

Course Code:	49050104
Course Name:	Design for Manufacturing & Assembly
Category of Course:	Elective
Prerequisite Course:	UG level course in Manufacturing

Teaching Scheme				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Total Hours
3	0	2	4	40

Course Objectives	
1	To introduce the basic concepts and design guidelines of different manufacturing processes.
2	To understand concepts of design for assembly to reduce number of parts and to optimize design without compromising function.
3	To understand current global trends and requirements of environmental design required to be addressed

Syllabus			
Unit No.	Topic	Prerequisite Topic	Teaching Hours
01	Introduction to Tolerances		04 (10%)
	1.1 Tolerances: Limits and Fits, tolerance Chains and identification of functionally important dimensions.	---	
	1.2 Dimensional chain analysis-equivalent tolerances method, equivalent standard tolerance grade method, equivalent influence method.		
	1.3 Geometric tolerances: applications, geometric tolerancing for manufacture as per Indian Standards and ASME Y 14.5 standard; surface finish, 1.4 Tolerance stack-up calculations; Review of relationship between attainable tolerance grades and different machining.		
02	Factors Influencing Form Design		08 (20%)
	2.1 Working principle, Material, Manufacture, Design, Possible solutions, Materials choice, 2.2 Influence of materials on form design, Form design of welded members, Forgings and castings	---	
03	Component Design - Machining Consideration		08 (20%)
	3.1 Design features to facilitate machining, Drills, Milling cutters, keyways, Doweling procedures, Counter sunk screws, Reduction of machined area	---	
	3.2 Simplification by separation, Simplification by amalgamation,		
	3.3 Design for machinability, Design for economy 3.4 Design for clampability, Design for accessibility, Design for assembly		
04	Component Design – Casting Consideration		08 (20%)
	4.1 Redesign of castings based on parting line considerations, Minimizing core requirements, machined holes, Redesign of cast members to obviate cores. 4.2 Identification of uneconomical design, Modifying the design, Group technology, Computer Applications for DFMA	---	
05	DFMA Tools		08 (20%)
	5.1 Rules and methodologies used to design components for manual, automatic and flexible assembly, traditional design and manufacture Vs concurrent engineering	---	
	5.2 DFA index, poke -yoke, lean principles, six sigma concepts		
	5.3 DFMA as the tool for concurrent engineering, three DFMA criteria for retaining components for redesign of a product 5.4 Design for manual assembly; design for automatic assembly- Computer-aided design for assembly using software		
06	Design for the Environment		04 (10%)
	6.1 Introduction, Environmental objectives, Global issues, Regional and local issues	---	
	6.2 Basic DFE methods, Design guide lines, Weighted sum assessment method, Lifecycle assessment method		
	6.3 Techniques to reduce environmental impact, Design to minimize material usage 6.4 Design for disassembly, Design for Recyclability, Design for remanufacture, Design for energy efficiency, Design to regulations and standards		

Course Outcome	
1	Outline the appropriate design for economical production and select the materials.
2	Select between various machining and metal joining processes.
3	Apply a systematic understanding of knowledge in the field of metal casting and forging.
4	Identify the design factors and processes along customer desires for manufacturing

Suggested Reference Books

1	A K Chitale and R C Gupta, "Product Design and Manufacturing", PHI, New Delhi
2	George E Deiter, "Engineering Design", McGrawHill International
3	Boothroyd G, "Product design for Manufacture and Assembly", First Edition, Marcel Dekker Inc, New York
4	Bralla, "Design for Manufacture Handbook", McGraw Hill
5	Kevin Otto and Kristin Wood, "Product Design", Pearson Publication

Proposed Evaluation Scheme by Academicians (Percentage of Weightage out of 100%)

Theory Descriptive Test	<input type="text"/>	MCQ Test	<input type="text"/>	Hands on Project	<input type="text"/>
Formulas and Derivation Test	<input type="text"/>	Numerical Test	<input type="text"/>	Seminar	<input type="text"/>

Practical Project/Hands On Project

Sr. No.	List of Practical Projects	Linked with Unit
1	Design and manufacture of a plug gauge.	---
2	Design evaluation of the components on the basis of casting, welding and machining requirements.	---
3	Geometric Dimensioning and Tolerancing in Tolerance Analysis	---
4	Tolerance stacks up analysis: Worst Case tolerance analysis, Statistical tolerance analysis.	---
5	Redesign: Perform exercise for a product to minimize number of parts without compromising its function.	---
6	Perform an exercise to identify features (self-locating, self-fastening, minimize orientation during assembly, retrieval, handling and insertion, symmetry) for assembly of a component	---
7	For a given products/component, identify differences and dissimilarities between Design for Manufacturing and Design for Assembly	---

List of Recommended MOOC Courses:

- 1) <https://www.coursera.org/learn/generative-design-additive-manufacturing>
- 2) <https://www.coursera.org/learn/generative-design-industrial-applications>
- 3) <https://www.coursera.org/specializations/3d-printing-additive-manufacturing>
- 4) <https://www.coursera.org/learn/additive-manufacturing-3d-printing>

List of Recommended Certifications:

- 1) <https://www.autodesk.com/certification/all-certifications/design-manufacturing-professional>

List of Recommended Software:

- 1) Autodesk Fusion 360
- 2) Inventor