DESIGN FOR MANUFACTURING

VII Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEC42	Elective	3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Prerequisite: Manufacturing Processes

I. COURSE OVERVIEW:

Design for manufacturing is an engineering methodology that focuses on reducing time-to-market and total production costs by prioritizing both the ease of manufacture for the product's parts and the simplified assembly of those parts into the final product. The main objective of this course is to design a product for Part Minimization, Quantitative analysis of a design's efficiency, Critique product designs for ease of assembly and the importance of involving production engineers in DFMA analysis.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The techniques of Design for Manufacturing and Assembly applied for minimizing product cost through design and process improvements.
II. The selection of material and process used in the prototype design in the early stages of product development for cost effectiveness.
III. The Identification of the manufacturing constraints that influence the design of parts and part systems
IV. The pattern movement in assembly process, assembly errors and minimization steps by considering logical sub-assemblies and re-orientation of parts during machining.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Identify** the concepts of design for manufacturing for product development which minimizes part count in manufacturing process.	Understand
CO 2	**Make use of** the suitable materials for product manufacturing in engineering applications to eliminate expensive and complex features.	Understand
CO 3	**Select** the proper gating and riser system needed for castingrequirements to achieve defect/error free components.	Apply
CO 4	**Categorize** various defects and shortcomings during gas weldingoperation such as TIG, MIG and Spot welding for real time applications.	Understand
CO 5	**Apply the** principles of design for manufacturing processes manual and automated assembly, economical production and material selection.	Apply
CO 6	**Select** the assemble process for assembly transfer systems, Automatic Transfer Systems and indexing mechanisms for development of assemble process in industries.	Apply

IV. COURSE SYLLABUS:

MODULE-I: INTRODUCTION TO DFM (09)

Introduction: Design philosophy, steps in design process, general design rules for manufacture ability, basic principles of designing for economical production, creativity in design; materials: Selection of materials for design, developments in material technology, criteria for material selection, and material selection interrelationship with process selection, process selection charts.

MODULE –II: DESIGN FOR MACHINING & MOULDING (09)

Machining Process: Overview of various machining processes, general design rules for machining, dimensional tolerance and surface roughness, design for machining ease, redesigning of components for machining ease with suitable examples, general design recommendations for machined parts. Plastics: Viscoelastic and Creep behavior in plastics – Design guidelines for Plastic components – Design considerations for Injection Moulding

MODULE –III: DESIGN FOR METAL CASTING &METAL JOINING (09)

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 weld joints - design of brazed joints. Forging - Design factors for Forging - Closed dies forging design - parting lines of dies drop forging die design - general design recommendations. Extrusion & Sheet Metal Work: Design guidelines for extruded sections - design principles for Punching, Blanking, Bending, Deep Drawing - Keeler Goodman Forming Line Diagram - Component Design for Blanking. .

MODULE –IV: DEVELOPMENT OF THE ASSEMBLE PROCESS (09)

Development of the assemble process, choice of assemble method assemble advantages social effects of automation. Automatic Assembly Transfer Systems: Continuous transfer, intermittent transfer, indexing mechanisms, and operator - paced free – transfer machine

MODULE –V: DESIGN OF MANUAL ASSEMBLY (09)

Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

V. TEXT BOOKS:

1. Geoffrey Boothroyd, “Assembly Automation and Product Design”, Marcel and Dekken, Inc., NY, 1992.
2. George E. Deiter, “Engineering Design - Material & Processing Approach”, McGraw Hill Intl. 2nd Edition, 2000.
3. Geoffrey Boothroyd,” Hand Book of Product Design”, Marcel and Dekken,, N.Y. 1990

VI. REFERENCE BOOKS:

1. Geoffrey Boothroyd, “Hand Book of Product Design”, Marcel and Dekken, 1st Edition, 2013.
2. Geoffrey Boothroyd, Peter Dewhurst, Winston, “Product Design for Manufacturing and Assembly”, CRC Press, 1st Edition, 2010.

VII. WEB REFERENCES:

1. http://www.nptel.ac.in/courses/107103012/
2. http://nptel.ac.in/courses/112101005/