INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**COMPUTER AIDED DESIGN LABORATORY**					
Course Code	BCCB09					
Programme	M. Tech					
Semester	I	M.Tech				
Course Type	Core					
Regulation	IARE - R18					
Course Structure	**Theory**			**Practical**		
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**	
	-	-	-	3	2	
Chief Coordinator	Mrs. T. Vanaja, Assistant Professor					
Course Faculty	Mrs. 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. CAD helps the user to design and build simple or complex products, assemblies, and plants. At first they were very expensive and hard to learn. Nowadays, with the advent of fast personal computers, user friendly GUI interfaces, and much more efficient calculation algorithms, CAD/CAM has become a household name in the engineering and manufacturing field. In fact, because of these tools, an engineer has become a designer, eliminating the need for a full time drafter.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
PG	BCCB01	I	Advanced CAD	3

III. MARKSDISTRIBUTION

Subject	SEE Examination	CIA Examination	Total Marks
Computer Aided Design Laboratory	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✘	Marker & talk	✘	Quiz	✘	Assignments	✘	Moocs
√	Lcd / ppt	√	Seminars	✘	Mini project	✘	Videos
✘	Open ended experiments						

V. EVALUATION METHODOLOGY:

Each laboratory will be 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 for 20 marks for the day to day performance and 10 marks for the final internal lab assessment.

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

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

20 %	To evaluate the preparedness for the programme.
20 %	To write the programme with input and computational variables.
20 %	To study the calculations and graphs related to the concern programme.
20 %	To interpret the results and the error analysis of the programme.
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 lab assessment during day to day performance, 10 marks for final internal lab assessment.

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 exams 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		Level	Proficiency assessed by
PO1	Apply advanced level knowledge, techniques, skills and modern tools in the field of computer aided engineering to critically assess the emerging technological issues.	3	Presentation on real-world problems
PO2	Have abilities and capabilities in developing and applying computer software and hardware to mechanical design and manufacturing fields.	3	Seminar
PO3	Conduct experimental and/or analytical study and analyzing results with modern mathematical / scientific methods and use of software tools.	3	Seminar
PO4	Function on multidisciplinary environments by working cooperatively, creatively and responsibly as a member of a team.	3	Term Paper
PO5	Write and present a substantial technical report / document.	3	Seminar
PO6	Independently carry out research / investigation and development work to solve practical problems	3	Seminar
PO7	Design and validate technological solutions to defined problems and recognize the need to engage in lifelong learning through continuing education.	3	Term Paper

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Basic understanding of modern trends in design and manufacturing using CAD/CAM.
II	Advanced aspects of enabling computer aided technologies used in design.
III	Application of thermal analysis software.

VIII. 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
BCCB09.01	CLO1	Understand the concept of Modeling and Analysis software.	PO 1	3
BCCB09.02	CLO2	Know the various types of CAD tools and	PO 1, PO 3	3

		apply it to design and model various products.		
BCCB09.03	CLO3	Understand the concept of Modeling and Analysis software.	PO 1, PO 3	3
BCCB09.04	CLO4	Understand Fundamentals of discretize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different loading conditions.	PO 1, PO 2, PO 4	2
BCCB09.05	CLO5	Performance of relative mechanisms in simulation module.	PO 1, PO 3	2
BCCB09.06	CLO6	Generation of part programming through assembly module.	PO 1, PO 2, PO 4	2
BCCB09.07	CLO7	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 1, PO 2, PO 3	1
BCCB09.08	CLO8	Understand various Work piece setting methods and tool setting methods	PO 1, PO 2, PO 3	1
BCCB09.09	CLO9	Practice on structural and thermal real time problems.	PO 1, PO 2	2
BCCB09.10	CLO10	Design, manufacture and analyze a Mechanical system using modern engineering software tools and measurement systems	PO 1, PO 3	2
BCCB09.11	CLO11	Utilize self-education to develop lifelong learning to appraise and adapt global and societal contexts to propose Engineering solutions	PO 1, PO 3	3
BCCB09.12	CLO12	Perform Practice session at industry	PO 1, PO 2	3

3= High; 2 = Medium; 1 = Low

IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OFPROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

(COs)	Course Outcomes						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3						
CO 2	3		2	3		3	
CO 3	3	3	2	3		3	

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

Course Learning Outcomes (CLOs)	Program Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CLO 1	3						
CLO 2	3						
CLO 3	3	3					

CLO 4	3	2					
CLO 5		2					
CLO 6	2	2	2				
CLO 7		1					
CLO 8		1	1				
CLO 9		2					
CLO 10	2	2					
CLO 12			3			3	

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1, PO2,PO3	SEE Exams	PO1,PO4	Assignments	-	Seminars	PO2,PO3,PO5,PO6
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO4,PO7						

XII. ASSESSMENT METHODOLOGIES–INDIRECT

√	Assessment of course Outcomes (by feedback, once)	√	Student feedback on faculty (twice)
✘	Assessment of mini projects by experts		

XIII. SYLLABUS:

Week-I	**INTRODCUTION TO CAD AND TOOLS :Part -1**
Creation of working drawing, creating geometry, constraining the profile, extracting a part using tools, creating pattern of hole.	
Week -2	**INTRODUCTION TO CAD AND TOOLS:Part-2**
Translating Rotating, Mirroring, Managing The Specification Tree. Creating Sheets And Views, Creating Text And Dimensions.	
Week-3	**ASSEMBLY OF PART DRAWING :Part -1**
Creating an assembly, moving components, assembling existing components, creating bill of materials	
Week-4	**ASSEMBLY OF PART DRAWING :Part -2**
Creating wire frame and surface geometry using generative shape design and sweep tools.	
Week-5	**GENERATION OF SURFACES :Part -1**
Generation of Ferguson's cubic surface patches, Bezier surface patches	
Week-6	**GENERATION OF SURFACES :Part-2**

Generation of Coon's patch, import and export of drawing from other software.	
Week-7	**ANALYSIS OF MODEL :Part -1**
Linear static analysis :Automatic calculation of rigid body modes using specified Eigen value shift, lumped and consistent mass matrices	
Week-8	**ANALYSIS OF MODEL:Part-2**
Buckling Analysis: Jacobi inverse iteration techniques, steady state harmonic response, and mode superposition method, overall structural and damping. Linear dynamic analysis: Non linear static analysis, Non-linear dynamic analysis. Steady state heat transfer analysis problems.	
Week-9	**THERMAL ANALYSIS :Part -1**
Transient Heat Transfer Analysis: Familiarity with element library, Defining Boundary conditions, multipoint constraint familiarity with different types of loads.	
Week-10	**THERMAL ANALYSIS:Part-2**
Solution techniques, direct and iterative solver. Results and analysis. Design optimization.	
Reference Books:	
1. Farid Amirouche, "Principles of Computer-Aided Design and Manufacturing, Pearson, 2nd Edition, 2004. 2. P. Radha Krishnan, "CAD/ CAM/ CIM", New Age International, 4th Edition, 2016. 3. Warren. S. Seames, "Computer Numerical Control Concepts and Programming", Delmar Cengage Learning, 4th Edition, 2013.	
Web References:	
1. http://www.tutorialspoint.com/catiav5/	

XIV. COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

Lecture No	Topic/s to be covered	Course Learning Outcomes (CLOs)	Reference
1-3	Creation of working drawing, creating geometry	CLO1	T1-1.1 , R1- 1.31.4 ,R2.1.7
4-6	constraining the profile, extracting a part using tools, creating pattern of hole.	CLO1	T1- 1.2, R1-1.8,
7-9	Translating Rotating, Mirroring, Managing The Specification Tree. Creating Sheets And Views, Creating Text And Dimensions.	CLO1,CLO10	T1- 1.15, R1- 1.16
10-12	Creating an assembly, moving components, assembling existing components, creating bill of materials	CLO2,CLO11	T1- 1.6
13-15	Creating wire frame and surface geometry using generative shape design and sweep tools.	CLO2	T1- 2.2, R2-2.6
16-18	Generation of Ferguson's cubic surface patches, Bezier surface patches	CLO2,CLO12	T1-2.6, R3-2.10
19-21	Generation of Coon's patch, import and	CLO3	T1-3.2, R2-3.3,

	export of drawing from other software.		
22-24	Buckling Analysis: Jacobi inverse iteration techniques, steady state harmonic response, and mode superposition method, overall structural and damping.	CLO3	T1-3.5
25-27	Linear dynamic analysis: Non linear static analysis, Non-linear dynamic analysis. Steady state heat transfer analysis problems.	CLO4,CLO11	T1-2.13, 2.14,R1- 2.16
28-30	Transient Heat Transfer Analysis: Familiarity with element library, Defining Boundary conditions, multipoint constraint familiarity with different types of loads.	CLO4,CLO9	T1-2.15, R1-2.15
31-33	Solution techniques, direct and iterative solver	CLO4,CLO11	T1-3.9, R1-3.9
34-36	Results and analysis. Design optimization.	CLO5	T1-6.1, R2-6.3

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

S No	Description	Proposed actions	Relevance with POs
1	For the better understanding can design and model real type problems.	Seminars	PO 1, PO 4
2	Understand the CAE tools	Seminars / NPTEL	PO 4, PO3

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