Skill Enhancement Courses (SEC)

Course Code	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
241ME019	Digital Manufacturing Lab	IC			2	2	50	50	100	-
241ME020	Analysis & Simulation Lab	AC			2	2	50	50	100	-
241AI001	Artificial Intelligence & Machine Learning Lab	AC			2	2	50	50	100	-
	Total				**6**	**6**				

Digital Manufacturing Lab

Course Code: 241ME019

L	T	P	C
0	0	2	2

Course Outcomes:

At the end of the course, student will be able to:

- **CO1:** Understand and Apply Basic Robotics Concepts:
- **CO2:** Understand and Apply Basic Robotics Concepts:
- **CO3:** Implement and Control Embedded Systems with Arduino:
- **CO4:** Integrate and Operate Advanced Robotics and Communication Systems
- **CO5:** Enhance Problem-Solving and Critical Thinking Skills

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	1	2								
CO2	2	1	2								
CO3	2	3	2								
CO4	2	1	2								
CO5	2	1	2								

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3	3	
CO4	2	
CO5	2	

Practice:

1. Install and explore CPRog software features and safety protocols.
2. Program an IGUS robot for pick and place tasks with a magnetic gripper.
3. Program an IGUS robot for pick and place tasks with a vacuum gripper.
4. Create a simple geometric shape using CAD software.
5. Design and assemble multiple CAD components with proper fit.
6. Develop a 3D parametric model by adjusting key parameters.
7. Slice a 3D model and print a simple part using a 3D printer.
8. Print and assemble multiple components, ensuring proper fit.
9. Print complex geometries using support structures.
10. Use Arduino and a potentiometer to control DC motor speed.
11. Use Arduino to control a servo motor's angular position.
12. Build and program an Arduino robot to avoid obstacles using ultrasonic sensors.

Additional Practice:

1. Design and program an Arduino system to monitor and display temperature data.
2. Develop and program a robot controlled via Bluetooth communication using Arduino.

Reference Books:

1. 3D Printing and Additive Manufacturing: Principles and Applications, Chee Kai Chua and Kah Fai Leong, World Scientific publishers, 2020, 5th edition, ISBN: 9813146761.
2. 3D Printing for Dummies, Richard Horne and Kalani Kirk Hausman, Wiley Publication, 2019, 2nd edition, ISBN: 978-8126569892.
3. A comprehensive approach to Digital Manufacturing, Arif Sirinterlikci, Yalcin Ertekin, Springer, 2023rd edition, 2023, ISBN: 9783031253539.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc21_mg83/preview
2. https://www.coursera.org/learn/introduction-digital-manufacturing-fusion-360
3. https://onlinecourses.swayam2.ac.in/ntr24_ed17/preview

Analysis & Simulation Lab

Course Code: 241ME020	L	T	P	C
	0	0	2	2

Course Outcomes: At the end of the course, student will be able to:

- **CO1:** Demonstrate the ability to create and analyze the FE models for trusses using ANSYS
- **CO2:** Demonstrate the ability to evaluate and interpret FE analysis results for design and evaluation purposes.
- **CO3:** Study the different meshing
- **CO4:** Solve the problem related to Finite Different Method
- **CO5:** Solve the problem for heat transfer.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	2		2		1	1	1		
CO2	2	2	2		2		1	1	1		
CO3	2	3	2		2		1	1	1		
CO4	2	2	3		2		1	1	1		
CO5	2	2	3		2		1	1	1		

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

Practice

1. Introduction to FEA software ANSYS Workbench.
2. Solving truss problems using ANSYS.
3. Two-dimensional truss problem using ANSYS
4. Analysis for 1-D temperature analysis.
5. Harmonic analysis of a Cantilever beam
6. Analysis of 3D Problems using ANSYS.
7. Introduction to CFD workbench (CFX/FLUENT).
8. Mesh generation technique with models.
9. Heat conduction through a slab.
10. Lumped heat capacity model.
11. Flow over a flat plate.
12. Flow through pipe

Additional Practice:

1. Project using ANSYS
2. Project using FLUENT

Reference Books:

1. Principles of CAD/CAM/CAE, Kunwoo Lee, Pearson, 1st Edition, ISBN 978-0201380361
2. Autodesk Fusion 360 Black Book, Verma G., CADACAMCAE Works, 2nd Edition, 2021, ISBN 978-1988722344

Web Links:

1. https://kashanu.ac.ir/Files/Content/ANSYS%20Workbench.pdf
2. https://www.ansys.com/content/dam/amp/2023/december/quick-request/ansys-education-resources-23q4-part-1/basics-of-fea-tutorial-tutfeameen24.pdf
   https://archive.nptel.ac.in/courses/112/105/112105254/

Artificial Intelligence & Machine Learning Lab

Course Code: 241AI001	L	T	P	C
	0	0	2	2

Course Outcomes: At the end of the course, student will be able to:

CO1: Apply basic data loading, preprocessing, and visualization techniques using Python.

CO2: Handle missing data, normalization, and basic data transformations using Python.

CO3: Implement fundamental classification algorithms such as Decision Tree, Naive Bayes, k-NN, and Logistic Regression using Python.

CO4: Implement regression algorithms such as Simple Linear Regression and Multiple Linear Regression using Python.

CO5: Apply unsupervised machine learning techniques and model evaluation methods such as K-Means clustering, train-test split, and cross-validation using Python.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	1	2		2			2	2		2
CO2	3	1	2		2			2	2		2
CO3	3	2	2		2			2	2		2
CO4	2	1	3		2			2	2		2
CO5	3	1	1		2			2	2		2

Practice

Write a program using PYTHON

1. To load a dataset and display its attribute details. Use any appropriate dataset.
2. To handle missing values using the Replace Missing Values filter or equivalent Python code. Use an appropriate dataset.
3. To demonstrate normalization and standardization of data. Use an appropriate dataset.
4. To visualize the dataset (plots/summary/statistics) and interpret the basic information. Use an appropriate dataset.
5. To demonstrate the working of a Decision Tree classifier, Use an appropriate dataset.
6. To demonstrate the working of the Naive Bayes classifier. Use an appropriate dataset.
7. To demonstrate the working of the k-Nearest Neighbors (IBk / KNN) classifier. Use an appropriate dataset.
8. To demonstrate the working of the Logistic Regression classifier. Use an appropriate dataset.
9. To demonstrate the working of Simple Linear Regression. Use an appropriate dataset.
10. To demonstrate the working of Multiple Linear Regression. Use an appropriate dataset.
11. To demonstrate the working of the K-Means clustering algorithm. Use an appropriate dataset.
12. To demonstrate train-test split and cross-validation for any classifier. Use an appropriate dataset.

Additional Practice:

1. To demonstrate the k-fold cross-validation for any classifier. Use an appropriate dataset.
2. To demonstrate the working of the Random Forest classifier. Use an appropriate dataset.

Reference Books:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, ISBN 978-1492032649
2. Practical Machine Learning, Sunila Gollapudi, ISBN 978-1784399689

Web Links:

1. https://archive.ics.uci.edu/ml/datasets.php
2. https://www.kaggle.com/
3. https://www.geeksforgeeks.org/machine-learning/