DESIGN FOR MANUFACTURING, ASSEMBLY AND ENVIRONMENT
(Professional Elective -III)

II Semester

Course Code: 19ME2158

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Course Outcomes: At the end of the course, the student will be able to

CO1: Outline the appropriate design for economical production and select the materials.

CO2: Select between various machining and metal joining processes.

CO3: Apply a systematic understanding of knowledge in the field of metal casting and forging.

CO4: Create basic parts and assemblies using powered and non – powered machine shop equipment in conjunction with mechanical documentation.

CO5: Integrate the knowledge of compliance analysis and interference analysis for assembly and also use visco-elastic and creep in plastics.

UNIT-I **(10-Lectures)**

Introduction: Design philosophy – steps in design process – general design rules for manufacturability – basic principles of designing for economical production – creativity in design, application of linear & non-linear optimization techniques. Materials: Selection of materials for design – developments in material technology – criteria for material selection – material selection interrelationship with process selection – process selection charts.

Learning outcomes:

1. Describe the general design rules for manufacturability. (L1)
2. Explain various steps in design process. (L2)
3. Explain the process of selection of materials for design with process selection charts. (L2)

UNIT-II **(10-Lectures)**

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. 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.

Learning outcomes:

1. Explain the general design rules for machining general design recommendations for machined parts. (L2)
2. Describe general design guidelines for pre and post treat of welds. (L2)
3. Explain the effects of thermal stresses in weld joints. (L2)

UNIT-III **(10-Lectures)**

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

Learning outcomes:

1. Explain general design considerations for casting. (L2)
2. Discuss various casting processes and their selection. (L2)
3. Identify various Design factors for forging. (L1)

UNIT-IV **(10-Lectures)**

Extrusion and sheet metal work: Design guidelines for extruded sections - design principles for punching, blanking, bending, and deep drawing – Keeler Goodman forming line diagram – component design for blanking.

Learning outcomes:

1. Describe Design guidelines for Extrusion and sheet metal work. (L1)
2. Explain design principles for punching and blanking. (L2)
3. Explain design principles for bending, and deep drawing. (L2)

UNIT-V **(10-Lectures)**

Assembly: Compliance analysis and interference analysis for the design of assembly – design and development of features for automatic assembly – liaison diagrams. Environment: Introduction to environment; motivations for environment principles of environment- eco-efficiency, product life cycle perspective, environment tools and processes, environment design guidelines.

Learning outcomes:

1. Describe Compliance analysis and interference analysis for the design of assembly. (L1)
2. Explain the design and development of features for automatic assembly. (L2)
3. Explain the environment tools and processes, environment design guidelines. (L2)

TEXT BOOK:

1. A K Chitale and R C Gupta, *Product Design and Manufacturing*, PHI, New Delhi, 2003.

REFERENCE BOOKS:

1. George E Deiter, *Engineering Design*, McGrawHill International, 2002.
2. Boothroyd G, *Product Design for Manufacture and Assembly*, 1st Edition, Marcel Dekker Inc, New York, 1994.