Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: Honors and Multidisciplinary Minor (Artificial Intelligence & Machine Learning)

(Major: Semester – IV)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	ITHO-0401	Fundamentals of Data Science	03	--	03	03	20	30	50
2	ITHO- 0402	Competency Lab-I	--	02	02	01	--	50	50
		Total	**03**	**02**	**05**	**04**	**20**	**80**	**100**

(Major: Semester – V)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	ITHO-0501	Artificial Intelligence & Machine Learning	03	--	03	03	20	30	50
2	ITHO - 0502	Competency Lab-II	--	02	02	01	--	50	50
		Total	**03**	**02**	**05**	**04**	**20**	**80**	**100**

(Major: Semester – VI)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	ITHO-0601	Deep Learning Techniques and Tools	03	--	03	03	20	30	50
2	ITHO - 0602	Competency Lab-III	--	02	02	01	--	50	50
		Total	**03**	**02**	**05**	**04**	**20**	**80**	**100**

(Major: Semester – VII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
1	ITHO-0701	Professional Training & Mini- Project-I	--	06	06	03	50	50	100
		Total	**00**	**06**	**06**	**03**	**50**	**50**	**100**

(Major: Semester – VIII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
1	ITHO-0801	Major Capstone Project (Design & Development)	--	06	06	03	50	50	100
		Total	--	**06**	**06**	**03**	50	50	100

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L- Lecture P-Practical

FA- Formative Assessment SA - Summative Assessment (For Laboratory End Semester performance) PBE-I– Project-based Examination (For Laboratory Mid Semester Performance)

PBE- II Project-based Examination (For Laboratory End Semester Performance)

PROGRESSIVE TOTAL CREDITS: 18

Guidelines:- Students will take up 5-6 addittional course in the same Engineering/ Technology discipline of 18 credit distributed over semester III –VIII. These 18 credits will be over and above the 176 credits prescribed for four year multidisciplinary bachelor's degree in Engg/Tech Program.

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Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: Double Minors (Multidisciplinary and Specialization Minors)

(Major: Semester – III)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	ITDO-0301	Basics of Data Structure	02	--	02	02	50	50	100
		Total	**02**	**--**	**02**	**02**	**50**	**50**	**100**

(Major: Semester – IV)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	ITDO-0401	Software Essentials	02	--	02	02	50	50	100
		Total	**02**	**--**	**02**	**02**	**50**	**50**	**100**

(Major: Semester – V)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	ITDO-0501	Database Management Systems	03	--	03	03	50	50	100
2	ITDO -0502	Database Management Systems Lab	--	02	02	01	50	-	50
		Total	**03**	**02**	**05**	**04**	**100**	**50**	**150**

(Major: Semester – VI)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	ITDO-0601	Basics of AI and ML	02	--	02	02	50	50	100
		Total	**02**	**--**	**02**	**02**	**50**	**50**	**100**

(Major: Semester – VII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	ITDO-0701	Python Programming	02	--	02	02	50	50	100
		Total	**02**	**--**	**02**	**02**	**50**	**50**	**100**

(Major: Semester – VIII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
1	ITDO -0801	Web Technology	02	--	02	02	50	50	100
2	ITDO -0802	Major Capstone Project(Design & Development)	--	08	08	04	50	50	100
		Total	--	**08**	**10**	**06**	100	100	200

L- Lecture P-Practical

FA- Formative Assessment SA - Summative Assessment (For Laboratory End Semester

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performance) PBE-I– Project-based Examination (For Laboratory Mid Semester Performance)

PBE- II Project-based Examination (For Laboratory End Semester Performance)

PROGRESSIVE TOTAL CREDITS: 18

Guidelines:- Students will take up 5-6 addittional courses in another Engineering/ Technology/ Emerging Area of Specialization of 18 credit distributed over semester III –VIII. These 18 credits will be over and above the 176 credits prescribed for four year multidisciplinary bachelor's degree in Engg/Tech Program.

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Government College of Engineering, Karad

Department of Information Technology

Programme: Honors and Multidisciplinary Minor (Artificial Intelligence & Machine Learning)

ITHO-0401: Fundamentals of Data Science

Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		FA	20
Tutorials	00 Hrs/week		SA	30
Total Credits	03			

Prerequisite : Mathematics, Programming Knowledge

Course Outcomes (CO): Students will be able to

CO1	Understand fundamental data science concepts and workflow.
CO2	Apply basic mathematics and probability in data science.
CO3	Analyze advanced probability and statistical methods.
CO4	Develop communication, visualization, and machine learning skills, addressing ethical considerations.

	Course Contents	**CO**	**Hours**
Unit 1	**Introduction to Data Science:** Basic definitions and key terms, Overview and importance, components and intersections, Types of data and their characteristics, Nominal, ordinal, interval, ratio, Overview of the data science workflow, The Five Steps of Data Science	**CO1**	**(07)**
Unit 2	**Basic Mathematics and Probability:** Basic symbols and terminology, Linear algebra fundamentals, Introduction to Probability, Rules of probability, Bayesian versus frequentist approaches, Introduction to binary classifiers.	**CO2**	**(07)**
Unit 3	**Advanced Probability and Statistics:** Revisiting Bayesian ideas ,Understanding random variables, An Introduction to Statistics, Definitions and importance, Obtaining and sampling data, Measuring statistics, The empirical rule, Point estimates, Sampling distributions, Confidence intervals, Hypothesis tests.	**CO3**	**(07)**
Unit 4	**Communication and Visualization:** Importance of communication, identifying effective visualizations, recognizing misleading graphs and statistics, Verbal communication techniques, Introduction to machine learning, Types of machine learning.	**CO4**	**(06)**
Unit 5	**ML Techniques and Applications:** Linear regression fundamentals, Naïve Bayes classification, Decision trees, Unsupervised learning deep dive, Feature extraction techniques, Introduction to PCA, Understanding pre-trained models, Different types of transfer learning, Transfer learning with BERT and GPT.	**CO4**	**(07)**
Unit 6	**Ethical and Practical Considerations in Data Science:** Sources of algorithmic bias , Measuring bias, Consequences and importance of fairness, Mitigating algorithmic bias, Bias in large language models, Emerging techniques in bias and fairness in ML, Mitigating model drift, (**Self Study:** COMPAS dataset case study, Text embedding using pretrained models and OpenAI)	**CO4**	**(07)**

Text Books

1. Sanjeev J. Wagh , Manisha S. Bhende, Anuradha D. Thakare "Fundamentals of Data Science, Tayler & Fransic CRC press 2021
2. Sinan Ozdemir " Principles of Data Science - Third Edition, 2024 , Packt Publication

Reference Books

1. Joel Grus - "Data Science from Scratch: First Principles with Python" - O'Reilly Media (2015)
2. Aurélien Géron - "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" - O'Reilly Media (2019)

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Useful Links			
1.	https://onlinecourses.nptel.ac.in/noc21_cs69/preview		
2.	https://onlinecourses.nptel.ac.in/noc22_cs32/preview		
3.	https://nptel.ac.in/courses/106106226/		

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO 1	3	2	2	1	3	-	-	2	2	-	1	-	-
CO 2	2	2	2	2	3	-	-	2	1	-	2	2	-
CO 3	3	3	3	3	3	2	-	2	1	-	3	1	2
CO 4	3	3	3	3	3	1	2	2	3	1	3	-	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	FA	SA
Remember	-	5
Understand	5	5
Apply	5	5
Analyse	5	5
Evaluate	5	10
Create	-	-
TOTAL	20	30

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Government College of Engineering, Karad				
Department of Information Technology				
Programme: Honors and Multidisciplinary Minor (Artificial Intelligence & Machine Learning)				
ITHO- 0402- Competency Lab-I				
Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		FA	-
Total Credits	01		SA	50

Prerequisite : Mathematics, Fundamentals of data science

Course Outcomes (CO): Students will be able to

CO1	Set up and configure a data science environment, and perform basic data manipulation and visualization.
CO2	Apply fundamental mathematical and statistical techniques to data science problems, including linear algebra, probability, and hypothesis testing.
CO3	Implement and evaluate various machine learning models, including regression, classification, and clustering techniques.
CO4	Analyze real-world datasets to identify biases and ethical considerations, and apply strategies to mitigate these issues.

Course Contents		CO
Implementation of following concepts		
Experiment 1	**Setting Up Data Science Environment** ● Installing and configuring Python, Jupyter Notebooks. ● Introduction to essential libraries: NumPy, Pandas, Matplotlib.	**CO1**
Experiment 2	**Data Manipulation with Pandas** ● Loading, cleaning, and transforming datasets. ● Performing basic operations such as filtering, grouping, and merging.	**CO1**
Experiment 3	**Descriptive Statistics and Data Visualization** ● Calculating descriptive statistics (mean, median, mode, standard deviation). ● Creating visualizations using Matplotlib and Seaborn to summarize data.	**CO1**
Experiment 4	**Linear Algebra with NumPy** ● Performing matrix operations and solving linear equations. ● Implementing vector and matrix transformations.	**CO2**
Experiment 5	**Probability Simulations and Distributions** ● Simulating probability experiments (coin flips, dice rolls). ● Visualizing probability distributions and calculating probabilities.	**CO2**
Experiment 6	**Hypothesis Testing and Confidence Intervals** ● Conducting hypothesis tests (t-tests, chi-square tests). ● Calculating and interpreting confidence intervals.	**CO2**
Experiment 7	**Building Linear Regression Models** ● Implementing linear regression using Scikit-Learn. ● Evaluating model performance and visualizing results.	**CO3**
Experiment 8	**Classification Algorithms: Naïve Bayes and Decision Trees** ● Building and evaluating Naïve Bayes and decision tree classifiers.	**CO3**

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	● Visualizing decision boundaries and confusion matrices.	
Experiment 9	**Unsupervised Learning: Clustering and PCA** ● Performing k-means clustering and visualizing clusters. ● Applying Principal Component Analysis (PCA) for dimensionality reduction.	**CO3**
Experiment 10	**Transfer Learning with Pretrained Models** ● Using pretrained models for image and text classification. ● Implementing transfer learning with BERT and GPT for specific tasks.	**CO3**
Experiment 11	**Detecting and Mitigating Algorithmic Bias** ● Identifying and measuring bias in datasets and models. ● Implementing strategies to mitigate bias and ensure fairness.	**CO4**
Experiment 12	**Real-World Case Study: COMPAS Dataset Analysis** ● **Analyzing the COMPAS dataset to identify biases and ethical considerations.** ● **Visualizing data insights and discussing implications for real-world applications.**	**CO4**
List of Submission:		
	● Minimum number of Experiments : 10	

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO 1	2	3	3	3	3	-	-	-	-	-	2	-	-
CO 2	2	2	2	2	3	-	-	2	2	2	2	2	2
CO 3	3	3	3	3	3	1	2	1	2	3	2	2	3
CO 4	2	3	2	3	3	2	2	2	2	1	2	1	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	5	5	5	5	5	5	5	5	5	5	5
Task III	5	5	5	5	5	5	5	5	5	5	5
ISE	25	25	25	25	25	25	25	25	25	25	25

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Government College of Engineering, Karad

Department of Information Technology

Programme: Honors and Multidisciplinary Minor (Artificial Intelligence & Machine Learning)

ITHO-0501: Artificial Intelligence & Machine Learning

Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		FA	20
Tutorials	00 Hrs/week		SA	30
Total Credits	03		TOTAL	50

Prerequisite : Mathematics, Programming Knowledge

Course Outcomes (CO): Students will be able to

CO1	Understand and apply search, optimization, and supervised learning techniques in AI & ML.
CO2	Implement probabilistic reasoning, fuzzy logic, and unsupervised learning methods for AI-based decision-making.
CO3	Analyze AI & ML applications across different industries and assess their real-world impact.
CO4	Evaluate the ethical, societal, and regulatory challenges of AI, including fairness, bias, and transparency.

	Course Contents	CO	Hours
Unit 1	**Search & Optimization in AI:** Local Search (Hill-Climbing, Simulated Annealing, Genetic Algorithms), Constraint Satisfaction Problems (CSPs), Decision Trees, Markov Decision Processes (MDPs), Utility Theory, Decision Networks	**CO1**	**07**
Unit 2	**Advanced Machine Learning Techniques:** Ensemble Learning (Bagging, Boosting, Stacking), Random Forest, AdaBoost, Gradient Boosting (XGBoost, LightGBM), SVM with Kernel Tricks, Bayesian Learning, Hyperparameter Tuning, Gradient Descent Variants (SGD, Adam, RMSprop)	**CO1**	**07**
Unit 3	**Probabilistic AI & Fuzzy Systems:** Bayesian Networks, Hidden Markov Models (HMMs), Fuzzy Logic (Membership Functions, Operations, Inference Systems - Mamdani & Sugeno), AI Applications of Fuzzy Logic.	**CO2**	**06**
Unit 4	**Unsupervised Learning & Anomaly Detection:** Clustering (Hierarchical, k-Means++, Gaussian Mixture Models), Dimensionality Reduction (PCA, t-SNE), Anomaly Detection (Isolation Forest, Local Outlier Factor, Autoencoders), Fraud Detection, Network Intrusion Detection	**CO2**	**07**
Unit 5	**AI & ML Applications in Industry:** AI in Healthcare (Disease Diagnosis, Drug Discovery), AI in Finance (Algorithmic Trading, Fraud Detection), AI in Robotics (Perception, Navigation), AI in Cybersecurity (Threat Detection, AI-driven Authentication), AI in Autonomous Systems (Self-Driving Cars, Drones)	**CO3**	**07**
Unit 6	**Ethics, Fairness & Future of AI:** Bias & Fairness in AI, Explainability, AI & Privacy (GDPR, CCPA), Societal Impact (Automation, Job Displacement, Misinformation), Future Trends (Human-AI Collaboration)	**CO4**	**06**

Text Books

1. Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education 2021. (Covers Unit 1, Unit 2, Unit 3, Unit 6)
2. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press. 2012. (Covers Unit 4, Unit 5, Unit 6)

Reference Books

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1.	Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer.
2.	Daphne Koller & Nir Friedman, Probabilistic Graphical Models: Principles and Techniques, MIT Press

Useful Links	
1.	https://www.coursera.org/learn/machine-learning (Andrew Ng's ML Course)
2.	https://www.edx.org/course/artificial-intelligence (AI Courses on edX)
3.	https://paperswithcode.com/ (Latest AI/ML Research Papers)

Guidelines for Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO 1	3	2	3	3	2	-	-	-	-	-	-	3	2
CO 2	2	3	3	3	2	-	-	-	-	-	-	3	3
CO 3	2	3	2	3	2	-	-	-	-	-	-	3	2
CO 4	2	2	3	2	2	-	-	-	-	-	-	2	3

: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	FA	SA
Remember	5	5
Understand	5	5
Apply	5	10
Analyse	5	5
Evaluate	-	5
Create	-	-
TOTAL	20	30

Government College of Engineering, Karad				
Department of Information Technology				
Programme: Honors and Multidisciplinary Minor (Artificial Intelligence & Machine Learning)				
ITHO- 0502- Competency Lab-II				
Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		FA	-
Total Credits	01		SA	50
Prerequisite : Mathematics, Fundamentals of data science				
Course Outcomes (CO): Students will be able to				
CO1	Implement and analyze search and optimization algorithms in A			
CO2	Develop and evaluate probabilistic reasoning and fuzzy logic models			
CO3	Apply advanced machine learning techniques, including ensemble learning and anomaly detection.			
CO4	Explore real-world AI & ML applications and assess their ethical considerations.			
Course Contents				**CO**

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Implementation of following concepts		
Experiment 1	Implementation of Local Search Algorithms (Hill Climbing, Simulated Annealing, Genetic Algorithms)	**CO1**
Experiment 2	Solving Constraint Satisfaction Problems (CSPs) using Backtracking Search and Forward Checking	**CO1**
Experiment 3	Implementation of Decision Trees for Decision-Making in AI	**CO1**
Experiment 4	Building Bayesian Networks for Probabilistic Inference and Hidden Markov Models (HMMs)	**CO2**
Experiment 5	Implementation of Fuzzy Inference Systems (Mamdani & Sugeno) for AI applications	**CO2**
Experiment 6	Ethics and Bias in AI: Analyzing fairness in machine learning models	**CO4**
Experiment 7	Ensemble Learning Techniques (Bagging, Boosting, Random Forest, AdaBoost)	**CO3**
Experiment 8	Implementation of Support Vector Machines (SVM) with Kernel Tricks	**CO3**
Experiment 9	Hyperparameter Tuning and Optimization Techniques (Grid Search, Random Search, Bayesian Optimization)	**CO3**
Experiment 10	Clustering Algorithms (K-Means++, GMM) and Dimensionality Reduction (PCA, t-SNE)	**CO3**
Experiment 11	Anomaly Detection using Isolation Forest and Autoencoders	**CO3**
Experiment 12	Real-World AI Applications: Fraud Detection, Cybersecurity, or Healthcare AI Case Study	**CO4**
List of Submission:		
● Minimum number of Experiments : 10		

Guidelines Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO 1	2	3	3	3	3	-	-	-	-	-	2	-	-
CO 2	2	2	2	2	3	-	-	2	2	2	2	2	2
CO 3	3	3	3	3	3	1	2	1	2	3	2	2	3
CO 4	2	3	2	3	3	2	2	2	2	1	2	1	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	5	5	5	5	5	5	5	5	5	5	5
Task III	5	5	5	5	5	5	5	5	5	5	5
ISE	25	25	25	25	25	25	25	25	25	25	25

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Government College of Engineering, Karad				
Department of Information Technology				
Programme: Honors and Multidisciplinary Minor (Artificial Intelligence & Machine Learning)				
ITHO-0601: Deep Learning Techniques and Tools				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		FA	20
Tutorials	00 Hrs/week		SA	30
Total Credits	03		TOTAL	50

Prerequisite : Linear Algebra, Probability, Machine Learning, Artificial Intelligence

Course Outcomes (CO): Students will be able to

CO1	Understand the fundamental principles of deep learning and neural networks.
CO2	Implement and analyze different architectures of deep neural networks.
CO3	Apply deep learning techniques to real-world applications such as computer vision and NLP.
CO4	Evaluate deep learning models using appropriate tools and optimization techniques.

	Course Contents	CO	Hours
Unit 1	**Introduction to Deep Learning:** Basics of Neural Networks: Perceptron, Multi-Layer Perceptron (MLP), Backpropagation Algorithm and Gradient Descent Optimization, Activation Functions: ReLU, Sigmoid, Tanh, Softmax, Loss Functions: Cross-Entropy, Mean Squared Error Regularization Techniques: Dropout, Batch Normalization , Introduction to Deep Learning Frameworks (TensorFlow, PyTorch)	**CO1**	**06**

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Unit 2	**Convolutional Neural Networks (CNNs):** Convolutional Layers and Pooling Layers, Architectures of CNNs: LeNet, AlexNet, VGG, ResNet, Transfer Learning and Fine-Tuning Models, Object Detection: YOLO, Faster R-CNN, Applications in Image Processing and Computer Vision	**CO1**	**07**
Unit 3	**Recurrent Neural Networks (RNNs) and Sequence Models:** Basics of RNNs: Vanishing Gradient Problem, Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRU), Sequence Modeling: Machine Translation, Text Generation, Attention Mechanism and Transformer Models, Introduction to Large Language Models (BERT, GPT)	**CO2**	**07**
Unit 4	**Generative Models and Unsupervised Learning** LLM, Autoencoders: Variational Autoencoders (VAE), Generative Adversarial Networks (GANs) and its Applications, Self-Supervised Learning and Representation Learning, Contrastive Learning Techniques	**CO2**	**06**
Unit 5	**Deep Learning Optimization and Scalability** Hyperparameter Tuning: Learning Rate Schedulers, Optimization Techniques (Adam, RMSProp), Model Compression: Pruning, Quantization, Knowledge Distillation, Distributed Training and Model Parallelism, Explainability and Interpretability in Deep Learning	**CO3**	**07**
Unit 6	**Applications and Tools in Deep Learning** AI for Healthcare, Finance, and Autonomous Systems, Deep Reinforcement Learning Basics Deployment of Deep Learning Models (ONNX, TensorFlow Serving), Ethics, Bias, and Fairness in Deep Learning Models	**CO4**	**07**

Text Books	
1.	Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016. (Units 1-5)
2.	François Chollet, Deep Learning with Python, Manning Publications, 2018. (Units 1-6)
Reference Books	
1.	Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media, 2019.
2.	Justin Johnson, Deep Learning for Computer Vision, Stanford Course Notes, 2021.
Useful Links	
1.	https://www.coursera.org/learn/machine-learning (Andrew Ng's ML Course)
2.	https://www.edx.org/course/artificial-intelligence (AI Courses on edX)
3.	https://paperswithcode.com/ (Latest AI/ML Research Papers)

Guidelines for Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO 1	3	2	3	3	2	-	-	-	-	-	-	3	2
CO 2	2	3	3	3	2	-	-	-	-	-	-	3	3
CO 3	2	3	2	3	2	-	-	-	-	-	-	3	2
CO 4	2	2	3	2	2	-	-	-	-	-	-	2	3

: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	FA	SA
Remember	5	5
Understand	5	5
Apply	5	10

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Analyse	5	5
Evaluate	-	5
Create	-	-
TOTAL	20	30

Government College of Engineering, Karad				
Department of Information Technology				
Programme: Honors and Multidisciplinary Minor (Artificial Intelligence & Machine Learning)				
ITHO- 0602- Competency Lab-III				
Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		FA	-
Total Credits	01		SA	50
Prerequisite : Mathematics, Fundamentals of data science				
Course Outcomes (CO): Students will be able to				
CO1	Implement and analyze various deep learning architectures such as MLP, CNN, and RNN.			
CO2	Apply deep learning techniques for image processing, NLP, and generative models.			
CO3	Optimize deep learning models using hyperparameter tuning and regularization techniques.			
CO4	Deploy and evaluate deep learning models using real-world datasets.			

	Course Contents	CO
Implementation of following concepts		
Experiment 1	Implement a simple artificial neural network (ANN) with forward and backward propagation.	**CO1**
Experiment 2	Train a Multi-Layer Perceptron (MLP) model for a classification task using TensorFlow/PyTorch.	**CO1**
Experiment 3	Implement and visualize convolution operations in CNNs using NumPy and OpenCV.	**CO1**
Experiment 4	Train a CNN model for image classification using a dataset (e.g., MNIST, CIFAR-10).	**CO2**
Experiment 5	Implement an RNN/LSTM model for text prediction or sentiment analysis.	**CO2**
Experiment 6	Train a Transformer-based model (e.g., BERT/GPT) for a simple NLP task.	**CO2**
Experiment 7	Implement an autoencoder for dimensionality reduction or denoising images.	**CO2**
Experiment 8	Develop a Generative Adversarial Network (GAN) for generating synthetic images.	**CO2**
Experiment 9	Perform hyperparameter tuning using Grid Search and Random Search for a given deep learning model.	**CO3**
Experiment 10	Apply dropout, batch normalization, and data augmentation to improve model performance.	**CO3**
Experiment 11	Deploy a trained deep learning model using Flask/Streamlit/TensorFlow Serving.	**CO4**

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Experiment 12	Evaluate the ethical considerations, bias, and fairness of an AI model using a real-world dataset.	CO4
List of Submission:		
● Minimum number of Experiments : 10		

Guidelines Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO 1	3	3	2	3	3	-	-	-	-	-	2	-	-
CO 2	2	2	3	2	3	-	-	2	2	2	2	2	2
CO 3	3	3	3	3	3	1	2	1	2	3	2	2	3
CO 4	2	3	2	3	3	2	2	2	2	1	2	1	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	5	5	5	5	5	5	5	5	5	5	5
Task III	5	5	5	5	5	5	5	5	5	5	5
ISE	25	25	25	25	25	25	25	25	25	25	25

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Government College of Engineering, Karad				
Department of Information Technology				
Programme: Honors and Multidisciplinary Minor (Artificial Intelligence & Machine Learning)				
ITHO- 0701- Professional Training & Mini Project-I				
Laboratory Scheme:			**Examination Scheme:**	
Practical	6 Hrs/week		PBE-I	50
Total Credits	03		PBE-II	50
			Total	100

Prerequisite : Programming Knoweldge

Course Outcomes (CO): Students will be able to

CO1	Ability to understand community needs.
CO2	Ability to convert idea in to product.
CO3	Ability to work in group.
CO4	Ability to communicate effectively with customers.

Course Contents

The specific objectives of the course could depend on the problem definition for the project but the overall performance must be measured on the following criteria.

1. Literature survey and Problem statement- Students should be able to define the problem statement with clearly specified inputs and outputs. Goals for complex problems could evolve over time but it is necessary to have one in the beginning. A brief survey of the available literature and an initial draft of possible directions should be adequate.

2. Modeling or Theoretical results- An appropriate model should be chosen for the problem. They should be able to reason the pros and cons of various models and choose a suitable one. It is important that they be in a position to defend their choices. The model should also involve the criteria by which they will quantify and test its performance. In case of theoretical work one should be able to describe the underlying mathematical basis of such problems in the literature.

3. Engineering or Mathematical tools- Numerous available methods could be put to use in implementing and testing the described model. They should demonstrate the ability to learn and put various methods to use.

4. Demonstration and Presentation- A model designed and implemented (or results derived or proved in case of theory) should be convincingly presented to showcase its positive and negative aspects. A demonstration to this end where applicable or a presentation in case of theoretical contributions should clearly describe the work. The purpose is to measure understanding of the techniques and methods used and to appreciate the results in the larger context of their applicability in science and engineering.

Maximum two students may carry out the mini project together. Evaluation will be done based on presentations, written report and developed system.

Project Report Format:

Project report should be of 15 to 20 pages (typed on A4 size sheets). For standardization of the project reports the following format should be strictly followed.

1. Page Size: Trimmed A4
2. Top Margin: 1.00 Inch
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inch
6. Para Text: Times New Roman 12 Point Font
7. Line Spacing: 1.5 Lines
8. Page Numbers: Right Aligned at Footer. Font 12 Point. Times New Roman

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9. Headings: Times New Roman, 14 Point Bold Face

10. Certificate: All students should attach standard format of Certificate as described by the department. Certificate should be awarded to group and not to individual student. Certificate should have signatures of the Guide, Head of Department and Principal/ Director.

11. Index of Report:

a. Title Sheet
b. Certificate
c. Acknowledgement
d. Table of Contents
e. List of Figures
f. List of Tables

12. References: References should have the following format

For Books: "Title of Book", Authors, Publisher, Edition

For Papers: "Title of Paper", Authors, Journal/Conference Details, Year

List of Submission:
1. Working model of the software project.
2. Project Report.
3. Presentation and demonstration of project in exhibition.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	3	2	3	2	2	3	2	2	2	3	3
CO2	2	3	3	2	3	2	1	2	3	2	2	3	3
CO3	2	3	3	2	3	2	2	2	2	3	2	3	3
CO4	2	3	3	2	3	2	1	2	2	3	3	3	3

Mapping of COs and POs

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

One supervisor from the department shall be assigned five project groups of the mini project. The weekly load for the supervisor is 2Hr/week. The continuous assessment shall be done by the supervisor based on attributes like problem analysis, design, development of solutions, and modern tool usage.

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Government College of Engineering, Karad

Department of Information Technology

Programme: Honors and Multidisciplinary Minor (Artificial Intelligence & Machine Learning)

ITHO- 0801- Major Capstone Project (Design &Development)

Teaching Scheme			**Examination Scheme**	
Practical	06 Hrs/week		PBE-I	50
Total Credits	06		PBE-II	50
			Total	100

Prerequisite : Programming Knowledge

Course Outcomes (CO): Students will be able to

CO1	Convert idea in to product.
CO2	Adapt new tools and technologies.
CO3	Exhibit communication skills and team work.
CO4	Write project report and research paper.

Course Contents

I Guidelines:

- Select a topic relevant to the Information Technology, Computer Science and Engineering.
- For selection of topic refer Scopus Index Journals, innovative ideas and societal use application.
- The project will be undertaken preferably by a group of 3-4 students who will jointly work and implement the project. The group will select a project with approval from a committee formed by the department of senior faculty to check the feasibility and approve the topic.
- The project work can be undertaken in own organisation/company/any reputed R&D Lab.
- Student must consult project guide in selection of topic.
- Projects should have preferably industrial exposure, societal use application and researchoriented.
- Student should report weekly to the project guide and log book of activities should be maintained for continuous assessment of the project work. The log book should be used for awarding CA marks.

II Project Report Format:

Report should be of 40 to 60 pages (typed on A4 size sheets). For standardization of the project reports the following format should be strictly followed.

1. Page Size: Trimmed A4
2. Top Margin: 1.00 Inch
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inch
6. Para Text: Times New Roman 12 Point Font
7. Line Spacing: 1.5 Lines
8. Page Numbers: Right Aligned at Footer. Font 12 Point. Times New Roman
9. Headings: Times New Roman, 14 Point Bold Face
10. Certificate: All students should attach standard format of Certificate as described by the department. Certificate should be awarded to the group and not to individual student. Certificate should have signatures of guide, Head of Department and Principal/ Director.

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11. The project report contains the details.

1. Problem definition
2. Requirement specification
3. System design details (UML diagrams)
4. System implementation – code documentation – dataflow diagrams/ algorithm, protocolsused.
5. Test result and procedure
6. Conclusions.
7. Appendix
   a) Tools used
   b) References

12. References: References should have the following format
For Books: "Title of Book", Authors, Publisher, Edition
For Papers: "Title of Paper", Authors, Journal/Conference Details, Year(IEEE format)

III. Assessment Guideline:

• Project work should be continually evaluated based on the contributions of the group members, originality of the work, innovations brought in, research and developmental efforts, depth and applicability and so on would be considered.

• There shall be at least two reviews in semester-VIII by the review committee constituted at department level by the programme head which includes presentations and demonstration of the work carried out by the students.

Review 3: Implementation status and testing document.

Review 4: Final Project Demonstration, Project Report and Result analysis.

End semester examination should be conducted by the panel of internal examiner and external examiners from reputed institute or industry.

• The final certification and acceptance of work ensures the satisfactory performance on the above aspects.

List of Submission:

1. Working model of the software /Hardware project.
2. Project report.
3. Presentation and demonstration of project in exhibition.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	3	2	3	2	2	3	2	2	2	3	3
CO2	2	3	3	2	3	2	1	2	3	2	2	3	3
CO3	2	3	3	2	3	2	2	2	2	3	2	3	3
CO4	2	3	3	2	3	2	1	2	2	3	3	3	3

Mapping of COs and POs

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

One supervisor from the department shall be assigned five project groups of the mini project. The weekly load for the supervisor is 2Hr/week. The continuous assessment shall be done by the supervisor based on attributes like problem analysis, design, development of solutions, and modern tool usage.

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Government College of Engineering, Karad				
Department of Information Technology				
Programme: Double Minors (Multidisciplinary and Specialization Minors)				
ITDO-0301: Basics of Data Structure				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		FA	50
Tutorials	00 Hrs/week		SA	50
Total Credits	02		TOTAL	100

Prerequisite : Mathematics, Computer Fundamentals

Course Outcomes (CO): Students will be able to

CO1	Identify the appropriate data structure.
CO2	Apply the data structure to solve given problem.
CO3	Analyse algorithms using time and space complexity.
CO4	Solve examples using searching and sorting techniques.

	Course Contents	CO	Hours
Unit 1	**Introduction to Algorithm, Data Structures and Analysis of Algorithms:** Introduction to Data Structures, Classification of Data Structures, Representation of pseudo code, Algorithmic Efficiency, Asymptotic notations.	**CO1**	**(04)**
Unit 2	**Sorting and Searching Techniques:** Need of Sorting and Searching, Bubble Sort, Insertion Sort, Selection Sort, Quick Sort and Merge Sort. Linear Search, Binary Search.	**CO4**	**(05)**
Unit 3	**Stack:** Stack as an ADT, Representation and Implementation of Stack using Sequential and Linked Organization. Applications of Stack: Postponement-infix to postfix conversion and postfix evaluation, backtracking- Goal seeking, Eight queens problem. (**Self Study:** Reversing a String.)	**CO1**	**(05)**
Unit 4	**Queues:** Queue as an ADT, Representation and Implementation of Linear Queue, Circular Queue, Priority Queue, Double Ended Queue. (**Self Study**: Queue simulation, Categorizing data)	**CO2**	**(05)**
Unit 5	**Linked List:** Concept of Linked List, Comparison of Sequential and Linked Organizations, Linked List using Dynamic Memory Management, Introduction to types of Linked List, Linked List operations.	**CO3**	**(05)**
Unit 6	**Trees and Graph:** Tree: Basic concept and terminology, Data structure for binary trees. Tree traversals, Binary search trees (BST). Graph: Basic concept and terminology, Graph operations, Graph representation-Matrix and Linked representation.	**CO3**	**(04)**

Text Books

1. E. Horwitz , S. Sahani, D. Mehta, "Fundamentals of Data Structures in C++", University Press, 2nd edition, 2008. (Unit: 1,2,3,4,5,6)
2. R. Gilberg, B. Forouzan, "Data Structures: A Pseudocode approach with C++", Brooks,1st Edition, 2001.

Reference Books

1. Yedidyah Langsam, Moshe J Augenstein, Aron M Tenenbaum, "Data Structures using C and C++", Pearson Education, 2nd edition, 2009.
2. A. Aho, J. Hopcroft, J. Ulman, "Data Structures and Algorithms", Pearson Education, 2nd edition, 2008.
3. Brassard and Bratley, "Fundamentals of Algorithmics", Prentice Hall India/Pearson Education, 2nd edition, 2009.

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Useful Links	
1.	http://nptel.ac.in/courses/106106130/, Dr. N S. Narayanaswamy, IIT Madras Programming and Data Structures
2.	http://nptel.ac.in/courses/106103069/, Dr. P. K. Rao IIT Guwahati Data Structures and Program Methodology
3.	http://nptel.ac.in/courses/106106127/, Dr. H. A. Murthy, IIT Madras Data Structures and Algorithms using C

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	-	3	-	-	-	-	-	-	-	-	-	2	2
CO 2	3	-	-	-	-	-	-	-	-	-	-	2	2
CO 3	-	-	3	-	-	-	-	-	-	-	-	2	2
CO 4	-	-	-	3	-	-	-	-	-	-	-	2	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	FA	SA
Remember	10	10
Understand	10	10
Apply	10	10
Analyse	10	10
Evaluate	10	10
Create	-	-
TOTAL	50	50

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Government College of Engineering, Karad

Department of Information Technology

Programme: Double Minors (Multidisciplinary and Specialization Minors)

ITDO-0401: Software Essentials (Multi-disciplinary Minor - 02)

Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		FA	50
Tutorials	00 Hrs/week		SA	50
Total Credits	02		TOTAL	100

Prerequisite : Mathematics, Computer Fundamentals

Course Outcomes (CO): Students will be able to

CO1	Understand basics of computer software and functioning of operating systems.
CO2	Identify the phases involved in the Program Development Life Cycle.
CO3	Analyze the significance of computer networking devices and databases in computer applications.
CO4	Apply the security measures to safeguard computer systems.

	Course Contents	**CO**	**Hours**
Unit 1	**Introduction to software:** Introduction, Types of Software, System Software, Operating System, Device Driver, System Utilities, Programming Languages, Translator Software, Application Software, Software Acquisition.	**CO1**	**(05)**
Unit 2	**Operating System:** Objectives of Operating System, Types of OS, Functions of OS, Process Management, Memory Management, File Management, Device Management, Protection and Security, User Interface, Examples of Operating Systems.	**CO1**	**(05)**
Unit 3	**Software Engineering Fundamentals:** Introduction, Software Development Life Cycle, Waterfall Model, Spiral Model, VV Model, Agile Software Development,	**CO2**	**(05)**
Unit 4	**Data Communication:** Importance of Networking, Data Transmission Media, Transmission Modes, Transmission Speed, Fundamental, Data Transmission Across Media, Data Transmission and Data Networking	**CO3**	**(04)**
Unit 5	**Computer Network:** Computer Network, Network Types, LAN Topologies, Communication Protocol, Network Devices, Wireless Networking, Wireless LAN, Wireless WAN.	**CO3**	**(04)**
Unit 6	**Computer Security:** Security Threat and Security Attack, Malicious Software, Virus, Worms, Trojan Horses, Hacking, Security Services, Cryptography, Digital Signature, Firewall, Users Identification and Authentication (**Self Study**: Other Security Measure, Security Awareness, Security Policy)	**CO4**	**(05)**

Text Books

1. Anita Goel, "Computer Fundamentals", Pearson Education, 1st edition (Unit: 1,2,4,5,6)
2. V. Rajaraman, Neeharika Adabala, "Fundamentals of Computers", Prentice Hall India Learning Private Limited, 6th edition.
3. Roger Pressman, "Software Engineering a practitioners approach", MGH, 5th edition, 2013. (Unit: 3)

Reference Books

1. Priti Sinha, Pradeep K. Sinha, "Computer Fundamentals", BPB Publications, 8th edition
2. E Balagurusamy, "Fundamentals of Computers", McGraw Hill Education

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3.	Pradeep K Sinha, "Foundations Of Computing", BPB Publications, 5th edition
Useful Links	
1.	https://nptel.ac.in/courses/106106197 Foundations to Computer Systems Design, Prof. V. Kamakoti, IIT Madras
2.	https://onlinecourses.swayam2.ac.in/cec19_cs06/preview Computer Fundamentals, Prof. Sanjay Tanwani, Devi Ahilya Viswavidyalaya, Indore
3.	https://nptel.ac.in/courses/106103068 Computer Organization and Architecture, Prof. Jatindra Kumar Deka, IIT Guwahati

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	3	-	-	-	-	-	-	-	-	-	-	2	-
CO 2	-	3	-	-	-	-	-	-	-	-	-	2	-
CO 3	-	-	-	3		-	-	-	-	-	-	-	2
CO 4	-	-	-	-	3	-	-	-	-	-	-	-	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	FA	SA
Remember	10	10
Understand	10	10
Apply	10	10
Analyse	10	10
Evaluate	10	10
Create	-	-
TOTAL	50	50

Chairman, BoS IT

Government College of Engineering, Karad				
Programme: Double Minors (Multidisciplinary and Specialization Minors)				
ITDO-0501: Database Management Systems				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		FA	50
Tutorials	00 Hrs/week		SA	50
Total Credits	03		TOTAL	100

Prerequisite : Fundamentals of data Structure, Discrete Mathematics

Course Outcomes (CO): Students will be able to

CO1	Understand the basic concepts of database management systems.
CO2	Analyze a database application scenario and apply the ER model to conceptually design the database.
CO3	Formulate relational algebra expressions, SQL queries for a given specification
CO4	Apply normalization techniques using indexing and concurrency control to improve database design

	Course Contents	CO	Hours
Unit 1	**Introduction to DBMS:** Early information systems: problems, Advantages of DBMS over file-processing systems, Organization of database, Components of database management systems, Schema Data manipulation operations.	**CO1**	**(05)**
Unit 2	**Data Models and E-R Model** Introduction to Data Models and its types, Overview of Entity Relation model, Constraint, mapping cardinalities, Structure of relational databases, The relational algebra, Tuple relational calculus.	**CO2**	**(06)**
Unit 3	**Integrity Constraints and Design:** Integrity Constraints Domain constraints, Referential integrity, Functional dependencies, Closure of set of functional dependencies, Pitfalls in relational database design, Decomposition, Desirable properties of decomposition, (**Self-study-**Normalization using functional dependencies (1NF, 2NF, BCNF, 3NF))	**CO2, CO4**	**(08)**
Unit 4	**SQL and PL SQL:** Structured Query Language (SQL), DDL, DML, DCL, TCL, DQL, views in database, Access control, Discretionary access control, Mandatory access control. PL SQL- Stored procedures, Functions, Trigger, Cursor, Views.	**CO3**	**(08)**
Unit 5	**Indexing and Hashing:** Data dictionary storage, Ordered indices, B+ Tree index files, B- Tree index files, Static hashing, Dynamic hashing, Comparison of indexing and hashing. (**Self-study-** Concurrency Control and Crash Recovery: Transaction Concept, Transaction state, concurrent execution)	**CO4**	**(06)**
Unit 6	**Applications of Database Management Systems:** Non-Relational Database: NoSQL, Applications of DBMS, MongoDB- Data Types in MongoDB, MongoDB Query Language CRUD operation, Indexes.	**CO1, CO4**	**(07)**

Text Books

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", McGraw-Hill, 6th edition, S2013 (Unit: 1,2,3,4,5,6)
2. Elmasri and Navathe, "Fundamentals of Database System", Addison Wesely Publication, 5th edition, 2005.

Reference Books

1. J. D. Ullman, "Principles of Database and Knowledge – Base Systems", Vol 1, Computer Science Press, 1988

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2.	Serge Abiteboul and Richard Hull, Victor Vianu, "Foundations of Databases", Reprint, Addison-Wesley, 1994
3.	Ram Krishnan and Gehrke, "Database Management System", 3rd Edition, McGraw Hill Inc, 2022
Useful Links	
1.	http://nptel.ac.in/courses/106106093/ Prof. D. Janakiram, IIT Madras. Database Design
2.	http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall2010/lecture-notes.
3.	https://www.cse.iitb.ac.in/~sudarsha/db-book/slide-dir
4.	http://www.tutorialspoint.com/dbms

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	2	3	2	1	-	-	-	-	-	-	-	2	-
CO 2	-	1	2	3	-	-	-	-	-	-	-	3	-
CO 3	-	1	2	3	-	-	-	-	-	-	-	3	-
CO 4	-	-	2	3	-	-	-	-	-	-	-	2	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	FA	SA
Remember	10	10
Understand	10	10
Apply	10	10
Analyse	10	10
Evaluate	10	10
Create	-	-
TOTAL	50	50

Chairman, BoS IT

Government College of Engineering, Karad				
Programme: Double Minors (Multidisciplinary and Specialization Minors)				
ITDO-0502: Database Management System Lab				
Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs./week		FA	50
Total Credits	01		SA	-

Prerequisite: Fundamentals of data Structure, Discrete Mathematics

Course Outcomes (CO): Students will be able to

CO1	Design ER diagrams for the case studies.
CO2	Apply DDL, DML, TCL and DCL statements on various databases.
CO3	Analyze and implement concepts in PL-SQL like Procedures, Triggers and Cursors.
CO4	Design Database and apply CRUD operations on the database.

	Course Contents	CO
Implementation of following concepts		
Experiment 1	Study and design of ER diagram for given case study.	**CO1**
Experiment 2	Implementation of DDL for given case study. (Create table with all constraints, Alter table, Drop table).	**CO2**
Experiment 3	Implementation of DML for given case study. (Basic SQL structure-select, from, where clause. Other DML clauses like insert, update, delete, between, etc.)	**CO2**
Experiment 4	Implementation of joins for given case study- (Natural Join, outer joins)	**CO2**
Experiment 5	Study and use of string, set operations, order by clause. Queries based on above commands. Aggregate functions, Group by, Having clauses for given case study.	**CO2**
Experiment 6	Study of TCL queries (SavePoint, RollBack, and Commit) for given case study.	**CO2**
Experiment 7	Implement a View and its operation on the given case study .	**CO3**
Experiment 8	Study of DCL queries (Grant, Revoke) for given case study.	**CO2**
Experiment 9	Implement Procedures and functions in PL-SQL.	**CO3**
Experiment 10	NoSQL database operations using MongoDB.	**CO3**
Experiment 11	Execute Aggregation operations : $avg, $min, $max, $push, $addToSet etc	**CO4**
Experiment 12	Implement a mini project based on given case study. (Mandatory)	**CO4**
List of Submission:		
	Minimum number of Experiments : 10	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

Chairman, BoS IT

Government College of Engineering, Karad				
Programme: Double Minors (Multidisciplinary and Specialization Minors)				
ITDO-0601: Basics of AI and ML				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		FA	50
Tutorials	00 Hrs/week		SA	50
Total Credits	02		TOTAL	100

Prerequisite : Linear Algebra, Python Programming

Course Outcomes (CO): Students will be able to

CO1	Recall AI fundamentals, history, characteristics, and applications in engineering domains.
CO2	Explain AI techniques, including search algorithms, rule-based systems, and ethical considerations.
CO3	Apply machine learning workflows and feature engineering techniques to solve engineering problems.
CO4	Analyze and evaluate supervised and unsupervised learning algorithms for engineering applications

	Course Contents	CO	Hours
Unit 1	**Fundamentals of Artificial Intelligence:** Introduction to AI, Definition of Artificial Intelligence, History and Evolution of AI, Key Characteristics of AI Systems, Applications of AI in Engineering Domains (Mechanical Engineering: Predictive maintenance, Automation, Civil Engineering: Smart cities, Structural health monitoring, Electrical and Electronics Engineering: Smart grids, Fault detection etc.)	**CO1**	**(04)**
Unit 2	**AI Techniques :** Search Algorithms: Breadth-First Search (BFS) and Depth-First Search (DFS), Rule-based Systems and Expert Systems, Challenges and Ethics in AI, Ethical issues: Bias, Privacy, Job Displacement, Explain ability and Transparency in AI.	**CO2**	**(04)**
Unit 3	**Basics of Machine Learning** Introduction to Machine Learning, Definition and Importance of Machine Learning, Difference between AI and ML, Types of Machine Learning, Machine Learning Workflow	**CO3**	**(05)**
Unit 4	**Feature Engineering** Data Collection: Types of engineering data (e.g., sensors, IoT data), Data Pre-processing: Cleaning and feature scaling, Feature Selection: Importance of relevant features in engineering problems, Feature Extraction: Simplifying complex data into meaningful information, Model Training and Testing: Importance of splitting datasets.	**CO3**	**(05)**
Unit 5	**Supervised Learning Algorithms:** Regression Techniques, Simple Linear Regression, Applications: Predicting stress-strain, load analysis, Polynomial Regression, Classification Techniques, Decision Trees, Evaluation Metrics, (**Self Study:** Applications of Supervised Learning)	**CO4**	**(05)**
Unit 6	**Unsupervised Learning Algorithms:** Clustering Techniques, K-Means Clustering: Explanation with engineering applications (e.g., grouping materials), Hierarchical Clustering: Basics and use cases, Dimensionality Reduction Principal Component Analysis (PCA): Simplified concept and benefits Importance of reducing high-dimensional engineering data, (**Self Study:** Applications of Unsupervised Learning)	**CO4**	**(05)**

Text Books

1.	Tom Mitchell, " Machine learning", McGraw-Hill series in Computer Science, (Unit 3,4,5,6)
2.	Peter Norvig and Stuart J. Russell "Artificial Intelligence: A Modern Approach" , 4th Edition, 2022, PHI Publisher (Unit 1,2)

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Reference Books	
1.	Shalev-Shwartz, Shai, and Shai Ben-David, "Understanding machine learning: From theory to algorithms", Cambridge university press, 2014
2.	Jiawei Han, Micheline Kamber, and Jian Pie, "Data Mining: Concepts and Techniques", Elsevier Publishers Third Edition, ISBN: 9780123814791, 9780123814807
3.	Bishop, Christopher M., and Nasser M. Nasrabadi, "Pattern recognition and machine learning",Vol. 4.No. 4. New York: springer, 2006
Useful Links	
1.	https://nptel.ac.in/courses/106106226 Dr. D. Khemani IIT Madras Artificial Intelligence: Search Methods for Problem Solving
2.	https://nptel.ac.in/courses/106102220 Prof. Mausam IIT Delhi An Introduction to Artificial Intelligence,
3	https://www.dkriesel.com/_media/science/neuronalenetze-en-zeta2-1col-dkrieselcom.pdf

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	-	2	-	1	-	-	-	-	-	-	-	3	3
CO 2	-		2	1	2	-	3	-	2	-	-	2	2
CO 3	-	2	1	3	3	-	-	2	2	2	-	3	3
CO 4	-	1	2	3	3	-	-	-	2	2	-	3	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	FA	SA
Remember	10	10
Understand	10	10
Apply	10	10
Analyse	10	10
Evaluate	10	10
Create	-	-
TOTAL	50	50

Chairman, BoS IT

Government College of Engineering, Karad				
Programme: Double Minors (Multidisciplinary and Specialization Minors)				
ITDO-0701: Python Programming				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		FA	50
Tutorials	00 Hrs/week		SA	50
Total Credits	02		TOTAL	100

Prerequisite : Basics of C programming, Object Oriented Programming

Course Outcomes (CO): Students will be able to

CO1	Develop algorithmic solutions to simple computational problems.
CO2	Write simple Python programs using conditionals and looping and functions for solving problems.
CO3	Represent compound data using Python lists, tuples, dictionaries etc.
CO4	Solve problems using file handling and OOP concepts.

	Course Contents	CO	Hours
Unit 1	**Introduction to Python:** Structure of a Python Program, Elements of Python, Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings and Operators.	**CO1**	**(03)**
Unit 2	**Conditional Statements, Looping and String:** Branching, Looping, Conditional Statement, Exit function, Difference between break, continue and pass. String Manipulation: Understanding string, Accessing Strings, Basic Operations, String slices, Function and Methods.	**CO2**	**(03)**
Unit 3	**Lists, Tuples and Dictionaries:** List: Accessing list, list operations, Working with lists, Function and Methods. Tuples: Accessing tuples, Operations, Working and Methods. Dictionary: Accessing values in dictionaries, Working with dictionaries	**CO3**	**(03)**
Unit 4	**Python Functions:** Python Functions: Defining and Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables, **(Self-Study**: Organizing python codes using functions.)	**CO2**	**(03)**
Unit 5	**Exception Handling:** Introduction to Exception, Exception Handling, Except clause, try, finally clause, User Defined Exceptions.	**CO4**	**(02)**
Unit 6	**File Handling:** Opening and closing file, Reading and writing files, Functions.	**CO4**	**(03)**

Text Books

1. Jeffrey C.Jackson, "Web Technologies: A Computer Science Perspective", 2nd Edition, Pearson Education, 2007, ISBN 978-0131856035. (Unit 1,2,3,4,5,6)
2. Robert W. Sebesta, "Programming the World Wide Web", 4th Edition, Pearson education, 2008.

Reference Books

1. Marty Hall, Larry Brown,"Core Web Programming", 2nd Edition, Pearson Education, 2001, ISBN 978-0130897930.
2. H.M. Deitel, P.J. Deitel and A.B. Goldberg, "Internet & World Wide Web How To Program", 3rd Edition, Pearson Education, 2006, ISBN 978-0131752429.
3. Chris Bates, "Web Programming Building Internet Applications", 3rd Edition, Wiley India, 2006.

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4.	Xue Bai et al, "The web Warrior Guide to Web Programming", Thomson, 2003.
Useful Links	
1.	https://nptel.ac.in/courses/106106145 Prof. Madhavan Mukund Chennai Programming, Data Structures And Algorithms Using Python
2.	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs84 Prof. Sudarshan Iyengar IIT Ropar A Joy of Computing using Python
3.	https://www.digimat.in/nptel/courses/video/106105191/L01.html
4.	http://www.nptelvideos.com/php/php_video_tutorials.php

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CO 2	1	3	2	2	-	-	-	-	-	-	-	1	2
CO 3	1	2	3	2	2	-	-	-	-	-	-	1	2
CO 4	-	3	2	3	1	-	-	-	-	-	-	1	2

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Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	FA	SA
Remember	10	10
Understand	10	10
Apply	10	10
Analyse	10	10
Evaluate	10	10
Create	-	-
TOTAL	50	50

Chairman, BoS IT

Government College of Engineering, Karad				
Programme: Double Minors (Multidisciplinary and Specialization Minors)				
ITDO-0801: Web Technology				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		PBE-I	50
Tutorials	00 Hrs/week		PBE-II	50
Total Credits	02		TOTAL	100

Prerequisite : Data Structure

Course Outcomes (CO): Students will be able to

CO1	Apply the client side technologies for web development.
CO2	Analyse the concepts of Servlet and JSP.
CO3	Create the effective web applications for business functionalities using latest web development platforms.
CO4	Analyse the Web services and frameworks.

	Course Contents	CO	Hours
Unit 1	**Web Essentials and Mark-up language- HTML** The Internet, basic internet protocols, the world wide web, HTTP Request message, web servers. HTML: Introduction, history and versions. HTML elements, CSS: Introduction to Style Sheet, CSS features, CSS core syntax, Style sheets and HTML, Bootstrap.	**CO1**	**(06)**
Unit 2	**Client Side Technologies: JavaScript and DOM** JavaScript: Introduction to JavaScript, JavaScript in perspective, basic syntax, variables and data types, statements, operators, DOM: Introduction to Document Object Model, jQuery, Overview of Angular JS.	**CO2**	**(04)**
Unit 3	**Java Servlets and XML** Servlet: Servlet architecture overview, Servlets generating dynamic content, Servlet life cycle, parameter data, sessions, cookies, URL rewriting, databases (MySQL) and Java Servlets. XML: XML documents and vocabularies, XML declaration,	**CO2**	**(04)**
Unit 4	**JSP and Web Services** JSP: Introduction to Java Server Pages, JSP and Servlets, running JSP applications, Basic JSP, JavaBeans classes and JSP, Support for the Model-view-controller paradigm, JSP related technologies. Web Services: Web Service concepts, WSDL. **(Self Study:** Communicating Object data: SOAP, Struts)	**CO3**	**(04)**
Unit 5	**Server Side Scripting Languages** PHP: Introduction to PHP, uses of PHP, general syntactic characteristics, Primitives, operations and expressions, output, control statements, arrays, functions, pattern matching, form handling	**CO3**	**(04)**
Unit 6	**Ruby and Rails** Introduction to Ruby: Origins & uses of Ruby, scalar types and their operations, simple input and output, control statements, fundamentals of arrays **(Self Study:** Introduction to EJB)	**CO4**	**(04)**

Text Books

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4.	Xue Bai et al, "The web Warrior Guide to Web Programming", Thomson, 2003.
Useful Links	
1.	https://nptel.ac.in/courses/106105084 Prof. Indranil Sengupta IIT Kharagpur Internet Technology
2.	https://onlinecourses.swayam2.ac.in/e-learning/preview/nou24_cs09 **Dr. Ashutosh Kumar Bhatt Haldwani Web Technology**
3.	http://www.nptelvideos.com/php/php_video_tutorials.php

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CO 3	1	2	3	1	-	-	-	-	-	-	-	1	2
CO 4	2	3	2	1	-	-	-	-	-	-	-	1	2

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Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	PBE-I	PBE-II
Remember	10	10
Understand	10	10
Apply	10	10
Analyse	10	10
Evaluate	10	10
Create	-	-
TOTAL	50	50

Chairman, BoS IT

Government College of Engineering, Karad				
Programme: Double Minors (Multidisciplinary and Specialization Minors)				
ITDO-0802: Major Capstone Project (Design & Development)				
Teaching Scheme			**Examination Scheme**	
Lectures	-		PBE-I	50
Practical	08 Hrs/week		PBE-II	50
Total Credits	04		Total	100

Prerequisites: Programming Knowledge

Course Outcomes (CO): Students will be able to

1.	Apply SDLC and meet the objectives of proposed development or research work.
2.	Test rigorously before deployment of work in objective 1.
3.	Validate the work undertaken during objective 1 and 2.
4.	Consolidate the development or research work as project report.

Course Contents

I Guidelines:

- Select a topic relevant to the Information Technology, Computer Science and Engineering.
- For selection of topic refer Scopus Index Journals, innovative ideas and societal use application.
- The Major Capstone Project will be undertaken preferably by a group of 3-4 students who will jointly work and implement the project. The group will select a project with approval from a committee formed by the department of senior faculty to check the feasibility and approve the topic.
- The Major Capstone Project work can be undertaken in own organization/company/any reputed R&D Lab.
- Student must consult project guide in selection of topic.
- Projects should have preferably industrial exposure, societal use application and research oriented.
- Student should report weekly to the project guide and log book of activities should be maintained for continuous assessment of the project work. The log book should be used for awarding CA marks.

II Project Report Format:

Report should be of 40 to 60 pages (typed on A4 size sheets). For standardization of the project reports the following format should be strictly followed.

1. Page Size: Trimmed A4
2. Top Margin: 1.00 Inch
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inch
6. Para Text: Times New Roman 12 Point Font
7. Line Spacing: 1.5 Lines
8. Page Numbers: Right Aligned at Footer. Font 12 Point. Times New Roman
9. Headings: Times New Roman, 14 Point Bold Face
10. Certificate: All students should attach standard format of Certificate as described by the department. Certificate should be awarded to the group and not to individual student. Certificate should have signatures of guide, Head of Department and Principal/ Director.
11. The Major Capstone Project report contains the details.
    1. Problem definition
    2. Requirement specification
    3. System design details (UML diagrams)
    4. System implementation – code documentation – dataflow diagrams/ algorithm, protocolsused.
    5. Test result and procedure

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6. Conclusions.
7. Appendix
a) Tools used
b) References

12. References: References should have the following format For Books: "Title of Book", Authors, Publisher, Edition For Papers: "Title of Paper", Authors, Journal/Conference Details, Year(IEEE format)

III. Assessment Guideline:

• Major Capstone Project work should be continually evaluated based on the contributions of the group members, originality of the work, innovations brought in, research and developmental efforts, depth and applicability and so on would be considered.

• There shall be at least two reviews in semester by the review committee constituted at department level by the Programme head which includes presentations and demonstration of the work carried out by the students.

Review 3: Implementation status and testing document.

Review 4: Project Demonstration, Project Report and Result analysis.

End semester examination should be conducted by the panel of internal examiner and external examiners from reputed institute or industry.

• The final certification and acceptance of work ensures the satisfactory performance on the above aspects.

List of Submission:

1. Working model of the software /Hardware project.
2. Project report.
3. Presentation and demonstration of project in exhibition.

Teaching Load :

One supervisor from the department shall be assigned four groups of project and weekly load for supervisor is 08 Hrs/week.

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CO 3	2	3	3	2	3	2	2	2	2	3	2	3	3
CO 4	2	3	3	2	3	2	1	2	2	3	3	3	3

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