25UMEL404	**COMPUTER AIDED MODELLING & ANALYSIS LAB**	Category	L	T	P	R	**Credit**	**Year of Introduction**
		PCL	0	0	3	0	**2**	**2025**

Preamble: This laboratory course is designed to develop competency in modern Computer Aided Design (CAD) and Computer Aided Engineering (CAE) tools used in contemporary mechanical engineering practice. The course emphasizes parametric and feature-based solid modelling, assembly modelling strategies, motion simulation, and design validation techniques. It integrates simulation-driven design through structural, thermal, and fluid flow analysis using finite element and computational fluid dynamics tools. The course aims to equip students with practical skills required for design analysis, optimization, and collaborative engineering environments.

Pre-requisite: EGS103 Engineering Graphics and Computer Aided Drawing

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

CO	Course Outcomes	Knowledge Level
CO1	Apply BIS standards, dimensioning, sectional views, GD&T, and constraint-based 3D sketching in engineering drawings.	**K3 Apply**
CO2	Develop constrained 3D part models and assemblies of standard machine components using modelling features and assembly constraints.	**K3 Apply**
CO3	Analyze 3D assemblies using material properties, mass properties, interference checks, and production drawings.	**K4 Analyze**
CO4	Apply basic FEA procedures to perform structural, thermal, and CFD simulations and interpret results.	**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	**3**	**1**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**1**
CO2	**3**	**2**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**3**
CO3	**3**	**2**	**3**	**1**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**3**
Avg	**3**	**2**	**2.75**	**1.5**	**3**	**-**	**-**	**-**	**2**	**1.75**	**-**	**2.75**	**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
*	*	*	*	*	*	*	–	–

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	**50**	**50**	**2.5 hrs**

Continuous Internal Evaluation Pattern:

Component	Marks
Attendance	5
Lab Performance & Record	15
Continuous Assessment Tests	30
Total	**50**

End Semester Examination:

Component	Marks
Part A – Assembly Modelling	20
Part B – Simulation (Structural/Thermal/CFD)	20
Viva Voce	10
Total	**50**

SYLLABUS

Part A: Fundamentals of 3D Part Modelling and Assembly

1. Study of BIS code of practice: types of lines, dimensioning conventions, scales, sectional views, and introduction to GD&T.
2. Practice of constraint-based sketching and creation of fully constrained 2D profiles with proper design intent.
3. Creation of basic 3D features: extrusion, revolution, sweep, loft, and multi-body modelling.
4. Surface modelling exercise and mass property evaluation.
5. Parametric modelling of standard machine elements such as nuts, bolts, and washers using design tables and configurations.

6. 3D part modelling and assembly of machine components including Knuckle Joint, Socket and Spigot Joint, Universal Coupling and Screw Jack with proper application of mates/constraints and generation of assembly drawings.
7. Interference check, material assignment, and preparation of detailed production drawings from 3D models.

Part B: Analysis and Simulation

1. Introduction to Finite Element Method concepts: discretization, element types, and mesh generation.
2. Geometry cleanup and mesh refinement techniques for structural analysis.
3. Application of boundary conditions and loads; static structural analysis for stress and deformation evaluation.
4. Basic steady-state thermal analysis including conduction and convection boundary conditions.
5. Introduction to CFD: domain creation, meshing, application of inlet/outlet boundary conditions, and interpretation of velocity and pressure contours.

Text Books:

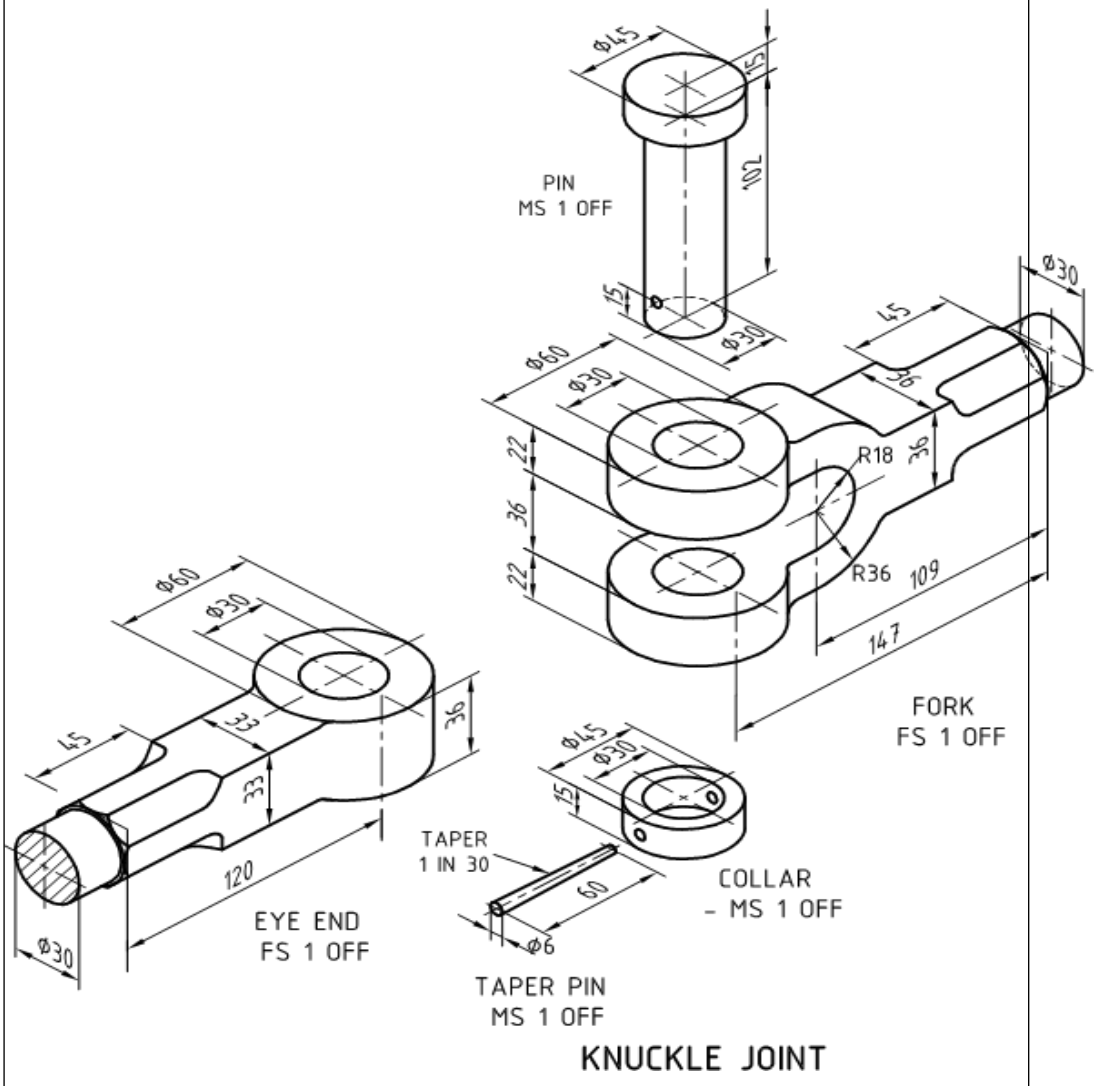
1. Narayana, K. L., & Kannaiah, P., *Fundamentals of machine drawing*. Scitech Publications, 2015.
2. Zeid, I., *Mastering CAD/CAM*. McGraw Hill Education, 2018.
3. Rao, P. N., *CAD/CAM: Principles and applications*. McGraw Hill Education, 2017.
4. Chandrupatla, T. R., & Belagundu, A. D., *Introduction to Finite Elements In Engineering*. Pearson Education, 2012.

Reference Books:

1. Hutton, D. V., *Fundamentals of finite element analysis*. Tata McGraw Hill, 2003.
2. Moaveni, S., *Finite element analysis: Theory and application with ANSYS*. Pearson, 2015.
3. Vajpayee, K., *CAD/CAM, robotics and flexible automation*. McGraw Hill Education, 2020.
4. Bendsøe, M. P., & Sigmund, O., *Topology optimization: Theory, methods, and applications*. Springer, 2013.

END SEMESTER LAB EXAMINATION – MODEL QUESTION PAPER

Qn No.	Question	Marks
	Part A	
1	Create an assembly model using the part details given below.	20



	Part B	
Qn No.	**Question**	**Marks**
2	To conduct the fluid flow analysis of a horizontal pipe section of diameter 50mm and length 400mm having an inlet velocity of 4m/s.	20
3	Viva Voce	10

25UMEL405	**FLUID FLOW AND**	Category	L	T	P	R	**Credit**	**Year of**

	HYDRAULIC SYSTEM LAB							**Introduction**
		PCL	0	0	3	0	**2**	**2025**

Preamble: The Fluid Flow and Hydraulic System Lab offers hands-on experience in applying the principles of fluid mechanics and dynamics through practical experiments. It enables students to study viscous flow behavior, discharge measurement in closed and open channels, and the performance characteristics of various hydraulic machines.

Prerequisite: 25UMET302 Fluid Mechanics and Hydraulic Machines

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

CO	Course Outcomes	Knowledge Level
CO1	Perform experiments to determine flow measurement parameters and hydraulic coefficients in fluid flow systems.	**K3 Apply**
CO2	Determine flow characteristics and losses in pipe flow systems.	**K3 Apply**
CO3	Analyze the stability and performance characteristics of hydraulic devices and floating bodies.	**K4 Analyze**
CO4	Determine the performance characteristics of hydraulic pumps and turbines under different operating conditions.	**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	3	2	1	2	2	-	-	-	-	-	-	3	1
CO2	3	3	1	2	2	-	-	-	-	-	-	3	1
CO3	2	3	2	2	1	-	-	-	-	-	-	2	2
CO4	3	3	2	2	2	-	-	-	-	-	-	3	2
Avg	**2.75**	**2.75**	**1.5**	**2**	**1.75**	-	-	-	-	-	-	**2.75**	**1.5**

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
*	*	*	*	*	*	*	*	-

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	**50**	**50**	**2.5 hrs**

Continuous Internal Evaluation Pattern:

Attendance : 5 marks
Continuous Assessment Test : 25 marks
Internal Examination : 20 marks

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

SYLLABUS

Experiments

1. Determination of coefficient of discharge and calibration of Notches.
2. Determination of coefficient of discharge and calibration of Orifice meter.
3. Determination of coefficient of discharge and calibration of Venturi meter.
4. Determination of hydraulic coefficients of orifices and mouthpieces with constant and varying head.
5. Determination of Chezy's constant and Darcy's coefficient on pipe friction apparatus.
6. Determination of the minor losses in pipe.
7. Experiments on hydraulic ram.
8. Reynolds experiment.
9. Bernoulli's experiment.
10. Determination of metacentric height and radius of gyration of floating bodies.
11. Performance test on Positive displacement pumps.
12. Performance test on Centrifugal pumps and determination of operating characteristics.
13. Performance test on Gear pump.
14. Performance test on Pelton turbine and determination of operating characteristics.
15. Performance test on reaction turbines (Francis and Kaplan Turbines) and determination of operating characteristics.
16. Speed variation test on Pelton turbine.

Minimum 10 experiments should be completed

Text Books:

1. Çengel, Y. A., & Cimbala, J. M*., Fluid mechanics*. Tata McGraw Hill, 2013.
2. Bansal, R. K., *Fluid mechanics and hydraulic machines*. Laxmi Publications, 2005.
3. Som, S. K*., Introduction to fluid mechanics and fluid machines*. McGraw Hill Education, 2011.

Reference Books:

1. White, F. M., *Fluid mechanics*. Tata McGraw Hill, 2003.
2. Fisher, C., & Henley, E. J., *Engineering applications of fluid dynamics*. Willford Press, 2023.