Practice	Dieter Schmalstieg Tobias Höllerer	1st	Addison Wesley
2.	VIRTUAL REALITY	Steven M. LaValle	1st	Cambridge University press

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Understanding Augmented Reality: Concepts and Application	Alan B. Craig	1st	Morgan Kaufmann (Elsevier)
2.	Understanding Virtual Reality: Interface, Application, and Design	William R. Sherman, Alan B. Craig	2nd	Morgan Kaufmann

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
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23AI603T(ii)	PE -II Information Retrieval	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to provide</p> <ul style="list-style-type: none">the fundamental concepts and components of Information Retrieval systems.the text processing techniques and indexing structures for efficient retrieval.	<p>Students will be able to</p> <ul style="list-style-type: none">Learn the fundamentals, architecture, and applications of Information Retrieval systems.Apply text preprocessing and indexing techniques for document representation and efficient search.Examine retrieval models and ranking methods to compare and retrieve relevant information.Evaluate IR systems using standard performance metrics and test collections.Analyze web search engine components, link analysis algorithms, and advanced neural IR approaches.

Unit I: Introduction to Information Retrieval & Indexing Basics	[9Hrs]
Boolean retrieval, Example IR problem, Inverted index basics, Boolean query processing, Ranked retrieval, Term vocabulary, Document processing, Skip pointers, Positional postings, Dictionary structures, Wildcard queries, Spelling correction, Phonetic correction, Index construction, Blocked sort-based indexing, SPIMI indexing, Distributed indexing, Dynamic indexing, Index compression, Dictionary compression, Postings compression	
Unit II Retrieval Models & Scoring	[9Hrs]
Scoring and term weighting, TF, IDF, TF-IDF variants, Vector Space Model, Query scoring, IR system components, Ranking methods, Evaluation of IR systems, Precision, Recall, F-measure, MAP, nDCG, Test collections, Relevance assessment, Relevance feedback, Pseudo relevance feedback, Query expansion, Global reformulation methods	
Unit III Structured Search & Probabilistic Models	[9Hrs]
Basic XML concepts, Challenges in XML retrieval, Vector space model for XML, Evaluation of XML retrieval, Text-centric vs data-centric retrieval, Probability Ranking Principle, Binary Independence Model, Extensions of probabilistic IR, Language models, Query likelihood model, Extended LM approaches.	
Unit IV Text Classification & Machine Learning Approaches	[9Hrs]
Text classification task, Naive Bayes classifier, Bernoulli model, Feature selection, Classification evaluation, Vector space classification, Rocchio classification, K-NN classification, Linear vs nonlinear classifiers, Multi-class classification, Bias-variance tradeoff, Support Vector Machines, SVM extensions, Machine learning methods in IR	
Unit V: Clustering, LSI & Web Search	[9Hrs]
Flat clustering, K-means, Model-based clustering, Clustering evaluation, Hierarchical clustering, HAC, Single-link, Complete-link, Group-average clustering, Divisive clustering, Cluster labeling, Matrix decomposition, Term-document matrices, SVD, Latent Semantic Indexing (LSI), Web search basics, Web characteristics, Duplicate detection, Shingling, Crawling, Distributed indexes, Connectivity servers, PageRank, HITS algorithm	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Introduction to Information Retrieval	Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze	1st	Cambridge University Press, 2008
2	Modern Information Retrieval: The Concepts and Technology behind Search	Ricardo Baeza-Yates, Berthier Ribeiro-Neto	2nd	Addison-Wesley, 2011
3	Search Engines: Information Retrieval in Practice	Bruce Croft, Donald Metzler, Trevor Strohman	1st	Pearson, 2010

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Information Retrieval: Implementing and Evaluating Search Engines	Stefan Büttcher, Charles L. A. Clarke, Gordon V. Cormack	1st	MIT Press, 2010
2	Managing Gigabytes: Compressing and Indexing Documents and Images	Alistair Moffat, Ian H. Witten	2nd	Morgan Kaufmann, 1999

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI603T(iii)	PE- II Computer Vision	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to</p> <ul style="list-style-type: none"> Review image processing techniques for computer vision. Apply various features and recognition techniques of computer vision. Learn about histogram and binary vision. 	<p>Students will be able to</p> <ul style="list-style-type: none"> Learn low level processing of image and transformation techniques applied to images. Adapt the feature extraction, segmentation and object recognition methods. Apply Histogram transform for detection of geometric shapes like line, ellipse and objects. Illustrate 3D vision process and motion estimation techniques. Apply vision techniques to real time applications.

Unit I Introduction	[9 Hrs]
Image Processing, Computer Vision - Low-level, Mid-level, High-level; Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.	
Unit II Feature Extraction and Feature Segmentation	[10 Hrs]
Feature Extraction -Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space 69 Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. Image Segmentation -Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation.	
Unit III Images, Histograms, Binary Vision	[8Hrs]
Simple pinhole camera model – Sampling – Quantisation – Colour images – Noise – Smoothing – 1D and 3D histograms - Histogram/Image Equalisation - Histogram Comparison - Back-projection - k-means Clustering – Thresholding - Threshold Detection Methods - Variations on Thresholding - Mathematical Morphology – Connectivity.	
Unit IV 3D Vision And Motion	[10 Hrs]
Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion–spline- based motion- optical flow – layered motion.	
Unit V Applications	[8 Hrs]
Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing , Application based on Deep Learning for computer vision.	

Text Books

Sr. No	Title	Authors	Edition	Publisher
1	Computer Vision: A Modern Approach"	D. A. Forsyth, J. Ponce,	2 nd	Pearson Education
2	Computer Vision: Algorithms and Applications	Richard Szeliski	2 nd	Springer Verlag London Limited

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Computer Vision: Models, Learning, and Inference	Simon J. D. Prince	2 nd	Cambridge University
2	Feature Extraction & Image Processing for Computer Vision,	Mark Nixon and Alberto S. Aquado	3 rd	Academic Press
3	Computer & Machine Vision	E. R. Davies	4 th	Academic Press

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23AI604T(i)	PE-III Big Data Analytics	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to provide</p> <ul style="list-style-type: none">To introduce the fundamental concepts, architectures, and ecosystem components of Big Data and distributed storage systems.To develop the ability to process, analyze, and manage large-scale datasets using MapReduce, NoSQL systems, and distributed frameworks.To enable students to apply scalable big data technologies such as Spark and cloud platforms for real-time analytics and AI-driven applications.	<p>Students will be able to</p> <ul style="list-style-type: none">Define and explain Big Data concepts, architectures, and Hadoop ecosystem components.Apply the MapReduce programming model and big data querying tools (Pig, Hive) for large-scale data processing.Differentiate NoSQL data models and demonstrate basic operations using MongoDB and HBase.Explain the components of the Apache Spark ecosystemAnalyze big-data-driven AI applications, cloud platforms, and industry case studies to suggest appropriate large-scale data solutions.

Unit I: Introduction To Big Data	(9 Hours)
Big Data: Definition, Characteristics (5Vs), Challenges & Applications, Data Types: Structured, Semi-Structured, Unstructured, Big Data Ecosystem Overview, Hadoop Architecture: HDFS & YARN, Hadoop Cluster: Components, Data Replication, Fault Tolerance, Big Data Architectures: Batch, Stream, Lambda Model.	
Unit II: MapReduce & Big Data Processing	(9 Hours)
MapReduce Programming Model: Map, Shuffle, Reduce, Writing MapReduce Programs (Java/Python Streaming), Input/Output Formats & Data Flow, Combiners, Partitioners & Optimization, Introduction to Pig: Data Flow, Pig Latin, Introduction to Hive: Tables, Partitions, Basic Queries.	
Unit III: NOSQL Systems	(9 Hours)
Introduction to NoSQL: Need, CAP Theorem, BASE Properties, NoSQL Types: Key-Value, Document, Column Family, Graph, MongoDB Data Model: Documents, Collections, MongoDB Operations: CRUD, Indexing, Aggregation, HBase Architecture: Region Servers, Column Families, NoSQL in AI Pipelines: Handling Large & Real-Time Data.	
Unit IV: Apache Spark Ecosystem	(9 Hours)
Introduction to Apache Spark: Components & Architecture, RDDs, DataFrames, Datasets: Transformations & Actions, Spark SQL: DataFrames, Queries & Optimization, PySpark for AI/ML	
Unit V: Big Data Applications & Cloud	(9 Hours)
Machine Learning with Big Data: Distributed Training, Feature Engineering at Scale, Graph Processing: PageRank, Connected Components, Big Data Security & Privacy, and Cloud Platforms for Big Data: AWS, Azure, Industry Case Studies (Netflix, Uber, Amazon, Google).	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Hadoop: The Definitive Guide	Tom White	Latest Edition	O'Reilly Media
2	Mining of Massive Datasets	Jure Leskovec, Anand Rajaraman, Jeffrey Ullman	Latest Edition	Cambridge University Press
3	Spark: The Definitive Guide	Bill Chambers, Matei Zaharia	Latest Edition	O'Reilly Media

Reference Books

S.N	Title	Authors	Edition	Publisher
1	NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence	Pramod J. Sadalage, Martin Fowler	Latest Edition	Pearson
2	Big Data: Principles and Best Practices of Scalable Realtime Data Systems	Nathan Marz, James Warren	Latest Edition	Manning Publications
3	Data Analytics with Hadoop	Benjamin Bengfort, Jenny Kim, Michelle Brush	Latest Edition	O'Reilly Media

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI604T(ii)	PE-III Optimization Techniques in ML	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to</p> <ul style="list-style-type: none">Provide understanding of the requirements, and essential steps involved in building a machine learning pipelining.Equip with conceptual knowledge and hands-on experience in ML model deployments on different targets.Experience in automating the process for continually developing, evaluating, deploying and updating the ML models.Introduce and apply industry practices for model monitoring and observability.	<p>Students will be able to</p> <ul style="list-style-type: none">Learn MLOps fundamentals, ML lifecycle, workflows, tools, and model performance metrics.Apply ML pipeline automation, data management techniques, DVC, and feature stores for scalable ML systems.Develop and manage ML models using MLflow, CI/CD practices, and estimate training time and GPU costs.Deploy, serve, and monitor ML models across different environments while analyzing system performance.Implement MLOps practices for LLMs including model versioning, optimization, security, bias handling, and governance.

Unit I: Introduction to MLOps	[8 Hrs]
Overview of MLOps and its significance in machine learning systems, Machine learning engineering, Machine learning lifecycle, comparison between traditional software development, DevOps, and MLOps, the key components of an MLOps system, benefits for MLOps. MLOps workflow, the landscape of modern MLOps tools. Model performance metrics	
Unit II: ML Pipelines & Data Management	[9 Hrs]
Data engineering tools and practices, data management strategies for machine learning models, and automation of ML pipelines. Data storage size estimation, data throughput, pipeline execution time calculation, and retraining frequency cost analysis Concepts of data version control using DVC, feature store principles, overview of Feast and its architecture, role of feature stores in machine learning and generative AI applications in MLOps.	
Unit III: Model Development & Pipelining for ML	[9 Hrs]
Machine Learning Model Development: Comparison of development of small model's vs large models including LLMs, Experiment tracking and model management using MLflow, hyperparameter tuning and optimization techniques. CI/CD (Pipelining) for ML Models: Use of version control systems like Git for model development, automated testing & validation, model delivery strategies. Training time estimation, GPU cost calculation	
Unit IV: Model Deployment, Serving & Monitoring	[10 Hrs]
Model Deployment and Serving: Overview of containerization and orchestration technologies and various other cloud-based deployment options, Deployment strategies for different environments (cloud, edge, on-premises), Model serving options, Monitoring and Performance Optimization: Techniques for monitoring model performance in production, Logging and error tracking for ML systems, Throughput, latency, response time and resource utilization	
Unit V: MLOps for LLMs, Security & Governance	[9 Hrs]
MLOps practices for Large Language Models including model versioning for foundation and fine-tuned models and CI/CD challenges specific to LLMs, model size, compression ratio, inference cost, and token-based pricing analysis, ML observability for large models, machine learning security and MLSecOps, bias and toxicity handling, model explainability, ML governance frameworks and Federated Learning.	

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Introducing MLOps	Mark Treveil & Dataiku Team	1 st Edition	O'Reilly Media
2.	Designing Machine Learning Systems	Chip Huyen	1 st Edition	O'Reilly Media
3.	Engineering MLOps: Rapidly build, test, and manage production-ready machine learning life cycles at scale	Emmanuel Raj	1 st Edition	Packt Publishing

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Reliable Machine Learning: Applying SRE Principles to ML in Production	Cathy Chen, Niall Richard Murphy, Kranti Parisa (et al.)	-	O'Reilly Media
2.	Machine Learning Engineering	Andriy Burkov	1st Edition	True Positive Inc
3.	Building Machine Learning Pipelines: Automating Model Life Cycles with TensorFlow	Hannes Hapke & Catherine Nelson	1st Edition (illustrated)	O'Reilly Media

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI604T(iii)	PE - III Reinforcement Learning	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to provide</p> <ul style="list-style-type: none"> Understand the fundamental concepts of Reinforcement Learning Learn and analyze classical RL methods Develop proficiency in model-free RL algorithms Explore advanced RL techniques Apply RL algorithms in real-world problems 	<p>Students will be able to</p> <ul style="list-style-type: none"> Explain RL fundamentals, MDPs, and agent-environment interaction. Implement Dynamic Programming, Monte Carlo, and TD algorithms for RL tasks. Apply model-free RL techniques such as Q-learning and SARSA to solve control problems. Design and train Deep RL models using deep neural networks. Evaluate and apply RL algorithms for real-world applications and research problems.

Unit I: Introduction to Reinforcement Learning	[9 Hrs]
Basics of Machine Learning vs Reinforcement Learning Components of RL: Agent, Environment, Rewards, State, Policy. Types of RL Tasks: Episodic vs Continuous Markov Processes, Markov Reward Processes (MRP) Markov Decision Processes (MDP), Bellman Equations Exploration vs Exploitation, Applications of RL in Robotics, Games, Finance, IoT, Autonomous Driving.	
Unit II: Dynamic Programming, Monte Carlo & TD Methods	[9Hrs]
Dynamic Programming (DP): Policy Evaluation, Policy Iteration, Value Iteration, Generalized Policy Iteration. Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Control: Exploring Starts, ϵ -greedy Off-policy MC Temporal Difference (TD) Learning TD Prediction (TD(0)) SARSA Q-Learning On-Policy vs Off-Policy Learning n-step TD Methods	
Unit III: Function Approximation & Policy Gradient Methods	[9Hrs]
Need for Function Approximation Linear Value Function Approximation Non-linear Approximation Gradient Descent in RL. Policy Gradient Methods REINFORCE Algorithm Actor-Critic Architecture, Advantage Functions (A2C, A3C), Baseline and Variance Reduction Techniques.	
Unit IV: Deep Reinforcement Learning	[9Hrs]
Basics of Deep Learning for RL, Deep Q-Network (DQN), Experience Replay, Fixed Target Networks, Double DQN, Dueling DQN, Deep Deterministic Policy Gradient (DDPG), Twin Delayed DDPG (TD3), Proximal Policy Optimization (PPO), Soft Actor Critic (SAC).	
Unit V: Applications & Case Studies	[9Hrs]
RL in Robotics (Navigation, Manipulation), RL in Autonomous Vehicles, RL in Smart IoT Systems / Internet of Vehicles RL in Game Playing: Atari, AlphaGo, AlphaZero, Multi-Agent RL basics, Ethical Issues and Safety in RL, Case Study on Research Trends in Reinforcement Learning.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Reinforcement Learning: An Introduction	Richard S. Sutton and Andrew G. Barto	2nd Edition	MIT Press, 2020.
2.	An Introduction to Deep Reinforcement Learning	Francois-Lavet, D., Henderson, P., Islam, R., Bellemare, M.G., Pineau, J.,	1st Edition	Morgan & Claypool Publishers, 2018.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courville	1st Edition	MIT Press, 2016
2.	Deep Reinforcement Learning Hands-On,	Maxim Lapan,	2nd Edition	Packt Publishing,
3.	Grokking Deep Reinforcement Learning	Aditya Bhargava,	1st Edition	Manning Publications, 2021.

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
23AS601T	Economics and Management	2	-	-	2	MSE	CA	ESE	Total
						7.5	7.5	35	50

Course Objectives	Course Outcomes
<ul style="list-style-type: none">The course examines how the economics, business and industrial management practices are related and how business decision is taken.	<ul style="list-style-type: none">Apply economic principles for business decisions by understanding production cost relationshipsAssess impact of macroeconomics and government policies on business and economy.Recognize key management, marketing, financial and HRM functions and their role in effective business decision-making

Unit I	[10Hrs]
Economics, Classification of economics, Industrial economics, Consumer demand, Law of Demand, Determinants of demand, Demand forecasting, Law of supply, Types of Elasticity of demand, Concept of Production, Factors of Production, types of cost, cost curves,	
Unit II	[10Hrs]
Market Structures-Perfect competition, Monopoly, and Monopolistic competition, Functions of central bank, Inflation, Deflation, Recession, National income, GDP, GNP, Liberalization, Privatization and Globalization	
Unit III	[10Hrs]
Definition of management, functions of management, Functions of human resources Management, Marketing Management, Functions of Marketing Management. Methods of pricing, advertising and sales promotion. Financial Management, functions of financial management, Sources of finance.	

Text Books

S. N	Title	Authors	Edition	Publisher
1.	Managerial Economics	D.N. Dwivedi	8th	Vikas Publishing
2.	Modern Economic Theory	K.K. Dewett	2005	S. Chand Publisher
3.	Industrial Management	Dr.I.K. Chopde, Dr.A.M. Sheikh	Revised edition	S. Chand Publisher

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Industrial Organization and Industrial economics	T.R. Banga, S.C. Sharma	2006	Khanna Publishers

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI6610(i)	OE-II: Introduction to Cloud Computing with ML	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
This course is intended to <ol style="list-style-type: none">Understand the Machine Learning WorkflowLeverage AWS Services for MLHands-On Practical ExperienceFocus on Model Deployment and Management	Students will be able to <ol style="list-style-type: none">Introduction to cloud and machine learning concepts.Apply machine learning on AWS and data preparation.Performing exploratory data analysis in AWS.Apply Model Selection, training, evaluation and hyper parameter tuning in AWS cloud.Apply Deploying, monitoring and managing ML Models on AWS

Unit I: Introduction to cloud and machine learning	[9Hrs]
Definition and Evolution of Cloud Computing, Cloud Service Models: IaaS, PaaS, SaaS, Cloud Deployment Models: Public, Private, Hybrid, Community, virtualization, virtual machine concept, Overview of Major Cloud Service Providers. Overview of machine learning concepts, definition, types of machine learning, applications. Machine learning algorithms: Supervised algorithms: Regression, classification: KNN, Naïve bayes, decision trees, random forest, SVM. Unsupervised algorithms: k-means, DBSCAN, hierarchical clustering algorithms.	
Unit II: Introduction to Machine Learning with AWS	[9Hrs]
AWS Services for Machine Learning, Setting Up Your AWS Environment, Introduction to Amazon SageMaker, Data Preparation for Machine Learning Data Collection and Preprocessing, Data Storage on AWS: S3, RDS, DynamoDB, Hands-On: Uploading and Managing Data on AWS.	
Unit III: Exploratory Data Analysis in AWS.	[9Hrs]
Techniques for EDA, Visualizing Data with AWS Services, Hands-On: EDA using AWS Glue and Amazon QuickSight, Run Glue Crawler & Create Glue Job, Validate the Output from Glue Job, Amazon Redshift, AWS Data Exchange, Analyze and visualize data for machine learning.	
Unit IV: Model Selection, training, evaluation and hyperparameter tuning	[9Hrs]
Choosing the Right Model, Training Machine Learning Models, Distributed Training on AWS, Hands-On: Training a Model with Amazon SageMaker, Evaluating Model Performance, Hyperparameter Tuning Techniques, Using SageMaker for Hyperparameter Optimization, Hands-On: Hyperparameter Tuning on AWS	
Unit V: Deploying, monitoring and managing ML Models on AWS	[9Hrs]
Introduction to Model Deployment, Deploying Models with SageMaker Endpoints, Hands-On: Deploying a Model to Production on AWS, Model Monitoring and Logging, Managing Model Versions, Hands-On: Monitoring and Managing Models with SageMaker, Case Study: Healthcare, Finance, and Retail.	

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Cloud Computing: Concepts, Technology & Architecture	Thomas Erl	1 st	Prentice Hall
2.	Practical Machine Learning with AWS: Process, Build, and Deploy Intelligent Solutions	Himanshu Singh and Drew Tawse	1 st	Packt Publishing
3.	Architecting the Cloud: Design Decisions for Cloud Computing Service Models	Michael J. Kavis	1 st	Wiley

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Mastering Cloud Computing: Foundations and Applications Programming	Rajkumar Buyya, Christian Vecchiola, and S. Thamarai Selvi	1st Edition	Morgan Kaufmann
2.	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	2nd Edition	O'Reilly Media

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						MSE	CA	ESE	Total
23AI661O(ii)	OE-II Ethical Hacking	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to</p> <ul style="list-style-type: none"> To explore the concepts of security testing and the knowledge required to protect against the hacker and attackers. To understand reconnaissance and the publicly available tools used to gather information on potential targets. To discover the scanning techniques used to identify network systems open ports. To identify network system vulnerabilities and confirm their exploitability. To explore techniques for identifying web application vulnerabilities and attacks. 	<p>Students will be able to</p> <ul style="list-style-type: none"> Use the various security tools to assess the computing system. Predict the vulnerabilities across any computing system using penetration testing. Identify prediction mechanism to prevent any kind of attacks. Protect the system from malicious software and worms. Evaluate the wireless network flaws and able to apply security patches.

Unit I: Introduction to Hacking	[7Hrs]
Introduction to Hacking – Important Terminologies – Penetration Test – Vulnerability Assessments versus Penetration Test – Pre-Engagement – Rules of Engagement – Penetration Testing Methodologies – OSSTMM – NIST – OWASP – Categories of Penetration Test – Types of Penetration Tests – Vulnerability Assessment Summary – Reports.	
Unit II: Information Gathering and Scanning	[8Hrs]
Information Gathering Techniques – Active Information Gathering – Passive Information Gathering – Sources of Information Gathering – Tracing the Location – Traceroute – ICMP Traceroute – TCP Traceroute – Usage – UDP Traceroute – Enumerating and Fingerprinting the Webservers – Google Hacking – DNS Enumeration – Enumerating SNMP – SMTP Enumeration – Target Enumeration and Port Scanning Techniques – Advanced Firewall/IDS Evading Techniques.	
Unit III: Network Attacks	[7Hrs]
Vulnerability Data Resources – Exploit Databases – Network Sniffing – Types of Sniffing – Promiscuous versus No promiscuous Mode – MITM Attacks – ARP Attacks – Denial of Service Attacks – Hijacking Session with MITM Attack – SSL Strip: Stripping HTTPS Traffic – DNS Spoofing – ARP Spoofing Attack - Manipulating the DNS Records – DHCP Spoofing – Remote Exploitation – Attacking Network Remote Services – Overview of Brute Force Attacks – Traditional Brute Force – Attacking SMTP – Attacking SQL Servers – Testing for Weak Authentication.	
Unit IV: Attack Exploitation	[7Hrs]
Introduction to Metasploit – Reconnaissance with Metasploit – Port Scanning with Metasploit – Compromising a Windows Host with Metasploit – Client Side Exploitation Methods – E-Mails with Malicious Attachments – Creating a Custom Executable – Creating a Backdoor with SET – PDF Hacking – Social Engineering Toolkit – Browser Exploitation – Post-Exploitation – Acquiring Situation Awareness – Hashing Algorithms – Windows Hashing Methods – Cracking the Hashes – Brute force - Dictionary Attacks – Password Salts – Rainbow Tables – John the Ripper – Gathering OS Information – Harvesting Stored Credentials.	
Unit V: Enterprise Security	[7Hrs]
Gaining and Maintaining Access : Systems hacking – Windows and Linux – Metasploit and Kali Linux, Keylogging, Buffer Overflows, Privilege Escalation, Network hacking - ARP Poisoning, Password Cracking, WEP Vulnerabilities, MAC Spoofing, MAC Flooding, IPSpoofing, SYN Flooding, Smurf attack, Applications hacking : SMTP/Email-based attacks.	

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Ethical Hacking and Penetration Testing Guide	Rafay Baloch	1 st	CRC Press
2.	Ethical Hacking for Dummies	Kevin Beaver	6 th	Wiley

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Hands-on ethical hacking and network defense.	Simpson, Michael T., Kent Backman, & James Corley	1	Course Technology Press, 2012.
2.	Exploitation and countermeasures for modern web applications	Hoffman, Andrew.	1	O'Reilly Media, 2020

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI606P	Project - I	-	-	4	2	50	50	100

Course Objectives	Course Outcomes
<p>This course is intended to provide</p> <ul style="list-style-type: none">• Provide students with exposure to real-world problem identification and solution development processes.• Enable students to apply theoretical knowledge and technical skills to design and develop practical systems.• Foster analytical thinking, experimentation, testing, and performance evaluation abilities.• Cultivate professional ethics, teamwork, documentation practices, and technical communication skills.	<p>Students will be able to</p> <ul style="list-style-type: none">• Analyze real-world problems and formulate clear problem statements with defined objectives and scope.• Design and develop appropriate solutions using suitable algorithms, tools, and methodologies.• Implement, test, and evaluate the project outcomes using relevant performance metrics and validation techniques.• Demonstrate professional ethics, effective documentation, teamwork, and technical presentation skills during project execution.

Course Plan	4 Hrs
<p>The course is designed to cover the complete project development lifecycle, beginning with problem identification, literature review, and formulation of clear objectives. This is followed by system design and selection of appropriate algorithms, tools, and methodologies. The project progresses through development, implementation, testing, and performance evaluation with continuous monitoring through scheduled seminars and reviews. The course concludes with final validation, report submission, and technical presentation, ensuring structured exposure to real-world project development practices and professional standards.</p>	

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI641P	Career Development VI	-	-	2	1	50	-	50

Course Objectives	Course Outcomes
<p>The sole objective of imparting aptitude training is to make students able to critically evaluate various real-life situations by resorting to an analysis of key issues and factors.</p> <p>This Aptitude Training helps them to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.</p> <p>To categorize, apply and use thought process to distinguish between concepts of Quantitative methods.</p>	<ol style="list-style-type: none"> Students shall solve real life problems comparison of various probabilities, Permutation and combinations to ascertain the best outcomes expected Students shall draw conclusions or Understand geometrical terminology for angles, triangles, quadrilaterals and circles with the help of formulas. The ability to analyze and interpret different forms of data, including tables, graphs, charts, and more. Enable students to critically analyze material (information) to order to evaluate evidence, construct reasoned arguments, and communicate inferences and conclusions. The ability to analyses visual information and solve problems based on visual reasoning.

Unit I	[6Hrs]
Aptitude:- Permutation and Combinations:- Letter Arrangement, Number Arrangement, miscellaneous questions Probability:- Color balls, Dice Problems, coins Problems, Playing Cards Problem, Miscellaneous Imax:- Learn Start-up, True Entrepreneurship,	
Unit II	[6Hrs]
Aptitude: - Mensuration: - 2-Dimension Problems, 3-Dimension Problems, Area, Volume, Surface Area, Total Surface Area. Geometry: - Lines, Circle, Triangles Etc. Imax:- Personal Accountability, Innovation Lessons from our Ancestors	
Unit III	[6Hrs]
Aptitude:- Data Interpretation:- Tabular DI Bar Graph Line graph Pie Char	
Unit IV	[6Hrs]
Aptitude:- Logical Thinking (Syllogism) and Venn Diagram problem:- Some, No, All, Some Not, Very Few, Few, Possibility Problem Imax:- Interview Practice 1, Interview Practice 2, Interview Practice 3	
Unit V	[6Hrs]
Aptitude:- Non Verbal Reasoning:- Mirror Images, Water Images, Paper Cutting, Paper Folding, Fig Embedded Imax:- Interview Practice 4, Interview Practice 5, Interview Practice 6	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Quantitative Aptitude By R. S. Aggarwal	R.S. Aggarwal		
2	Quantitative Aptitude	Shripad Deo		Allied Publication
3	A Modern Approach to Verbal & Non-Verbal Reasoning	R.S. Aggarwal		

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Quantitative Aptitude for CAT by Arun Sharma	Arun Sharma		

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AI631M	MDM - IV AI for Engineering System	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to provide</p> <ol style="list-style-type: none"> Understand the principles, data workflows, and architectural foundations required to design AI-enabled engineering systems. Explain various machine learning model types and apply them for integrating intelligent components into multidisciplinary engineering domains. Analyze, test, and evaluate AI-driven engineering systems with respect to system performance, reliability, scalability, and lifecycle management. 	<p>Students will be able to</p> <ol style="list-style-type: none"> Explain the architecture and key components of AI-based engineering systems. Develop and manage data pipelines required for AI model development in multidisciplinary applications. Identify and select suitable ML model types for different engineering problems. Integrate AI models into engineering workflows and analyze system behavior for improved performance and automation. Evaluate AI-enabled engineering systems through verification, validation, and reliability assessment techniques.

Unit I: Foundations of AI Engineering	[9 Hrs]
Overview of AI Engineering and Intelligent Systems, Characteristics of AI-driven systems: data-centric, uncertainty, model behaviour, AI system lifecycle: data → model → integration → deployment → monitoring, Differences between traditional software engineering and AI system engineering.	
Unit II: Data Engineering for AI Systems	[9Hrs]
Data pipelines, ETL, data cleaning, labeling standards, Dataset versioning, metadata management, data governance Feature engineering basics for engineering systems, Tools: Data lakes, feature stores, automated data quality checks	
Unit III: AI Model Development & ML Model Types	[9Hrs]
Categories of Machine Learning models: Supervised, Unsupervised, Semi-supervised, Deep Learning models (CNN, RNN, Transformers), Reinforcement Learning fundamentals. Model development workflow: training, validation, hyperparameter tuning. Experiment tracking, reproducibility, and model versioning. AI architecture patterns: modular AI components, pipeline-based architectures. Model evaluation metrics for engineering systems.	
Unit IV: AI Integration with Engineering Systems	[9Hrs]
Integration of AI components with traditional engineering systems, System modelling and simulation with AI support, AI-enabled control systems and feedback loops, AI for automation in mechanical, civil, electrical, and computer-based systems, Human-AI interaction in engineering environments, Scalability and reliability considerations in multidisciplinary engineering systems.	
Unit V: Applications & Governance in Engineering AI Systems	[9Hrs]
AI applications across engineering disciplines: Mechanical: predictive maintenance, robotics control. Civil: structural health monitoring, smart city infrastructure. Electrical/Electronics: energy optimization, smart grids, signal processing Computer/IT: intelligent networks, IoT-based decision systems. Governance & lifecycle management: Documentation and audit trails for engineering AI systems, Validation, verification, testing & quality assurance, Risk assessment and system reliability for AI-enabled engineering projects.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Engineering AI Systems: Architecture and DevOps Essentials	Len Bass, Qinghua Lu, Ingo Weber, Liming Zhu..	1st Edition	Springer 2023
2.	Artificial Intelligence: A Modern Approach	Stuart Russell, Peter Norvig	4th Edition	Pearson 2020.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Machine Learning Engineering	Andriy Burkov	1st Edition	True Positive Publishing 2020
2.	Building Machine Learning Powered Applications	Emmanuel Ameisen	1st Edition	O'Reilly Media 2020
3.	Foundations of Machine Learning	Mohri, M. Rostamizadeh, A., & Talwalkar, A.	2nd Edition	MIT Press 2018

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