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

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.

Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: Honors with Research and Multidisciplinary Minor

(Major: Semester – VII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
1	ITHRO-0701	Research Project Phase -I	--	18	18	09	100	100	200
		Total	**--**	**18**	**18**	**09**	**100**	**100**	**200**

(Major: Semester – VIII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
1	ITHRO -0801	Research Project Phase -II	--	18	18	09	100	100	200
		Total	**--**	**18**	**18**	**09**	**100**	**100**	**200**

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 work on research project for 18 credits in the semester VII –VIII in the respective Major Engineering/Tecnology discipline. These 18 credits will be over and above the 176 credits prescribed for four year multidisciplinary bachelor's degree in Engg/Tech Program.

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 performance)

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

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

<u>PROGRESSIVE TOTAL CREDITS: 18</u>

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.

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	Analyse 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)

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	PO 12	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	1	2	-	2	1	-	3	1	2
CO 4	3	3	3	3	3	2	1	2	2	3	1	3	-	-

: 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

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. • Visualizing decision boundaries and confusion matrices.	CO3
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	CO4
	• Analyzing the COMPAS dataset to identify biases and ethical considerations. • Visualizing data insights and discussing implications for real-world applications.	

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	PO 12	PSO1	PSO2
CO 1	2	3	3	3	3	1	-	-	-	-	-	2	-	-
CO 2	2	2	2	2	3	2	-	-	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	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: 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			

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.

Useful Links

1.	http://nptel.ac.in/courses/106106130/, Dr. N S. Narayanaswamy, IIT Madras
2.	http://nptel.ac.in/courses/106103069/, IIT Guwahati
3.	http://nptel.ac.in/courses/106106127/, Prof. Shankar Balachandran, IIT Madras

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	PO 12	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

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			

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
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	PO 12	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