

<b>COURSE TITLE</b>	<b>DESIGN FOR MANUFACTURING AND ASSEMBLY</b>
<b>COURSE CODE</b>	<b>01CA1112</b>
<b>COURSE CREDITS</b>	<b>3</b>

**Objective:**

- 1 The course is intended to strengthen fundamentals of applied mechanics of solids and build understanding of design and analysis of machine components under dynamic loading. The course introduces design and analysis of machine components at elevated temperature. The course also includes fundamentals and application of fracture mechanics and surface failures in machine component design.

**Course Outcomes:** After completion of this course, student will be able to:

- 1 Use quality principles in design for manufacture and assembly to improve reliability and reduce defects.
- 2 Incorporate DFM techniques to improve product design and ease assembly.
- 3 Analyze the design concepts for casting, welding, forming, and assembly to evaluate their impact on manufacturability and performance.
- 4 Determine design factors and manufacturing processes in alignment with customer requirements.

**Pre-requisite of course:** The course is intended to strengthen fundamentals of applied mechanics of solids and build understanding of design and analysis of machine components under dynamic loading. The course introduces design and analysis of machine components at elevated temperature. The course also includes fundamentals and application of fracture mechanics and surface failures in machine component design.

**Teaching and Examination Scheme**

<b>Theory Hours</b>	<b>Tutorial Hours</b>	<b>Practical Hours</b>	<b>ESE</b>	<b>IA</b>	<b>CSE</b>	<b>Viva</b>	<b>Term Work</b>
3	0	0	50	30	20	0	0

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Tolerances:</b> Tolerances: Limits and Fits, tolerance Chains and identification of functionally important dimensions. Dimensional chain analysis-equivalent tolerances method, equivalent standard tolerance grade method, equivalent influence method. Geometric tolerances: applications, geometric tolerance for manufacture as per Indian Standards and ASME Y 14.5 standard; surface finish, Tolerance stack up calculations; Review of relationship between attainable tolerance grades and different machining	7

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
2	<b>Form design of castings, weldments, forging and sheet metal components:</b> Form design of castings, weldments, forging and sheet metal components: Materials choice, Influences of materials, Space factor, Size, Weight- Surface properties and production method on form design. Redesign of castings based on parting line considerations, minimizing core requirements, redesigning cast members using Weldments-Form design aspects in Forging and sheet metal components.	9
3	<b>Design for Assembly - Machining Considerations:</b> DFMA Tools: Rules and methodologies used to design components for manual, automatic and flexible assembly, traditional design and manufacture Vs concurrent engineering, DFA index, poke -yoke, lean principles, six sigma concepts, DFMA as the tool for concurrent engineering, three DFMA criteria for retaining components for redesign of a product; design for manual assembly; design for automatic assembly- Computer-aided design for assembly using software	9
4	<b>Design for the Environment:</b> Design for the Environment: Introduction, Environmental objectives, Global issues, Regional and local issues, Basic DFE methods, Design guide lines, Weighted sum assessment method, Lifecycle assessment method, Techniques to reduce environmental impact, Design to minimize material usage, Design for disassembly, Design for Recyclability, Design for remanufacture, Design for energy efficiency, Design to regulations and standards	8
<b>Total Hours</b>		<b>33</b>

**Textbook :**

- 1 Assembly Automation and Product Design, Second Edition (Manufacturing Engineering and Materials Processing), Geoffrey Boothroyd , Taylor & Francis, 2005
- 2 Product Design for Manufacture and Assembly, Third Edition, Geoffrey Boothroyd, Peter Dewhurst, Winston Anthony Knight, Taylor & Francis, 2011

**References:**

- 1 Product Design and Development, Product Design and Development, Karl T. Ulrich, Steven D. Eppinger , Irwin/McGraw-Hill , 2000
- 2 Design for Manufacturability Handbook, Design for Manufacturability Handbook, James G. Bralla, McGraw-Hill Education, 1999
- 3 Engineering Design : A Materials and Processing Approach, Engineering Design : A Materials and Processing Approach, George Ellwood Dieter, McGraw-Hill, 2007
- 4 Mechanical Tolerance Stackup and Analysis, Mechanical Tolerance Stackup and Analysis, Bryan R. Fischer, Taylor & Francis, 2004

**References:**

- Mechanical Assemblies : Their Design, Manufacture, and Role in Product Development ·, Mechanical Assemblies : Their Design, Manufacture, and Role in Product Development ·, Daniel E. Whitney, Oxford University Press, 2004

**Suggested Theory Distribution:**

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
15.00	30.00	25.00	15.00	15.00	

**Instructional Method:**

- whiteboard markers throughout the classroom, Advanced technology presentations, and scientific video sharing are examples of instructional methods.

**Supplementary Resources:**

- <https://nptel.ac.in/courses/107103012>