# MACHINE DESIGN

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | **CIA** | **SEE** | **Total** |
| **AMEC28** | **Core** | 3 | 1 | - | 4 | 30 | 70 | 100 |
| **Contact Classes: 45** | **Tutorial Classes: 15** | **Practical Classes: Nil** | | | | **Total Classes: 60** | | |

**VI Semester: ME**

**Prerequisite: Design of Machnie Elements**

## I. COURSE OVERVIEW:

Machine design emphasizes for safer design practices in the mechanical systems using different theories of failure modes. The Design philosophy is based on strength, stiffness and material selection for manufacture of machine elements. The main objective of this course is to provide rules for the design of general-purpose machine elements such as roller contact and sliding bearings and transmission systems, engine pistons etc, which are covered in specialized courses. After the successful completion of the course, the student shall be able to cover all steps of the analysis stage of the design process.

## II. COURSE OBJECTIVES:

**The students will try to learn:**

| I | To build a system, component, or process that meets desired needs within realistic design constraints for safety, manufacturability and sustainability. |
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| II | To make use of design data hand books to understand the design standards for introducing empirical design data process applicable for mechanical standard elements. |
| III | To analyze the design parameters for performance evaluation for mechanical transmission elements including bearings, gears and power screw transmission systems. |
| IV | To elaborate different design criteria and their procedure to carry out the required design steps for application of beam strength criteria for power transmissions in mechanical and allied engineering optimization. |

## III. COURSE OUTCOMES:

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

| CO 1 | **Understand** the lubrication processes of various surface contact bearings and their basic features, terminology and limitations for low speed applications. | Understand |
|---|---|---|
| CO 2 | **Discuss** the elemental design procedures for various IC engine parts for automobiles applications. | Remember |
| CO 3 | **Apply** the design procedures to calculate the performance of various belt and rope drives for improving transmission efficiencies. | Understand |
| CO 4 | **Implement** process of checking for dynamic and wear considerations for helical, bevel and worm gears. | Apply |
| CO 5 | **Design** of internal combustion engine component by applying the structural and thermal loads to meet the input design specifications using equilibrium equation. | Understand |
| CO 6 | **Identify** the kinematic synthesis for power transmission systems and their scope of application | Apply |

## IV. COURSE SYLLABUS:

### MODULE-I: BEARINGS (10)

Bearings: Types of bearings, basic modes of lubrication, bearing modulus, full and partial bearings, Clearance ratio, Heat dissipation of bearings, bearing materials, Journal bearing design. Ball and roller bearing, Static load-dynamic load, equivalent radial load-design and selection of ball and roller bearings.

### MODULE –II: DESIGN OF IC ENGINE PARTS (08)

Connecting rod: thrust in connecting rod-stress due to whipping action on connecting rod ends-cranks and crankshafts, forces acting on Piston-construction design and proportions of piston.

**MODULE –III:POWER TRANSMISSION SYSTEMS (09)**
Transmission of power by belt and rope drives, transmission efficiencies, Belts-Flat and V belts
Ropes- materials-chaindrives.

**MODULE –IV: GEARS (10)**
Spur Gears: Load concentration factor-dynamic load factor, surface compressive strength-bending strength-design analysis of spur gear, check for dynamic and wear considerations. Helical and Bevel Gear: Load concentration factor-dynamic load factor, Analysis of helicaland bevelgears, check for dynamic and wear considerations. Design of Worm gears: properties of wormgears-selections of materials-strength and wear rating of wormgears- Force analysis-friction in worm gears-thermal Considerations.

**MODULE –V POWER SCREWS (08)**
Power screw, design of nut, compound screw, differential screw, ball screw- possible failures.

**V.TEXT BOOKS:**
 1. Richard G. Budynas, J. Keith Nisbett, "Shiegly"s Mechanical Engineering Design", 10th Edition, 2014.
 2. V.B. Bandari, "A Text Book of Design of Machine Elements", 3rd edition, Tata McGraw hill, 2011.

**VI.REFERENCE BOOKS:**
1. P. Kannaiah, "Machine Design", Scitech Publications India Pvt. Ltd, 2nd Edition, New Delhi, 2012.
2. R.L. Norton, "Machine Design-An Integrated approach", Person Publisher, 2nd Edition, 2006.
3. U.C. Jindal, "Machine Design", Pearson, 1st Edition, 2010.
4. R.S. Khurmi, A. K. Gupta, "Machine Design", S. Chand & Co, 1st Edition, New Delhi, , 2014.

**VII.WEB REFERENCES:**
1.  http://nptel.ac.in/courses/Webcourse- contents/IIT%20Kharagpur/Machine%20design1/New_index1.html
2.  http://nptel.ac.in/downloads/112105125/
3.  http:/alljntuworld.in/download/design-machine-members-1-dmm-1-materials-notes/
4.  http:/scoopworld.in/2015/03/design-of-machine-members-dmm-mech.html

**VIII. E-TEXT BOOKS:**
1.  http://faadooengineers.com/threads/26687-Machine-design-by-shigley-ebook-download-pdf
2.  http://freepdfbook.com/design-of-machine-elements-by-v-b-bhandari/
3.  http:/only4engineer.com/2014/10/a-textbook-of-machine-design-by.html