

Design for Manufacture and Assembly(DFMA) - Web course

COURSE OUTLINE

Unit 1: Introduction to DFMA: History of DFMA, Steps for applying DFMA during product design, Advantages of applying DFMA during product design, Reasons for not implementing DFMA, Introduction to Manufacturing Process: Classification of manufacturing process, Basic manufacturing processes, Mechanical properties of material: Tensile properties, Engineering stress-strain, True stress strain, Compression properties, Shear properties, Introduction to materials and material selection: Classification of engineering materials, Material selection for product design

Unit 2: Sand casting: Introduction to sand casting, Typical characteristics of a sand cast part, Design recommendation for sand casting, Investment casting: Introduction, Steps in investment casting, Design consideration of Investment casting, Typical characteristics and applications, Die casting: Introduction to die casting, Advantages of the die casting process, Disadvantages of the die casting process, Applications, Suitable material consideration, General design consideration, Specific design recommendation, Injection moulding: Introduction to injection moulding, Typical characteristics of injection moulded parts, Effect of shrinkage, Suitable materials, Design recommendations, Design for powder metal processing: Introduction to powder metal processing, Typical characteristics and applications, Limitations, Design recommendations.

Unit 3: Design for machining: Introduction to machining, Recommended materials for machinability, Design recommendations, Design for turning operation: Process description, Typical characteristics and applications, Suitable materials, Design recommendations, Design for machining round holes: Introduction, Suitable materials, Design recommendations, Recommended tolerances, Parts produced by milling: Process description, Characteristics and applications of parts produced on milling machines, Design recommendations for milling, Dimensional factors and tolerances, Parts produced by planning, shaping and slotting: Process description, Design recommendation planning, Design for broached parts: Process description, Typical characteristics of broached parts, Suitable materials for broaching, Design recommendations.

Unit 4: Metal Extrusion: Process, Suitable material for extrusion, Design recommendation for metal extrusion, Metal stamping: Process, Characteristics and application of metal stamping, Suitable materials for stamping, Design Recommendations for metal stamping, Fine blanked parts: Fine blanking process, Material suitable for fine blanked parts, Design recommendations for piece parts, Rolled formed section: Process, Design recommendations rolled section, Impact or cold extrusion: Process, Design recommendations for backward extrusion, Forward extrusion: Process, Design recommendations for forward extrusion, Design for Forging: Forging processes, Forging nomenclature, Suitable materials for forging, Design recommendations, Metal injection moulded parts: Process, Materials suitable, Design recommendations for metal injection-molded parts.

Unit 5: Design for cleaning: Introduction to cleaning process, In-process cleaning operations, Cleaning processes and their applications, Design recommendations, Design for polishing and plating: Introduction to Polishing processes, Design recommendations for polishing process, Design for plated surface: Electroplating process, Typical characteristics, Design recommendations for plating, Hot Dip Metallic Coating: Process, Design recommendations for Hot Dip Metallic coating, Thermal sprayed coating: Process, Design recommendations for thermal sprayed coating, Vacuum Metalized surfaces: The process, Typical characteristics and applications, Design recommendations, Design for heat treatment: Introduction to heat treatment, Heat treating process for steel, Applications of heat-treated parts, Design recommendations for heat treatment.

Unit 6: Introduction to welding process: Different types of welding processes, Design for



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**Engineering
Design**

Additional Reading:

Fundamental manufacturing books, Technical papers on manufacturing and assembly

Coordinators:

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welding: Design for recommendation for welding process, Design for solder and brazed assembly: Process, Typical characteristics, Suitable materials, Detail Design recommendations, Design for adhesively bonded assemblies: Introduction, Typical characteristics, Suitable materials, Design recommendations for adhesive joint,

Unit 7: Introduction to Assembly: The assembly process, Characteristics and applications, Example of common assembly, Economic significance of assembly, General taxonomies of assembly operation and systems, Assembling a product, Design for Assembly: Introduction, Design consideration, Design for Fasteners: Introduction, Design recommendation for fasteners.

Unit 8: Introduction to CAD: Geometric Representation in CAD, Extraction of part feature information from CAD Model: Introduction, Feature recognition techniques, Free Form Features, Hybrid Techniques, Reference, Extraction of assembly feature information from CAD Model: Introduction, Assembly features, Definition of assembly feature attributes, Characterization of assembly feature, Examples of Assembly feature, Overview of procedure to extract assembly features from CAD model of Assembly, Description of steps in the assembly feature extraction procedure, Examples of assembly feature extraction: Aircraft wing and automotive chassis assembly.

Module		Lecture details		
No	Topic	Lecture no	Topic detail	No of lectures(Hours)
M1	Introduction	L1	Introduction to DFMA	1
		L2	Introduction to manufacturing process	1
		L3	Introduction to Materials and material selection	1
		L4	Mechanical properties of materials	1
M2	Casting	L1	Sand casting	1
		L2	Investment casting	1
		L3	Die casting	1
		L4	Injection moulding	1
		L5	Design for powder metal processing	1
		L1	Design for	1

M3	Machining	L1	machining	1
		L2	Design for tuning operation	1
		L3	Design for machining round holes	1
		L4	Parts produced by milling	1
		L5	Parts produced by planing, shaping and slotting	1
		L6	Design for broached parts	1
M4	Metal Extrusion	L1	Metal Extrusion	1
		L2	Metal stamping	1
		L3	Fine blanked parts	1
		L4	Rolled formed section	1
		L5	Impact or cold extrusion	1
		L6	Forward extrusion	1
		L7	Design for Forging	1
		L8	Metal injection moulded parts	1
		L1	Design for cleaning	1
		L2	Design for polishing and plating	1
		L3	Design for plated surface	1

M5	Cleaning	L4	Hot Dip Metallic Coating	1
		L5	Thermal sprayed coating	1
		L6	Vacuum Metalized surfaces	1
		L7	Design for heat treatment	1
M6	Permanent joining	L1	Introduction to welding process	1
		L2	Design for welding: Design for recommendation	1
		L3	Design for solder and brazed assembly	1
		L4	Design for adhesively bonded assemblies	1
M7	Assembly	L1	Introduction to Assembly	1
		L2	Design for Assembly	1
		L3	Design for Fasteners	1
M8	DFMA and CAD	L1	Introduction to CAD	1
		L2	Extraction of part feature information from CAD Model	1
		L3	Extraction of assembly feature information from CAD Model	2



Total Modules	8	Total Lectures	41
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References:

1. J. Lesko, (1999) Industrial Design, Materials and Manufacture Guide, John Willy and Sons, Inc
2. George E. Dieter and Linda C. Schmidt (2009), Engineering Design, Fourth edition, McGraw-Hill companies, New York, USA
3. Geoffrey Boothroyd, Peter Dewhurst and Winston Knight (2002) Product Design for Manufacture and Assembly, Second Edition, CRC press, Taylor & Francis, Florida, USA
4. O. Molloy, S. Tilley and E.A. Warman (1998) Design for Manufacturing and assembly, First Edition, Chapman &Hall, London, UK.
5. D. E. Whitney, (2004) Mechanical Assemblies: Their Design, Manufacture, and Role in Product Development, Oxford University Press, New York
6. A.K. Chitale and R.C. Gupta, (1999) Product design and Manufacturing, Prentice Hall of India, New Delhi.
7. James G. Bralla (1998) Design for Manufacturability Handbook, Second Edition, McGraw-Hill companies, New York, USA
8. Geoffrey Boothroyd (2005) AssemblyAutomation and Product Design, Second Edition, CRC press, Taylor & Francis, Florida, USA
9. G. Q. Huang (1996) Design for X, Concurrent Engineering Imperatives, First Edition, Chapman &Hall, London, UK