INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTION FORM

Course Title	:	**DESIGN FOR MANUFACTURING AND ASSEMBLY**			
Course Code	:	A70339			
Regulation	:	R15 – JNTUH, IV B-TECH, I-SEM			
Course Structure	:	Lectures	Tutorials	Practicals	Credits
		4	0	-	4
Course Coordinator	:	Mr. A Venuprasad Assistant Professor, Department of Mechanical Engineering.			
Team of Instructor	:	Mr. A Venuprasad Assistant Professor, Department of Mechanical Engineering.			

I. COURSE OVERVIEW

Design for manufacturing and assembly covers basic design philosophy ,creativity in product design, selection of materials for engineering applications, design rules for machining, design rules for joining, casting, forming and important factors in product assembly.

II. PREREQUISITE(S)

Level	Credits	Periods	Prerequisite
UG	4	4	Metallurgy and material Science , Production technology, Design of Machine Members - I, Design of Machine Members -II

III. MARKS DISTRIBUTION

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 fill in the blank 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

I. Understanding the basic design rules for manufacturing and material selection.
II. Applying the production process for ease of manufacturing.
III. Analyze factors for selection of metals and alloys and relationship to manufacturing processes
IV. Apply the concepts of design for manufacturing and assembly for product manufacturing.
V. Compare various manufacturing processes and assembly techniques required for product development.

VI. COURSE OUTCOMES

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

1. Understand to relate design rules for manufacturability.
2. Remember the basic principles of designing for economical production-creativity in design.
3. Understand the principles of selection of materials for product development.
4. Apply design rules for ease of machining.
5. Understand the General design recommendations for machined parts.
6. Enumerate the general design considerations for casting, casting tolerances.
7. Remember the factors in design of weldments.
8. Analyze the effects of thermal stresses in welded joints.
9. Understand the various advantages and limitations of joining techniques.
10. Remember Design factors for forging.
11. Identify the various forming techniques in manufacture products.
12. Understand the Design guide lines for extruded sections.
13. Remember Keeler -Goodman formability diagram and its concept.
14. Apply design guidelines to assembly.
15. Remember the Classification system for manual insertion and fastening.

VII. HOW PROGRAM OUTCOMES ARE ASSESSED

Program		Level	Proficiency assessed by
PO1	**Engineering knowledge:** Capability to apply the knowledge of Mathematics, Science and Engineering in the field of Mechanical Engineering.	H	Assignments and Tutorials
PO2	**Problem analysis:** An ability to analyze complex engineering problems to arrive at relevant conclusions using knowledge of Mathematics, Science	H	Tutorials
PO3	**Design/development of solutions:** Competence to design a system, compo nent or process to meet societal needs within realistic constraints.	S	Exams
PO4	**Conduct investigations of complex problems:** To design and conduct research oriented experiments as well as to analyze and implement data using research methodologies.	S	Mini Projects
PO5	**Modern tool usage:** An ability to formulate, solve complex engineering problems using modern engineering and Information Technology tools.	H	Assignments, Exams

PO6	**The engineer and society:** To utilize the Engineering practices, Techniques, skills to meet needs of the health, safety, legal, cultural and societal issues.	N	Assignments, Mini Projects
PO7	**Environment and sustainability:** To understand impact of Engineering solutions in the societal context and demonstrate the knowledge for sustainable development.	N	----
PO8	**Ethics:** An understanding and Implementation of professional and Ethical responsibilities.	H	------
PO9	**Individual and teamwork:** To function as an effective individual and as a member or leader in Multi-disciplinary environment and adopt in diverse teams.	S	Assignments, Tutorials and Exams
PO10	**Communication:** An ability to assimilate, comprehends, communicate, give and receive instructions to present effectively with engineering community and society.	S	-----
PO11	**Project management and finance:** An ability to provide leadership in managing complex engineering projects at Multidisciplinary environment and to become a professional engineer.	H	Mini Projects
PO12	**Life-long learning:** Recognition of the need and an ability to engage in life-long learning to keep abreast with technological changes.	S	------

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED

Program Specific Outcomes		Level	Proficiency Assessed by
PSO 1	**Professional Skills:** To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.	H	Lectures, Assignments
PSO 2	**Design/Analysis:** An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.	S	Projects
PSO 3	**Successful Career and Entrepreneurship:** To build the nation, by imparting technological inputs and managerial skills to become Technocrat.	S	Guest Lectures

N - None **S - Supportive** **H – Highly Related**

IX. SYLLABUS

UNIT – I

Introduction: Design Philosophy, steps in design process, General design rules for manufacturabilty; Basic principles of designing for economical production-creativity in design

Materials: Selection of materials for design, Developments in materials technology, Criteria for materials selection, Material selection inter relationship with process selection

UNIT-II

Machining process: Over view of various machining processes. General design rules for machining, Dimensional tolerance and surface roughness, Design for machining ease, Redesign of components for Machining ease with suitable examples, General design recommendations for machined parts.

UNIT – III

Metal casting: Appraisal of various casting processes; selection of casting process, general design considerations for casting, casting tolerances, use of solidification simulation in casting design, product design rules for sand casting

Metal joining: Appraisal of various welding processes, factors in design of weldments, general design guidelines, pre and post treatment of welds, effects of thermal stresses in welded joints, design of brazed joints

UNIT IV

Forging: Design factors for forging, closed die forging, design parting lines of dies, drop forging die design, General design recommendations.

EXTRUSION: Sheet metal work and plastics, Design guide lines for extruded sections, Design principles for punching, blanking, bending, deep drawing, Keeler -Goodman formability diagram,(forming limit diagram) Component design for blanking,

UNIT V

Design for assembly: General design guidelines for manual assembly, Development of systematic DFA methodology, Assembly efficiency, Classification system for manual handling, Classification system for manual insertion and fastening, Effect of part symmetry on handling time.

TEXT BOOKS:

1. Product design for manufacture and assembly, Geoffry Booth royd, Peter Dewhurst and W. A. Knight, CRC Press, T1

REFERENCE BOOKS:

1. A. K. Chitale and R.C. Gupt ‘‘Product design and Manufacturing**”** –prentice-Hall of India, New Delhi, 2003, R1
2. Kevin Otto and Kristin Wood, **”**Production Design**”**, Person Education, R2
3. Surender Kumar, Goutham Sutradhar, **‘‘**Design and Manufacturing**”**, oxford & IBH Publishing co, Pvt Ltd, 1998, R3

X. COURSE PLAN:

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

Lecture No.	Course Learning Outcomes	Topics to be covered	Reference
1 -2	Define design and explain types	**UNIT-I** Design philosophy, Definition, four “C” s of design, Types.	R1: 1.2
3	Compare scientific and design method	Comparison between scientific and design method, problem solving,	T1: 1.3
4	Explain 7 phases of design manufacturing	7 phases of design, feasibility, detailed design, planning production process, distribution, consumption, retirement.	T1 : 1.5
5-7	Explain different Types of production (Manufacturing) and plant layouts.	Design rules for manufacturability, selection of manufacturing process, compatibility between processes and materials.	T1:1.7
8-12	Explain standardization, creativity	Benefits of standardization, Group technology, Classification of parts, mistake proofing, six sigma, Creative thinking, barriers.	T1:1.9
13	Describe procedure for material selection	Selection of materials for design.	T1:1.9
14	Explain Ashby charts	Ashby charts for material selection.	T1 : 2.5
15-16	Analyze design process and process selection	**UNIT-2** Design process and material selection, Influence of material on process selection, casting processes.	T1:10.1
18-19	Describe forming and casting processes	Forming processes, machining.	T1:10.4

20-21	Describe steps in selecting manufacturing process	Decision on manufacturing process, steps in selecting a manufacturing process, case study	R1 :2.3
22-23	Categorize & Describe machining processes	Over view of machining processes	T1:2.5
24-26	Explain design guide lines for machining	**UNIT-3** Super finishing, DFM guidelines for machining, Rotational components, non-rotational components, tolerances, surface finish	T1:7.11
27	Describe factors for machining ease	Factors for machining ease	T1:7.13
28	Explain good and bad design	Examples of poor and good design for machining	T1:7.8
29	Describe goals for machining	Goals for design for machining	T1:7.16
30	Discuss casting processes	Appraisal of various casting processes	R1:5.2
31-32	Evaluate casting processes	Selection of casting process	R1:5.2.4
33	Describe the effect of alloying elements	Design considerations for casting	R1:5.5
34	Explain die casting	Design principles for die casting	R1:5.6
35-38	Explain tolerances for casting	Casting tolerances,	R1:5.7.1
39-40	Describe various cast irons	Solidification in casting,	R1:5.7.2
41	Examine classification of aluminum alloys	Requirements for sound casting	R1:5.8
42	Discuss the properties of copper alloys	Simulation of solidification, benefits	R1:5.9
43-44	Describe joining processes	**UNIT-4** Metal joining processes, classification	T1:13.1
45	Describe Brazing and soldering	Brazing and soldering	T1:13.3
46	Explain adhesive bonding	Adhesive bonding	T1:13.4
47-48	Describe joint design	Joint design for welding, brazing and soldering	T1:13.5
49	Explain design guidelines	DFM guideline for welding	T1:13.5.5
50-51	Describe heat treatment	Preheating, post heating, heat treatment, Thermal stresses	T1:13.6
52-53	Explain closed die forging	Design guidelines for closed die	T1:13.7.1
54	Describe guidelines for horizontal machines	Designing forgings for horizontal machines	T1:14.1
55	Describe extruded sections and design	Design guidelines for extruded sections	T1:14.2
56	Explain sheet metal bending	Sheet metal bending	T1:14.3
57	Describe blanking	Design guidelines for blanking	T1:14.4
58	Explain design guidelines for deep drawing	Design guidelines for stretching and deep drawing	T1:14.5
59	Describe manual assembly design	**UNIT-5** Design guidelines for manual	T1:3.1
60	Explain DFA methodology	Systematic DFA methodology	T1:3.2
61	Describe guidelines for handling	Design guidelines for handling	T1:3.3
62	Explain manual assembly methods	Types of manual assembly methods	T1:3.5.2
63	Describe assembly automation	Design for high speed automatic	T1:3.9
64	Explain Robot assembly	Product design for robot assembly	T1:3.11
65	Describe extruded sections and design	Design guidelines for extruded sections	T1:3.13

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		

N = None **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	PO11	PO 12	PSO 1	PSO 2	PSO 3
1	H				S				H						S
2		H									S		S		
3		H			S			H							
4	S										H			H	
5				H							H	S			S
6		S													
7			S				H			H					H
8															
9						S								H	
10		S	H						S		S				
11					H					H			S		H
12							H								
13		S		S					S			H		S	
14															
15	H					H				H				H	S

N = None **S = Supportive** **H = Highly related**

Prepared by:

Mr. A Venuprasad, Assistant Professor

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