INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**CAD/CAM**			
Course Code	**A70328**			
Class	**IV BTECH I SEM-R15**			
Course Structure	**Lectures**	**Tutorials**	**Practicals**	**Credits**
	4	**0**	**-**	**4**
Course Coordinator	**Dr. D. Govardhan, Professor, Dept Of AE**			
Team of Instructors	**Dr. D. Govardhan, Professor, Dept Of AE** **Mr. Suresh Kumar R, Assistant Professor, Dept Of AE**			

I. COURSEOVERVIEW

Computer Aided Design / Computer Aided Manufacturing (CAD-CAM) is a course of primary important to Aeronautical Engineering students. The aim is to impart the Over view of computer applications for design and manufacturing the discrete engine components, assemblies and final product to meat he global competition.

The course covers the Lifecycle of a product, describes the product model generation, analysis for structural, thermal, dynamic behaviors. This course also deals with the creation of synthetic curves and surfaces. It impose the knowledge of latest manufacturing techniques using CNC/DNC Machine centres with different CNC programming methods, Manufacturing processes, group technologies . It make the student to understand the modern inspection methods and concepts of CIM.

II. PREREQUISITE(S)

Level	Credits	Periods	Prerequisite
UG	4	4	Engineering drawing
UG	4	4	Aircraft Production Technology.

III. MARKSDISTRIBUTION

Sessional Marks	University End Exam Marks	Total Marks
There shall be 2 midterm examinations. Each midterm examination consists of subjective type and Objective type tests. The subjective test is for 10 marks, with duration of 1 hour. Subjective test of each midterm exam shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. The objective type test is for 10 marks with duration of 20minutes. It consists of 10 Multiple choice and 10 objective type questions. The student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first 2 ½ units of syllabus and second midterm examination shall be conducted for the remaining 2 ½ units. Five marks are earmarked for assignments. There shall be two assignments in every theory course. Marks shall be awarded considering the average of two assignments in each course reason whatsoever, will get zero marks(s).	75	100

IV. EVALUATION SCHEME

S.No	Component	Duration	Marks
1	I Mid examination	80 minutes	20
2	I Assignment	--	05
3	II Mid examination	80 minutes	20
4	II Assignment	--	05
5	External examination	3 hours	75

V. COURSE OBJECTIVES

Upon completion of this course, students will be able to:

I. Explain the concepts of design and manufacturing of a product.
II. Describes computer hard ware and software requirements and data base management for the various CAD/CAM applications.
III. Impart the knowledge of CNC/DNC Machine centers and CNC programming Techniques
IV. Demonstrate different grouping and coding systems.
V. Give knowledge about the process planning of a product and advanced quality control methods
VI. Illustrates concepts of integrated manufacturing system

VI. COURSE OUTCOMES

After completing this course the student must demonstrate the knowledge and ability to:

1. Define the meaning of CAD/CAM and its Support functions.
2. Describe the various hardware and software requirements for CAD/CAM applications.
3. Identify different data base requirements.
4. Solve the transformation equation of the geometry.
5. Write a CNC programme for a product for Manufacturing.
6. Classify the various types CNC/DNC Machine centers.
7. Create different geometrical solid models.
8. Generate a code for a component or object.
9. Identify different types of AGV systems that are used in different operations in manufacturing systems.
10. Prepare the product documentation.
11. Write the process planning for the manufacturing of a product.
12. Identify the errors in manufacture product.
13. Develop an integrated manufacturing system.
14. Impart the mathematical knowledge on modeling for synthetic curves and surfaces and 2D&3D Images onscreen.
15. Discuss the various options of material handling system.

VII. HOW PROGRAM OUTCOMES ARE ASSESSED

Program outcomes		Level	Proficiency assessed by
PO1	**General knowledge:** An ability to apply the knowledge of mathematics, science and Engineering for solving multifaceted issues of Aeronautical Engineering	S	Assignments
PO2	**Problem Analysis**: An ability to communicate effectively and to prepare formal technical plans leading to solutions and detailed reports for Aeronautical systems	S	Exercise
PO3	**Design/Development of solutions**: To develop Broad theoretical knowledge in Aeronautical Engineering and learn the methods of applying them to identify, formulate and solve practical problems involving Aerodynamics	H	Discussion
PO4	**Conduct investigations of complex problems**: An ability to apply the techniques of using appropriate technologies to investigate, analyze, design, simulate and/or fabricate/commission complete systems involving complex aerodynamics flow situations.	H	Exercise

PO5	**Modern tool usage**: An ability to model real life problems using different hardware and software platforms, both offline and real-time with the help of various tools along with upgraded versions.	------	------
PO6	**The engineer and society**: An Ability to design and fabricate modules, control systems and relevant processes to meet desired performance needs, within realistic constraints for social needs	S	Exercise
PO7	**Environment and sustainability**: An ability To estimate the feasibility, applicability, optimality and future scope of power networks and apparatus for design of eco-friendly with sustainability	------	------
PO8	**Ethics**: To Possess an appreciation of professional, societal, environmental and ethical issues and proper use of renewable resources	------	------
PO9	**Individual and team work**: An Ability to design schemes involving signal sensing and processing leading to decision making for real time Aeronautical systems and processes at individual and team levels.	------	------
PO10	**Communication**: an Ability to work in a team and comprehend his/her scope of work, deliverables, issues and be able to communicate both in verbal, written for effective technical presentation	------	------
PO11	**Project management and finance**: To be familiar with project management problems and basic financial principles for a multi-disciplinary work	------	-----
PO12	**Life-long learning**: An ability to align with and upgrade to higher learning and research activities along with engaging in life-long learning.	S	Prototype, Discussions

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO 1	**Professional skills:** Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products	H	Lectures
PSO 2	**Problem solving skills:** imparted through simulation language skills and general purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles	S	Tutorials
PSO3	**Practical implementation and testing skills:** Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies	H	Assignments
PSO4	**Successful career and entrepreneurship:** To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats	-	-

S–Supportive **H – Highly Related**

IX. SYLLABUS

UNIT-I

Fundamentals of cad cam automation, design process, application of computers for design, benefits of cad computer application for cad application - computer peripherals, design work station, graphic terminal CAD software, definition of system software and application software, CAD database and structure.

Geometric modeling: 3-D wire frame modeling, wire frame entities and their definitions, interpolation and approximation of curves, concepts of parametric and non-parametric representation, curve fitting techniques, definition of cubic spline, Bezier and b-spline.

UNIT-II

Surface modeling : Algebraic & Geometric form , Parametric Space Surface, Blending functions, Parameterization of surface patch , sub dividing , cylindrical surface , ruled surface , surface of revolution of spherical surface , composite surface , Bezier surfaces , Regenerative surface & pathological conditions. **Solid modeling:** Definition of cell composition & spatial occupancy enumeration, sweep representation, constructive & solid geometry, boundary representations.

UNIT-III

NC Control production systems: Numerical control, elements of NC system, NC part programming; Methods of NC part programming, manual part programming,

Computer assisted part programming, post processor, computerized part program, SPPL (A Simple programming language), CNC,DNC,& Adoptive control systems.

UNIT-IV

Group Technology: Part families, parts classification & coding, production flow analysis, machine cell design. Computer aided process planning, difficulties in traditional process planning, computer aided process planning: retrieval & generative type, machinability data systems.

Computer aided manufacturing resource planning: Material resource planning input to MRP, MRP output records, benefits of MRP, Enterprise resource planning, capacity requirements planning.

UNIT-V

Flexible manufacturing system: FMS Equipment, FMS layouts, Analysis methods of FMS, Benefits of FMS.

Computer aided quality control: Automated inspection offline online. Contact & non-contact co-ordinate measuring machines, machine vision.

Computer integrated manufacturing: CIM systems, benefits of CIM.

TEXT BOOKS:

1. CAD/CAM/GROOVER.P/PEARSON education.
2. CAD/CAM Concepts &applications/Alavala /PHI

REFERENCE BOOKS:

1. CAD/CAM Principles and Applications /P.N.RAO/TMH.
2. CAD/CAM Theory and Practice / Ibrahim Zeid /TMH.
3. CAD/CAM/CIM Radha Krishnan & Subramanian / Newage.
4. Principles of computer Aided Design and Manufacturing / Fanlc / Amirouche /Pearson.
5. Computer Numerical Control Concepts and Programming / Warrens &Seames /Thomson.

X. COURSEPLAN:

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

Lecture No.	Course Learning Outcomes	Topics to be covered	Reference
1	Identify the role of computers in industrial design and manufacturing a product	UNIT-I: INTRODUCTION Computers In Industrial manufacturing	T1:1.1
2	Describe the concept of product cycle and Distinguish Product cycle in conventional and computerized manufacturing	Product cycle	T2:1.1
3	List various types of Hard ware and Explain them	CAD/ CAM hardware,	T1:2.1

4	Explain Basic Computer structure with necessary block diagrams	Basic Computer structure	T1:1.2-1.4
5	Explain CPU and Memory devices and list out different types of devices with merits.	CPU, Memory Types	T1:2.5
6	List The various Input Devices and Display Devices. Discuss each device with their applications.	Input Devices, Display Devices	T2:2.3-2.4
7-9	List The various Display Devices and Discuss each device with their applications.	Display Devices	T1:2.6
10	Discuss various Hard copy devices	Hard copy devices.	T1:2.5-2.6
11	Explain Raster scan graphic coordinate System and compare between these two.	Raster scan graphic coordinate System	T1:3.1
12	Discuss various Database Structure for graphic Modeling	Database Structure for graphic Modeling	T1:3.2-3.8
13	Identify the requirements for geometric modeling	Geometric Modeling Requirements	T2:3.1-3.8
14	Explain. Various Geometrical Model like 2D, 2.5D and 3D-Line model, Surface model and Solid model	Geometric Models	T1:8.1-8.6
15	Describe different types of Geometric Construction Models like extrusion, Rotational sweep and Lofting etc. and primitives(CSG) Construction based modeling, Cell decomposition and variant methods	Geometric Construction Models	T2:1.1-1.8
16	Discuss various types of Curve like Implicit, parametric for circle, hyperbola, ellipse and parabola synthetic curves like Bezier ,Hermit Cubic Spline B- spline and NURB	Curve representation Methods	T2:1.1-1.8
17	Explain different Surface representation methods	**UNIT-II** Surface representation methods	T2:4.1-4.8
18	Identify best modeling facility	modeling facilities desired	T1: 4.1-4.8
19	Define solid modeling List how many ways a solid can be modeled.	Solid Modeling	T1: 6.1-6.8
20	Describe constraint –based modeling	Constraint based Modeling	T1:6.10
21	Explain meaning of Numerical Control .Distinguish between NC & CNC. Identifying different modes of Operation.	**UNIT :III** Numerical Control: NC, NC modes	T1: 6.1-6.8
22	Explain all the important elements of NC &CNC machine tools.	NC elements , NC Machine tools	T2:6.8
23	Describe the Structure of CNC Machine tools	Structure of CNC Machine tools	T1:11.1
24	Discuss - various Feature of Machining Centre	Feature of Machining Centre	T1:11.2
25	Demonstrate CNC Turning Centre Estimate the turning time and power requirement	CNC Turning Centre	T1:11.7
26	Describe the fundamentals of CNC part programming. Identify Different programmed techniques.	CNC Part programming fundamentals	T1:11.5
27	Illustrate Manual Part programming Methods Describe ISO Standards for coding Narrate the Preparatory Functions G codes	Manual Part programming Methods	T2:15.1-15.5

	& M codes. Write the part programme for small parts		
28	Illustrate Computer Aided Part programming Methods Write the part program for small parts	Computer Aided Part programming	T1:11.01
29	Explain Concepts of group technology and part family advantages and limitations	**Unit IV:** Group Technology: Concepts , Part family	T1:11.09
30	Distinguish between classification and coding and various methods	Coding and classification	T1:11.11, 15.18
31-32	Discuss the two important types of production flow analysis and Analyze some practical problems	Production flow Analysis	T1:3.4,3.7 , 3.10
33	Summarize Advantages and limitations production PFA	Advantages and limitations	T2:3.2-3.3
34	Explain the concepts of Computer Aided process Planning and impertinent approaches	Computer Aided process Planning	T1:3.5-3.6
35	Discuss in detail Retrieval Type of CAPP	Retrieval Type	T1:3.9
36	Discuss in detail Generative type type of CAPP	Generative type	T1:3.11
37-38	Discuss about Computer aided manufacturing resource planning	Material resource planning input to MRP, MRP output records, benefits of MRP	T1:1.1
39-40	Discuss about Computer aided manufacturing resource planning	Enterprise resource planning, capacity requirements planning.	T1:1.1
41	Discuss about Flexible Manufacturing System	**UNIT: V** FMS Equipment, FMS layouts	T1:2.1
42	Discuss about Flexible Manufacturing System	Analysis methods of FMS, Benefits of FMS.	T1:1.2-1.4
43	Define the important terminologies of in Quality control	Computer Aided Quality Control: Terminology in Quality control	T1:2.5
44	Identify the role of Computers in QC Classify the various various types of inspection methods. Distinguish between tasting and Inspection.	Computers in QC	T1:2.5-2.6
45-46	Discuss in detail the Contact inspection methods CMM	Contact inspection methods	T1:2.6
47	Discuss in detail the classification Non Contact inspection methods – and Explain optical systems	Non Contact inspection methods –optical systems	T1:2.5-2.6
48	Explain Non Contact inspection methods –Non optical systems	Non Contact inspection methods –optical systems	T1:3.1
49	Discuss Computer aided testing and Integration of CAQC with CAD/CAM	Computer aided testing	T1:3.2-3.8
50	Illustrate the Integration of CAQC with CAD/CAM	Integration of CAQC with CAD/CAM	T1:3.1-3.8
51	Explain historic development of CIM Definition of CIM	COMPUTER INTEGRATED MANUFACTURING SYSTEMS	T1:9.1-9.8
52	Discuss different types of Manufacturing system (FMS, TMS)	Types of manufacturing systems	T2:1.1-1.8
53	Explain Machine tools and related equipment's	Machine tools and related equipment's	T1:4.1-4.8
54	Explain principles of material handling systems	Material handling system	T1: 4.1-4.8
55-56	Discuss AGV, Robots AS/RS Sensors and Guidance.	Computer control systems	T1: 6.1-6.8
57	Explain historic development of CIM Definition of CIM	COMPUTER INTEGRATED MANUFACTURING SYSTEMS	T1:6.10

58	Discuss different types of Manufacturing system (FMS, TMS)	Types of manufacturing systems	T1: 6.1-6.8
59	Explain Machine tools and related equipment's	Machine tools and related equipment's	T1:6.8
60	Explain principles of material handling systems	Material handling system	T2:11.1
61-62	Discuss AGV, Robots AS/RS Sensors and Guidance.	Computer control systems	T1:11.2
63	Explain Human labor in the manufacturing systems	Human labor in the manufacturing systems	T1:11.1
64	Definition Integration List out the CIM benefits	CIM benefits	T2:11.2

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF THE PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
I	H				S			H					S		
II					S						H				S
III	H		S				S					H		H	
IV		S									H				S
V						S			H				H		
VI				H				S			S			H	S

S=Supportive **H = Highly related**

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

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	H				S										S
2		H									S		S		
3		H			S										
4	S										H			H	
5											H	S			S
6					S										
7		S									H		S		
8					H							S			
9			H						S					H	
10		H									S				S
11	H											S	S		
12					H		S								
13			H						S					H	
14	H											S	S		
15					H		S								

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