



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

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

B. Tech. Scheme of Examination & Syllabus 2024-25

ARTIFICIAL INTELLIGENCE

Annexure – I

CREDIT FRAMEWORK STRUCTURE

Semester	I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course (BSC)	7	7	-	-	-	-	-	-	14
Engineering Science Course (ESC)	6	6	-	-	-	-	-	-	12
Program Core Course (PCC)					11	9	9	-	72
Program Elective Course (PEC)					3	3	3	3	
Multidisciplinary Minor (MDM)	-	-	2	3	3	3	3	-	14
Open Elective (OE)	-	-	-	-	-	2	3	3	08
Vocations Skill Courses (VSC)	-	-	-	2	2	-	-	-	04
Ability Enhancement Course (AEC)	1	1	-	3	-	-	-	-	05
Indian Knowledge System (IKS)	2	-	-	-	-	-	-	--	02
Value Education Course (VEC)	-	-	3	-	-	-	-	-	03
Skill Enhancement Courses (SEC)	1	3	1	1	1	1	-	-	08
Co-curricular Courses (CC)	2	2	-	-	-	-	--	--	04
Project work, seminar and internship in industry (ELC)	-	-	1	1	-	2	2	12	18
Research Methodology	-	-	-	-	-	-	-	2	02
Total Credits (Major)	22	22	22	20	20	20	20	20	166

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FIFTH SEMESTER

Sr No	Course Category	Course Code	Course Title	Hours per Week			Credits	Maximum Marks				Minimum Passing	No of Hours for ESE
				L	T	P		Mid-Sem Examination	Continual Assessment	End Sem Examination	Total		
1	PCC	24AI501T	Machine Learning	3	-	-	3	20	20	60	100	45	3
2	PCC	24AI501P	Machine Learning Lab	-	-	2	1	-	25	25	50	25	-
3	PCC	24AI502T	Software Engineering and Project Management	3	-	-	3	20	20	60	100	45	3
4	PCC	24AI502P	Software Engineering and Project Management Lab	-	-	2	1	-	25	25	50	25	-
5	PCC	24AI503T	Theory of Computation	3	-	-	3	20	20	60	100	45	3
6	PEC	24AI504T	Program Elective – I	3	-	-	3	20	20	60	100	45	3
7	VSC	24AI505P	Technical Skill Development – II	-	-	4	2	-	50	-	50	25	-
8	HSSM	24AI541P	Career Development – V	-	-	2	1	-	50	-	50	25	-
9	MDM	24AI531M	Multidisciplinary Minor – III	3	-	-	3	20	20	60	100	45	3
Total				15	0	10	20	100	250	350	700		

Program Elective - I	
24AI504T(i)	Data Warehousing and Mining (DWM)
24AI504T(ii)	Human Computer Interaction (HCI)
24AI504T(iii)	Image Processing

Multidisciplinary Minor – III	
24AI531M	Explainable AI

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24AI501T	Machine Learning	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
<p>This course is intended</p> <ol style="list-style-type: none"> To introduce Human learning aspects and Machine learning. To study primitives and methods in learning process by computer. To familiarize nature of problems solved with Machine Learning. 	<p>Students will be able to</p> <ol style="list-style-type: none"> Explain fundamentals of Machine Learning. Analyze supervised classification techniques. Apply Logistic Regression to real-world problems. Implement distance-based, probability-based, and clustering models. Apply dimensionality reduction and association rule mining.

Unit I : Introduction	[9Hrs]
Introduction to Machine learning (ML), Need of Machine learning, Relationship between ML and human learning, Examples of Machine Learning Problems, Learning Process, Learning methods, Forms of learning, Training versus Testing, Characteristics of Machine learning tasks, Descriptive, Predictive and Prescriptive tasks ML Techniques: Supervised, Semi- Supervised, Unsupervised and Reinforcement Learning. Feature Selection Techniques in Machine Learning, Data Preprocessing operations and their requirements. Machine Learning Perspective of Data and Feature Engineering, Exploratory Data Analysis (EDA), Performance measures.	
Unit II: Regression	[9Hrs]
Regression: Correlation Coefficient, Pearson, Spearman and Kendall Correlation, Linear Regression, Simple Linear Regression, Multiple Linear Regression, Assessing performance of Regression- MSE, MAE, MAPE, R2 Score, Adjusted R2, Overfitting, Underfitting. Polynomial Regression, Multivariate Regression, Regression Diagnosis, Nonlinear Regression Regularization Methods: Ridge, LASSO, Elastic Net Regression.	
Unit III: Supervised learning	[9Hrs]
Classification: Binary Classification, Multi-Class Classification, Multi-Label Classification, Imbalanced Classification, Confusion Matrix, Classification Assessment- Precision, Recall, F1-Score and Accuracy. Machine Learning Algorithms based on Classification: Logistic Regression- Sigmoid Function, Finding Probability, Data Model : Receiver Operating Characteristic (ROC), Area Under Curve (AUC), Decision Tree Classification- Entropy, Gini Index, Classification and Regression Trees. Distance Based Models: Neighbors and Examples, Nearest Neighbor Classification, Finding values of K, Distance Measures. Kernel Based Models: Support Vector Machines, Linear SVM, RBF SVM, Sigmoid SVM, Polynomial SVM. Probability Based Models: Conditional Probability, Bayes Theorem, Naive Bayes Classification, Bayesian Regression.	
Unit IV: Unsupervised learning	[9Hrs]
K-means Clustering- Introduction to Clustering, Algorithm, Elbow Method, Silhouette Score Hierarchical Clustering- Dendrogram, Distance Measures, Ward method K-medoids Clustering, K-Prototype Clustering, DBSCAN, Performance Evaluation of Clustering, Real Life Example of Clustering	
Unit V: Dimensionality reduction techniques	[9Hrs]
Association Rules- Rules Mining, Support, Confidence, Lift, Conviction, Leverage, Apriori Algorithm, FP-Growth Algorithm. Dimensionality Reduction- Curse of Dimensionality, Normalization, Standardization, Eigen Vector and Values, Support Vector Decomposition, Principal Component Analysis, Factor Analysis.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Introduction to Machine Learning	Ethem Alpaydin	2nd	PHI
2	Machine Learning: The Art and Science of Algorithms that Make Sense of Data,	Peter Flach	1st	Cambridge University Press

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Pattern Recognition and Machine Learning	C.M. Bishop	1st	Springer
2	Data Mining, Practical Machine Learning Tools and Techniques	Ian H Witten	3rd	Elsevier

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24AI501P	Machine Learning Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended to <ol style="list-style-type: none">1. Apply theoretical knowledge in practical learning.2. Develop programming skills.3. Implement machine learning skills4. Work with real world datasets.	Students will be able to <ol style="list-style-type: none">1. Explain the implementation procedures for the machine learning algorithms.2. Apply appropriate data sets to the Machine Learning algorithms.3. Identify and apply Machine Learning algorithms to solve real world problems.4. Implement Supervise machine learning techniques5. Demonstrate Unsupervised machine learning techniques

Sr. No.	Title of Experiment
1	Data preprocessing techniques to make data suitable for machine learning.
2	Evaluate the accuracy of the model through linear regression.
3.	logistic regression techniques.
4.	Determine accuracy using KNN classifier.
5.	Naïve Bayes algorithm.
6.	Ddecision tree algorithm.
7.	k-means clustering algorithm and evaluate the performance.
8.	DBSCAN clustering technique.
OPEN ENDED PRACTICALS	
9	ANN algorithm on a dataset.
10	basic natural language processing techniques.

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Pattern Recognition and Machine Learning	C.M. Bishop	1st	Springer
2.	Data Mining, Practical Machine Learning Tools and Techniques	Ian H Witten	3rd	Elsevier

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24AI502T	Software Engineering and Project Management	3	-	-	3	20	20	60	100
Course Objectives					Course Outcomes				
This course is intended to <ol style="list-style-type: none"> Understand general idea of software engineering Develop skills to design various software process models Improve skills required for software testing and various risk strategies 					Students will be able to <ol style="list-style-type: none"> Illustrate 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. Use various software testing methods and debugging concepts Comprehend project management, software risks and principles of quality management 				
Unit I: Introduction					[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: Measures and Requirement Analysis					[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: 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 Management and 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

Sr. No	Title	Authors	Edition	Publisher
1	Software Engineering A Practitioner's Approach	Roger Pressman (TMH)	6th	(TMH)
2	Software Engineering for students	Douglas Bell	4th	Pearson

Reference Book

Sr. No	Title	Authors	Edition	Publisher
1	Software Engineering	K. K. Aggarwal and Yogesh Singh	3rd	New age International Publishers
2	Software Engineering	Pfleeger, Atlee	4th	Pearson

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24AI502P	Software Engineering and Project Management Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
<p>This course is intended to</p> <ul style="list-style-type: none"> Understand and apply different software process models Perform effective requirements engineering and analysis modeling Design software architecture and user interfaces using structured methods Apply testing techniques to improve software quality Use 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 project Create SRS and develop UML analysis models Design architecture, components, and user interfaces for a software system Perform software testing using black-box, white-box, unit, and integration testing techniques Apply metrics, maintain versions using Git, and follow principles of SCM and quality assurance

Expt. No.	Title of the experiment
1	Software Process Model Case Study
2	Software Requirement Specification (SRS) using IEEE Format
3	Analysis Modeling using UML Tools
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	Micro Project (Real world project Management applications using Github)

Reference Books

Sr. No	Title	Authors	Edition	Publisher
1	Software Engineering: A Practitioner's Approach	Roger Pressman (TMH)	6th	TMH
2	Software Engineering for students	Douglas Bell	4th	Pearson

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24AI503T	Theory of Computation	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
<p>This course is intended to</p> <ol style="list-style-type: none"> 1. Explain the basic concepts in the theory of computation. 2. To teach formal languages and various models of computation. 3. To exhibit fundamental concepts related with computability theory 	<p>Students will be able to</p> <ol style="list-style-type: none"> 1. Outline the formal relationships among machines, languages and grammars. 2. Design and optimize finite automata for given regular language. 3. Construct Push-Down Automata, Turing Machine for given languages. 4. Demonstrate use of computability, decidability. 5. Apply recursive function theory through Problem solving

Unit I: Introduction	[9Hrs]
Mathematical Preliminaries: Basics of Sets and Relations, Countability and Diagonalization, Principle of Mathematical Induction, Pigeonhole Principle, Fundamentals of Formal Languages.	
Unit I: Finite automata	[9Hrs]
Deterministic finite automata (DFA), Nondeterministic finite automata (NFA) and equivalence with DFA, Minimization of finite automata, NFA with Epsilon Transitions, Finite Automata with output.	
Unit III: Regular Expression and Language	[9Hrs]
Regular Expressions and Regular Languages, Regular Grammars and Equivalence with Finite Automata, Properties of Regular Languages, Pumping Lemma for Regular Languages, Context-Free Grammars (CFG) and Context-Free Languages (CFL), Parse Trees and Derivations, Ambiguity in CFG, Reduction and Simplification of CFGs, Chomsky Normal Form (CNF) and Greibach Normal Form (GNF).	
Unit IV: Push Down Automata	[9Hrs]
Deterministic Pushdown Automata (DPDA), Non-Deterministic Pushdown Automata (NPDA), Acceptance by Empty Stack and Final State, Equivalence of Pushdown Automata and CFG, Closure Properties of CFLs.	
Unit V: Turing machine	[9Hrs]
Basic Model of Turing Machines (TM), Turing Recognizable (Recursively Enumerable) Languages, Turing-Decidable (Recursive) Languages, Variants of Turing Machines, Unrestricted Grammars and Equivalence with Turing Machines, Turing Machines as Enumerators.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Introduction to Automata Theory, Languages, and Computation.	John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman	3rd	Pearson Education Asia

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Elements of the Theory of Computation	C. Kozen, Automata and Computability	2nd	Springer
2.	Introduction to the Theory of Computation	Michael Sipser	2nd	PWS Publishing

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24AI504T(i)	PE – I Data Warehousing and Mining (DWM)	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
<p>This course is intended to</p> <ol style="list-style-type: none"> Understand fundamentals of Data Warehousing and Data Mining. Learn preprocessing and visualization techniques for data analysis. Apply association, classification, and clustering methods. Analyze datasets using AI-oriented data mining techniques. Explore real-world applications of data mining in AI systems. 	<p>Students will be able to</p> <ol style="list-style-type: none"> Explain concepts of data warehousing and data mining. Apply preprocessing and visualization techniques on datasets. Implement association rule mining techniques. Apply classification methods for prediction problems. Perform clustering and analyze AI-based applications.

UNIT-I: Introduction to Data Warehousing and OLAP	[9 Hrs]
Introduction to data warehouse, OLTP vs OLAP, data warehouse architecture, data cube concept, OLAP operations such as roll-up, drill-down, slice and dice, applications of data warehousing in business intelligence and AI.	
UNIT II: Data Mining and its techniques	[9 Hrs]
Introduction to Data Mining, types of data and datasets, data mining functionalities, applications of data mining in Artificial Intelligence, data cleaning, data integration, data transformation, data reduction, data visualization, similarity and distance measures.	
UNIT III: Association Rule Mining	[9 Hrs]
Frequent pattern mining, association rules, support and confidence measures, Apriori algorithm, pattern evaluation, market basket analysis, recommendation system basics and applications.	
Unit IV Classification Techniques	[9 Hrs]
Introduction to classification, decision tree classification, Naïve Bayes classification, rule-based classification, model evaluation techniques, ensemble methods basics, introduction to Support Vector Machine and neural network classification, applications in predictive analytics.	
UNIT V: Clustering and Web Mining	[9 Hrs]
Introduction to clustering, K-Means clustering, hierarchical clustering, DBSCAN basics, cluster evaluation, introduction to web mining, web content and usage mining, social media data analysis, AI applications of clustering.	

Text Books

Sr. No	Title	Authors	Edition	Publisher
1	Data Mining: Concepts and Techniques	Jiawei Han, Micheline Kamber, Jian Pei	3rd Edition	Elsevier
2	Introduction to Data Mining	Pang-Ning Tan, Michael Steinbach, Vipin Kumar	2nd Edition	Pearson
3	Data Warehousing	Amitesh Sinha	2nd Edition	Thomson Learning

Reference Books

Sr. No	Title	Authors	Edition	Publisher
1	Data Mining Techniques	Arun K. Pujari	3rd Edition	Universities Press
2	Principles of Data Mining	David Hand, Heikki Mannila, Padhraic Smyth	1st Edition	MIT Press

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24AI504T(ii)	PE – I Human Computer Interaction (HCI)	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
<p>This course is intended to</p> <ol style="list-style-type: none"> 1. Explain fundamental principles relating to the design, implementation and evaluation of interactive applications. 2. User centric design approaches that contribute to the development of usable interface and interaction are focused. 	<p>Students will be able to</p> <ol style="list-style-type: none"> 1. Introduce the student to the literature of human-computer interaction. 2. Provide the future user interface designer with concepts and strategies for making design decisions. 3. Expose the future user interface designer to tools, techniques, and ideas for interface design. 4. Illustrate the importance of good user interface design 5. Demonstration of various software tools.

UNIT-I: Introduction:	[9 Hrs]
Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design, The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.	
Unit II Design Process:	[9 Hrs]
Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, and understanding business junctions.	
Unit III Screen Designing	[9 Hrs]
Screen Designing : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.	
Unit IV Windows Navigation	[9 Hrs]
Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls, Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.	
Unit V: Software Tools	[9 Hrs]
Software tools – Specification methods, interface – Building Tools, Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.	

Text Books

Sr. No	Title	Authors	Edition	Publisher
1	The essential guide to user interface design	Wilbert O Galitz, Wiley DreamaTech.	3 rd	Willey
2	Designing the user interface	Ben Shneidermann	3 rd	Pearson Education
3.	User Interface Design	Søren Lauesen	1 st	Pearson

Reference Books

Sr. No	Title	Authors	Edition	Publisher
1	Human – Computer Interaction	Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg	3 rd	Pearson
2	Interaction Design: Beyond Human-Computer Interaction	Jenny Preece, Yvonne Rogers, Helen Sharp	2 nd	Willey

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24AI504T(iii)	PE - I Image Processing	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
<p>This course is intended</p> <ol style="list-style-type: none"> 1. Illustrate the fundamentals of digital image processing and image representation. 2. Extend image enhancement and restoration techniques. 3. Analyze image segmentation and morphological operations. 	<p>Students will be able to</p> <ol style="list-style-type: none"> 1. Explain the fundamentals of digital image processing and image representation techniques. 2. Apply image enhancement and restoration techniques to improve image quality. 3. Analyze segmentation and morphological processing methods for image analysis. 4. Implement image compression and feature extraction techniques. 5. Develop image processing applications using modern tools and techniques.

Unit I : Fundamentals of Digital Image Processing	[9Hrs]
Introduction to Digital Image Processing, Applications of Image Processing, Image Formation and Acquisition, Sampling and Quantization, Pixel Relationships, Connectivity, Distance Measures, Image Representation, Basic Mathematical Operations on Images, Gray Level Transformations, Color Models: RGB, HSV, HSI	
Unit II: Image Enhancement Techniques	[9Hrs]
Spatial Domain Processing, Histogram Processing and Equalization, Contrast Stretching, Smoothing Filters, Sharpening Filters, Median and Gaussian Filtering, Frequency Domain Fundamentals, Fourier Transform, Low Pass and High Pass Filtering	
Unit III: Image Restoration and Morphological Processing	[10Hrs]
Image Degradation Model, Noise Models, Image Restoration Techniques, Inverse Filtering, Wiener Filtering, Morphological Operations, Dilation, Erosion, Opening, Closing, Boundary Extraction, Morphological Applications	
Unit IV: Image Segmentation and Representation	[9Hrs]
Fundamentals of Segmentation, Edge Detection Techniques, Thresholding Methods, Region-Based Segmentation, Image Representation, Boundary Representation, Chain Codes, Shape Descriptors, Feature Extraction Techniques	
Unit V: Image Compression and Applications	[9Hrs]
Fundamentals of Image Compression, Redundancies in Images, Lossless and Lossy Compression Techniques, JPEG Compression, Wavelet-Based Compression, Object Recognition Basics, Applications in Medical Imaging, Remote Sensing, Biometrics, and Computer Vision	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Digital Image Processing	Rafael Gonzalez and Richard E. Woods	4 th	Pearson
2	Fundamentals of Digital Image Processing	Anil K. Jain	1 st	Pearson Education / Prentice Hall India

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Digital Image Processing Using MATLAB	Rafael C. Gonzalez, Richard E.	3 rd	McGraw-Hill Education
2	Computer Vision and Image Processing	Adrian Low	1 st	McGraw-Hill

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25AI505P	Technical Skill Development - II	-	-	4	2	50	-	50

Course Objectives	Course Outcomes
<p>This course is intended</p> <ol style="list-style-type: none"> Develop skills in data analytics, machine learning, and AI technologies using modern tools and frameworks. Enable students to perform data preprocessing, visualization, database operations, and ETL processes for AI applications. Strengthen problem-solving abilities through hands-on projects involving deep learning and real-world AI solutions. 	<p>Students will be able to</p> <ol style="list-style-type: none"> Apply Excel, SQL, ETL, and data visualization techniques for data-driven decision-making and AI applications. Implement machine learning and deep learning models using Python, TensorFlow, and PyTorch frameworks. Develop AI-based solutions utilizing NLP, reinforcement learning, computer vision, and project-based learning approaches.

Module 1: AI Implementation and AI Tools in Practice	[4 Hr]
Introduction to AI Applications, Generative AI Fundamentals, Prompt Engineering Basics, AI Productivity Tools, AI Coding Assistants, AI for Content Generation, AI for Data Analysis, AI Chatbots and Virtual Assistants, Responsible AI	
Module 2: Advanced Excel and Business Analytics	[4 Hr]
Advanced Excel Functions, Logical Functions, Lookup Functions (VLOOKUP, HLOOKUP, XLOOKUP, INDEX-MATCH), Conditional Formatting, Data Validation, Pivot Tables, Pivot Charts, Dashboard Design, What-if Analysis, Goal Seek, Solver, Business Analytics and Reporting using Excel.	
Module 3: Data Preprocessing and Data Wrangling	[4 Hrs]
NumPy, Pandas, Data Collection Techniques, Data Cleaning, Missing Value Handling, Outlier Detection, Feature Scaling, Data Transformation, Exploratory Data Analysis (EDA), Business and AI Data Insights.	
Module 4: Data Visualization with Python	[4 Hrs]
Plot creation with Matplotlib, line and bar charts, histograms, subplots, figure customization, Seaborn statistical plots, pair plots, heatmaps, distribution analysis, visualization for data patterns and AI insights.	
Module 5: Expert Systems	[4 Hrs]
Introduction to Expert Systems, Knowledge Representation Techniques, Rule-Based Systems, Production Rules, Knowledge Base Development, Inference Engine Concepts, Forward Chaining and Backward Chaining Demonstrations	
Module 6: Deep Learning and Neural Networks	[4 Hrs]
Artificial Neural Networks (ANN), Perceptron Model, Activation Functions, Feed Forward Networks, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Deep Learning Applications.	
Module 7: Advanced AI Applications	[4 Hrs]
Introduction to Natural Language Processing, Text Processing, Sentiment Analysis, Chatbots, Reinforcement Learning Concepts, Agent-Environment Interaction, Computer Vision Fundamentals, Image Classification Applications.	
Module 8: - Project-Based Learning and AI Solutions	[4 Hrs]
AI Mini Projects, Industry Case Studies, Hackathon Problem Statements, End-to-End AI Workflow, Dataset Analysis, Model Development, Presentation of AI-Driven Solutions, Team-Based Projects.	

Textbooks

Sr. No.	Title	Authors	Edition	Publisher
1	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	3 rd Edition	O'Reilly Media
2	Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter	Wes McKinney	3 rd Edition	O'Reilly Media

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ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

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B. Tech. Scheme of Examination & Syllabus 2026-27

ARTIFICIAL INTELLIGENCE

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24AI541P	Career Development – V	-	-	2	1	50	-	50

Course Objectives	Course Outcomes
To enhance students' aptitude, analytical reasoning, communication, teamwork, and professional presentation skills required for competitive examinations, higher education, and workplace success.	<p>CO1. Students will be able to solve problems related to time and work, pipe and cisterns, geometry, mensuration, and analytical puzzles using logical and quantitative reasoning skills.</p> <p>CO2. Students will be able to apply concepts of time, speed, and distance and solve coding-decoding and direction sense problems accurately using analytical thinking.</p> <p>CO3. Students will be able to perform SWOC analysis, set SMART goals, and deliver effective self-introductions with confidence and professional communication skills.</p> <p>CO4. Students will be able to conduct company profile presentations and participate effectively in table topic group discussions demonstrating teamwork, critical thinking, and spontaneous speaking skills.</p> <p>CO5. Students will be able to demonstrate improved verbal ability, grammar, vocabulary, reading comprehension, and active classroom participation for professional communication.</p>

Unit I (15marks)	[7Hrs]
Time and Work, Chain Rule, Pipe and Cistern, Geometry and mensuration Puzzles:- Analytical puzzle, Tabular Puzzle, Box or Floor based Puzzle, Rank based Puzzle	
Unit II (10marks)	[7Hrs]
Time Speed and Distance:- Basic Problems, Average Speed, Relative Speed, Problems on Trains, Boats and Streams, Escalators, Directions sense Problems Coding and Decoding	
Unit III (5marks)	[5Hrs]
SWOC Analysis and SMART Goal Setting - for Personal and Professional Development Self-Elevator Pitch – Self Introduction, Confidence Building, and Professional Communication Skills (5marks)	
Unit IV (10marks)	[6Hrs]
Company Profile Group Presentation – Research, Team Coordination, and Presentation Techniques (5marks) Table Topic Group Discussion – Critical Thinking, Spontaneous Speaking, and Team Interaction	
Unit V (10marks)	[3Hrs]
Verbal Ability Quiz – Grammar, Vocabulary Building, and Reading Comprehension for Professional Communication Continuous Assessment - Attendance, Individual Engagement & Team Dynamics	

Text Books

S.N	Title	Author s	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		
2	Developing Communication Skills	Krishna Mohan & Meera Banerji	2002	
3	Professional Communication Skills	Alok Jain	2006	S Chand & Company Ltd.
4	Personality Development & Soft Skills	Barun Mitra	2019	Cambridge University Oress

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B. Tech. Scheme of Examination & Syllabus 2024-25

ARTIFICIAL INTELLIGENCE

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24AI531M	MDM – III Explainable AI	3	-	-	3	20	20	60	100
Course Objectives		Course Outcomes							
This course is intended to		Students will be able to							
1. Explain concepts, evolution, and significance of Explainable Artificial Intelligence. 2. Explore XAI methods, forms, and frameworks. 3. Evaluate AI models using transparency, fairness, and interpretability metrics. 4. Analyze applications of XAI, especially in healthcare. 5. Assess ethical, regulatory, and human-centric aspects of XAI systems.		1. Determine the concepts, motivations, and evolution of Explainable Artificial Intelligence. 2. Apply XAI methods and frameworks. 3. Evaluate AI systems using transparency and interpretability metrics. 4. Analyze XAI applications in healthcare. 5. Interpret ethical, regulatory, and human–AI interface requirements.							

Unit I: Introduction to Explainable AI	[9Hrs]
Definition and Evolution of Explainable AI, Diversity of Motives for Creating Explainable AI, Contradiction Between the Motives for Creating Explainable AI, Paradigm Shift of Explainable AI, Proposed AI Model, Proposed Architecture.	
Unit II: XAI Methods, Forms and Frameworks	[9Hrs]
XAI Methods and Their Classifications, Methods of Explainable Artificial Intelligence, Forms of Explanation, Frameworks for Model Interpretability and Explanation.	
Unit III: Evaluation Measures for XAI	[10Hrs]
Techniques of Explainable AI, Explainable Modeling Methodologies, Metrics for Explainable Artificial Intelligence, Need for Transparency and Trust in AI, XAI's Evaluation Methods, Explainable AI Stakeholders, XAI Applications.	
Unit IV: XAI's Application in Healthcare	[9Hrs]
Introduction, The Multidisciplinary Nature of Explainable AI in Healthcare, Different XAI Techniques Used in Healthcare, Applications of XAI in Healthcare.	
Unit V: Trustworthy AI	8Hrs]
Introduction, Regulatory Requirements for Trustworthy AI, Explicability—An Ethical Principle for Trustworthy AI, An Example Use Case: Computational Pathology.	

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Explainable AI: Foundations, Methodologies and Applications	Mayuri Mehta, Vasile Palade, Indranath Chatterjee	1st	Intelligent Systems Reference Library
2.	Explainable AI for Practitioners	Michael Munn, David Pitman	1st	O'Reilly Media, Inc
3.	Interpretable Machine Learning, A Guide for Making Black Box Models Explainable	Christoph Molnar	1st	Leanpub

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Explainable AI with Python	Leonida Gianfagna, Antonio Di Cecco	1st	Springer
2.	Hands-On Explainable AI (XAI) with Python: Interpret, visualize, explain, and integrate reliable AI for fair, secure, and trustworthy AI apps	Denis Rothman	1st	Packt Publishing Limited

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