25UMEL305	MACHINING & ADDITIVE MANUFACTURING LAB	Category	L	T	P	R	Credit	Year of Introduction
		PCL	0	0	3	0	2	2025

Preamble: This laboratory course provides hands-on training in conventional machining processes including turning, shaping, drilling, milling, and grinding, enabling students to apply machining parameters and evaluate cutting performance. It also develops practical fabrication skills through arc and gas welding operations while emphasizing safety and quality considerations.

Course Outcomes: After the completion of the course, the student will be able to:

CO	Course Outcomes	Knowledge Level
CO1	Explain the working principles and operations of machining processes such as turning, shaping, drilling, milling and grinding.	K2 Understand
CO2	Explain welding processes, equipment and process parameters used in arc and gas welding.	K2 Understand
CO3	Apply machining and welding operations to fabricate simple components using conventional manufacturing machines.	K3 Apply
CO4	Apply CAD modelling, slicing and FDM 3D printing techniques to design and manufacture components.	K3 Apply

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	-	-	-	2	-
CO2	2	1	-	-	1	-	-	-	-	-	-	2	-
CO3	2	2	3	-	2	-	-	-	-	-	-	3	2
CO4	2	2	2	-	3	-	-	-	-	-	-	3	3
Avg	2	1.5	2.5	-	2	-	-	-	-	-	-	2.25	2.5

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	*	_	_	*	_
CO2	*	*	*	*	*	_	_	*	_
CO3	*	*	*	*	*	*	*	*	_
CO4	*	*	*	*	*	*	*	*	_

WKs Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*	*	*	*	-

SYLLABUS

Sl No.	Experiments
1	Exercises on lathe: - Plain and step turning.
2	Exercises on lathe: - Ball & curve, and Taper turning.
3	Exercises on lathe: - Thread cutting.
4	Exercises on lathe: - Measurement of cutting forces in turning Process.
5	Exercises on shaping machine: - flat surfaces.
6	Exercises on shaping machine: - Grooves and key ways.
7	Exercises on drilling machine: - drilling, boring, reaming, taping and counter sinking etc.
8	Exercises on drilling machine: - Measurement of cutting forces in drilling process.
9	Exercises on cylindrical grinding machine: - Grinding of a plain cylindrical surface.
10	Exercises on surface grinding machine: - Grinding of a flat surface.
11	Exercises on tool and cutter grinding machine: - Grinding of a single-point cutting tool.
12	Exercises on milling machine: - Plane and pocket milling operations.
13	Exercises on milling machine: - Spur gear cutting operation.
14	Study of Arc Welding Equipment, Electrodes and Process Parameters for SMAW
15	Study of Oxy-Acetylene Gas Welding Setup and Flame Characteristics
16	Exercises on arc welding: - butt welding and lap welding of M.S. sheets.
17	Exercises on gas welding: - butt welding and lap welding of M.S. sheets.

18	Develop 2D sketches and 3D models, apply geometric and dimensional constraints, assemble multiple parts, and export models to STL format.
19	Slicing of a CAD Model Using Different Techniques and Optimization of Process Parameters
20	Design and Fabrication of Assembled Components with Fits and Tolerances Using FDM 3D Printing Technology

A minimum of 12 sets of experiments are mandatory but experiments mentioned for Additive manufacturing are mandatory.

Course Assessment Method

(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	25	20	50

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.

Endorsement by External Examiner: The external examiner shall endorse the record.

Text Books:

1. Kalpakjian, S., & Schmid, S. R., *Manufacturing engineering and technology* (6th ed.). Prentice Hall, 2009.
2. Jain, R. K., *Production technology* (17th ed.). Khanna Publishers, 2001.

3. Gibson, I., Rosen, D., Stucker, B., & Khorasani, M., *Additive manufacturing technologies* (3rd ed.). Springer, 2021.
4. American Welding Society, *Welding handbook: Welding science and technology* (Vol. 1, 9th ed.). American Welding Society, 2001.

Reference Books:

1. Beddoes, J., & Bibby, M. J., *Principles of metal manufacturing processes.* Elsevier, 2003.
2. *The Welding Institute of Metals, Metals handbook* (Vol. 5). The Welding Institute of Metals, 1977.
3. Heine, R., Loper, C., & Rosenthal, P., *Principles of metal casting*. Tata McGraw Hill, 2004.
4. Flemings, M. C., *Solidification processes.* McGraw Hill, 1974.

Continuous Assessment (25 Marks)

1. Preparation and Pre-Lab Work (7 Marks)

Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.

Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. Conduct of Experiments (7 Marks)

Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.

Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.

Teamwork: Collaboration and participation in group experiments.

3. Lab Reports and Record Keeping (6 Marks)

Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.

Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. Viva Voce (5 Marks)

Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

1. Procedure/Preliminary Work (10 Marks)

Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.

Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.

2. Conduct of Experiment/Execution of Work/Programming (15 Marks)

Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. Result with Valid Inference/Quality of Output (10 Marks)

Accuracy of Results: Precision and correctness of the obtained results.

Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. Viva Voce (10 Marks)

Ability to explain the experiment, procedure results and answer related questions

Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. Record (5 Marks)

Completeness, clarity, and accuracy of the lab record submitted