INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**COMPUTER AIDED MODELING AND ANALYSIS LABORATORY**				
Course Code	AME114				
Programme	B Tech				
Semester	VII	ME			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	-	-	-	3	2
Chief Coordinator	Ms. T Vanaja, Assistant Professor				
Course Faculty	Ms. T Vanaja, Assistant Professor				

I. COURSE OVERVIEW:

In this laboratory the students learn the fundamentals of computer aided designing, modeling to accomplish preliminary design and layouts, design details and calculations, creating 3-D models, creating and releasing drawings, as well as interfacing with analysis, marketing, manufacturing, and end-user personnel.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AME010	V	Machine Tools and Metrology Lab	2

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Computer Aided Modeling And Analysis Laboratory	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✘	Chalk & Talk	✔	Quiz	✘	Assignments	✘	MOOCs
✔	LCD / PPT	✘	Seminars	✘	Mini Project	✔	Videos
✔	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

Semester End Examination (SEE):

Each laboratory is evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done 20 marks for day to day performance and 10 marks for the final lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall conducted by two examiners, one of them being internal examiners and other being External Examiner both nominated by the principal from the panel of experts recommended by chairman BOS.

The emphasis on the questions is broadly based on the following criteria:

20 %	To test the preparedness for the experiment.
20 %	To test the performance in the laboratory.
20 %	To test the calculation and graph related to the concern experiment.
20 %	To test the results and error analysis of the experiment.
20 %	To test the subject knowledge through viva-voce

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	**Laboratory**		**Total Marks**
Type of Assessment	Day to day performance	Final internal lab assessment	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE examination shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

Preparation	**Performance**	**Calculations and Graph**	**Results and error analysis**	**Viva**	**Total**
2	2	2	2	2	10

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Exercise, Discussion and Seminars
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2	Lab Experiments
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	Lab Experiments

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional Skills:** To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.	1	Experiments, Discussion and Seminars
PSO 2	**Software Engineering Practices:** An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.	-	-
PSO 3	**Successful Career and Entrepreneurship:** To build the nation, by imparting technological inputs and managerial skills to become technocrats.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES :

The course should enable the students to:	
I	Understand the features and specifications of CAD and 3D Modeling tools.
II	Develop the part design and drafting methods.
III	Use the CAE software and analyze the load conditions.
IV	Execute the results of reaction forces and stress and strain diagrams.

IX. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand the features and specifications of CAD and 3D Modeling tools.	CLO 1	Understand the concept of Modeling and Analysis software.
		CLO 2	Know the various types of CAD tools and apply it to design and model various products.
		CLO 3	Understand modern tools to formulate the problem, and able to create geometry.
CO 2	Develop the part design and drafting methods	CLO 4	Understand Fundamentals of discretize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different loading conditions.
		CLO 5	Performance of relative mechanisms in simulation module.
		CLO 6	Generation of part programming through assembly module.
CO 3	Use the CAE software and analyze the load conditions.	CLO 7	Generation of deflection of beams subjected to point, uniformly distributed and varying loads further to use the available results to draw shear force and bending moment diagrams.
		CLO 8	Understand various Work piece setting methods and tool setting methods
		CLO 9	Practice on structural and thermal real time problems.
CO 4	Execute the results of reaction forces and stress and strain diagrams.	CLO 10	Design, manufacture and analyze a Mechanical system using modern engineering software tools and measurement systems
		CLO 11	Utilize self-education to develop lifelong learning to appraise and adapt global and societal contexts to propose Engineering solutions
		CLO 12	Perform Practice session at industry

X. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AME116.01	CLO 1	Understand the concept of Modeling and Analysis software.	PO 1	3
AME116.02	CLO 2	Know the various types of CAD tools and apply it to design and model various products.	PO 2	2
AME116.03	CLO 3	Understand modern tools to formulate the problem, and able to create geometry.	PO 1	3
AME116.04	CLO 4	Understand Fundamentals of discretize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different loading conditions.	PO 1	3
AME116.05	CLO 5	Performance of relative mechanisms in simulation module.	PO 2	2
AME116.06	CLO 6	Generation of part programming through assembly module.	PO 2	2
AME116.07	CLO 7	Generation of deflection of beams subjected to point, uniformly distributed and varying loads further to use the available results to draw shear force and bending moment diagrams.	PO 2	2
AME116.08	CLO 8	Understand various Work piece setting methods and tool setting methods	PO 2	2

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AME116.09	CLO 9	Practice on structural and thermal real time problems.	PO 4	1
AME116.10	CLO 10	Design, manufacture and analyze a Mechanical system using modern engineering software tools and measurement systems	PO 4	1
AME116.11	CLO 11	Utilize self-education to develop lifelong learning to appraise and adapt global and societal contexts to propose Engineering solutions	PO 2	2
AME116.12	CLO 12	Perform Practice session at industry	PO 2	2

3= High; 2 = Medium; 1 = Low

XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes (POs)			
	PO 1	PO 2	PO 4	PSO1
CO 1	3	2		1
CO 2		2	1	
CO 3	3	2		1
CO 4	3	2		1

3 = High; 2 = Medium; 1 = Low

XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3												1		
CLO 2		2													
CLO 3	3												1		
CLO 4	3												1		
CLO 5		2													
CLO 6		2													
CLO 7		2													
CLO 8		2													
CLO 9				1											
CLO 10				1											

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 11		2											1		
CLO 12		2											1		

3 = High; 2 = Medium; 1 = Low

XIII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1, PO2, PO4,PSO1	SEE Exams	PO1, PO2, PO4,PSO1	Assignments	-	Seminars	PO1, PO2, PO4,PSO1
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO1, PO2, PO4,PSO1						

XIV. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XV. SYLLABUS

LIST OF EXERCISES	
Week - 1	**INTRODUCTION TO CATIA**
Familiarization and practicing of drawing and modifying commands, template creation, lettering, object snapping and sectioning.	
Week - 2	**DRAFTING OF SIMPLE 2D DRAWINGS**
Prepare the 2D drawings using draw and modify commands for simple geometric assemblies, sectional views for part drawing and assemblies.	
Week - 3	**SOLID MODELING**
Preparing the 2D and 3D models (wire frame, surface and solid models) by using B-REP, CSG. Introduction of Boolean operations. Generation of 2D, 3D models, through protrusion, revolve, sweep.	
Week - 4	**CREATING ORTHOGRAPHIC VIEWS FROM SOLID MODELS**
Development of orthographic views for assembly drawings and preparation of bill of materials(IC engine components, Machine tool accessories, Jigs and Fixtures).	
Week - 5	**INTRODUCTION TO ANSYS**
Determination of deflection and stresses in bar.	
Week - 6	**TRUSSES AND BEAMS**
Determination of deflection and stresses in 2D and 3D trusses and beams.	
Week - 7	**SHELL STRUCTURES**

Determination of stresses in 3D and shell structures (one example in each case).	
Week - 8	**HARMONIC ANALYSIS**
Estimation of natural frequencies and mode shapes, harmonic responses of 2D beams.	
Week - 9	**HEAT TRANSFER ANALYSIS**
Steady state heat transfer analysis of plane and axi-symmetric components	
Week - 10	**CONVENTIONAL REPRESENTATION OF MATERIALS**
Conventional representation of parts screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits, methods of indicating notes on drawings.	
Week - 11	**LIMTS FITS AND TOLERANCES**
Limits, Fits and Tolerances: Types of fits, exercises involving selection, interpretation of fits and estimation of limits from tables.	
Week - 12	**FORM AND POSITIONAL TOLERANCES**
Introduction and indication of form and position tolerances on drawings, types of run out, total run out and their indication.	
Week - 13	**SURFACE ROUHNESS AND ITS INTRODUCTION**
Definition, types of surface roughness indication surface roughness obtainable from various manufacturing processes, recommended surface roughness on mechanical components. Heat treatment and surface treatment symbols used on drawings.	
Week - 14	**DETAILED AND PART DRAWINGS**
Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors.	
Week - 15	**PRODUCTION DRAWING PRACTICE**
Part drawings using computer aided drafting by CAD software.	
Text Books:	
1. K.L. Narayana, P. Kannaiah, ―Production Drawing‖, New Age publishers, 3rd Edition, 2009 2. Goutham Pohit, Goutham Ghosh, ―Machine Drawing with Auto CAD‖, Pearson, 1st Edition, 2004.	
Reference Books:	
1. James D. Meadows, ―Geometric Dimensioning and Tolerancing‖, CRC Press, 1st Edition, 1995.	

XVI. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Understand practicing of drawing and modifying commands, template creation, lettering, object snapping and sectioning.	CLO 1	T2:26.3
2	Understand 2D drawings using draw and modify commands for simple geometric assemblies, sectional views for part drawing and assemblies.	CLO 2	R2:21.48

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
3	Understand 2D and 3D models (wire frame, surface and solid models) by using B-REP, CSG. Introduction of Boolean operations	CLO 3	T2:26.6 R2:21.50
4	Fundamentals of orthographic views for assembly drawings and preparation of bill of materials(IC engine components, Machine tool accessories, Jigs and Fixtures)..	CLO 4	T2:26.7 R2:21.51
5	Determination of deflection and stresses in bar.	CLO 5	T2:155-160
6	Determination of stresses in 3D and shell structures (one example in each case).	CLO 6	T2:161-174
7	Estimation of natural frequencies and mode shapes, harmonic responses of 2D beams.	CLO 7	T2:175-208
8	Steady state heat transfer analysis of plane and axi-symmetric components	CLO 8	T2:224-226
9	Conventional representation of parts screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits, methods of indicating notes on drawings.	CLO 9	T4:321-353
10	Limits, Fits and Tolerances: Types of fits, exercises involving selection, interpretation of fits and estimation of limits from tables.neration of part programming through the CAM software package, CAM-CNC programming and execution on milling and turning machines.	CLO 10	T4:368-390
11	Introduction and indication of form and position tolerances on drawings, types of run out, total run out and their indication	CLO 11	T4:368-390
12	Determination of deflection and stresses in 2D and 3D trusses and beams.	CLO 12	T4:321-353

XVII. GAPS IN THE SYLLABUS-TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	Description	Proposed Actions	Relevance With POs	Relevance With PSOs
1	For the better understanding can design and model real type problems.	Seminars	PO 1	PSO 1
2	Understand the CAE tools	Seminars NPTEL	PO 4	PSO 1
3	Introduce of meshing tools	Seminars	PO 2	PSO 1

Prepared by:
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