



## FACULTY OF ENGINEERING & TECHNOLOGY

### First Year Master of Engineering

#### Semester I

**Course Code:** 102320103

**Course Title:** Design for Manufacture and Assembly

**Type of Course:** Program Elective I

**Course Objectives:** This subject is designed to develop the knowledge and skills to design/redesign a product for the ease of manufacturing and assembly by keeping in mind different aspects of geometric dimensioning, manufacturing, environment and various DFMA tools.

#### Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Internal		External		Total
				Theory	J/V/P*	Theory	J/V/P*	
3	2	0	4	40/16	20/08	60/24	30/12	150/60

\* J: Jury; V: Viva; P: Practical

#### Detailed Syllabus:

Sr.	Contents	Hours
1	INTRODUCTION: Introduction to DFMA: History of DFMA, Steps for applying DFMA during product design, Advantages of applying DFMA during product design, Material Selection and Mechanical Properties of materials, Product Life Cycle and DFMA	4
2	GEOMETRIC DIMENSIONING AND TOLERANCES Limits and Fits, tolerance Chains and identification of functionally important dimensions, Dimensional chain analysis-equivalent tolerances method, equivalent standard tolerance grade method, Dimensioning and Tolerancing considerations for manufacturing and assembly as per Indian and ASME Standards	4
3	DESIGN ASPECTS OF MANUFACTURING PROCESSES: Review of Manufacturing Processes, Design for Casting, Design for Sheet Metal Forming processes, Design for Bulk deformation processes, Design for Machining, Design for Welding, Design for Powder Metallurgy, Design for Polymer Processing	10
4	DESIGN FOR MANUAL ASSEMBLY: General Guidelines for Manual Assembly, Development of systematic DFA methodology, Assembly Efficiency, Classification system for Part handling, Classification system for Manual Insertion and fastening, Boothroyd Dewhurst method, theoretical minimum number of parts, Xerox producibility index (XPI) method Estimation of insertion time, Reducing Disk-Assembly Problems, Effects of Holding down, Manual Assembly Data base and design data sheets	12



<b>5</b>	<b>DFMA TOOLS:</b> Application of tools like lean manufacturing, six sigma, poke-yoke, TPM, concurrent engineering in the perspective of DFMA	<b>4</b>
<b>6</b>	<b>DESIGN FOR THE ENVIRONMENT:</b> Introduction, Environmental objectives, Global issues, Regional and local issues, Basic DFE methods, Lifecycle assessment method, Techniques to reduce environmental impact, Design to minimize material usage, Design for Disassembly, Design for Failure	<b>5</b>
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## Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create
R	U	A	N	E	C	
15	20	15	15	20	15	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

## Reference Books:

1	Materials and Design - the art and science of material selection in product design, M F Ashby and K Johnson, Butterworth-Heinemann.
2	Engineering Design - a materials and processing approach, G Dieter, McGraw Hill.
3	Material Selection in Mechanical Design, M F Ashby, Butterworth-Heinemann.
4	Mechanical Behavior of Materials, T H Courtney, McGraw Hill.
5	Process selection: from design to manufacture, K G Swift and J D Booker, London, Arnold.
6	Engineering Optimization: theory and practice, S S Rao, John Wiley.
7	Product design for manufacture and assembly, John Wiley, G Boothroyd, P Dewhurst and W Knight, Marcel Dekkar.
8	Handbook for Product Design for Manufacture, J G Bralla, McGraw Hill.
9	Which Process - an introduction to welding and related processes and guide to their selection, Houldcroft, Abington Pub.
10	ASTM Design handbook.

## Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Students will apply various principles of DFMA for improving quality aspects of a product	40 %
CO-2	Students will have knowledge of different considerations for different manufacturing processes like casting, machining, welding, forming etc.	20 %
CO-3	Students will be able to demonstrate skills in new product development and optimization of the same for different issues related to it.	40 %
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CO-5	Click or tap here to enter text.	Click
CO-6	Click or tap here to enter text.	Click
CO-7	Click or tap here to enter text.	Click
CO-8	Click or tap here to enter text.	Click
CO-9	Click or tap here to enter text.	Click
CO-10	Click or tap here to enter text.	Click



## List of Practicals / Tutorials:

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1	To identify and understand various steps of DFMA.
2	To understand role of DFMA in product design.
3	To study concept of limits, fits and tolerances.
4	To understand Indian and ASME standards for dimensioning and tolerancing considerations.
5	To study design considerations of casting, welding and forming.
6	To study design considerations of machining, bulk deformation processes and polymer processing.
7	To study the various considerations for manual insertion and fastening in assembly.
8	To determine minimum number of parts for a given assembly using Boothroyd Charts.
9	To study and apply various tools in perspective to DFMA.
10	To understand Design for environment and asses lifecycle of a product.
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## Supplementary learning Material:

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## Curriculum Revision:

Version:	1
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22