

**Subject Code: 01ME1503**  
**Subject Name: Machine Design - I**  
**B. Tech. Year - III (Semester - 5)**

**Type of course :** Programme Core

**Prerequisite :** Machine Design & Industrial Drafting

**Rationale :** To develop an ability to design a system, component, or process to meet desired needs within realistic constraints. To determine the fundamentals of design procedure of machine components like Pressure vessel, spring and transmission system like belts, chain and ropes and analysis of components subjected to fluctuating loads.

**Course Outcome :**

After completion of syllabus, students will be able to:

1. Understand basic knowledge of design and design procedures and its effect under certain conditions and selection of materials for mechanical components.
2. Design mechanical components subjected to fatigue failure criteria.
3. Design mechanical springs with geometrical features and use the techniques, skills and modern tools necessary for the practice.
4. Design pressure vessels using conventional methods and understanding of design of gasketed joints.
5. Evaluate and design a Belt drive and Rope drive systems to meet desired needs in the field of mechanical engineering.

**Teaching and Examination Scheme :**

Teaching Scheme			Credits	Examination Marks					Total Marks
THEORY	TUTORIAL	PRACTICAL		Theory Marks			Practical Marks		
			ESE(E)	IA	CSE	Viva (V)	Term Work (TW)		
3	0	2	4	50	30	20	25	25	150

**Content :**

Sr. No.	Content	Total Hrs.
1	<b>Machine Design Introduction:</b> Classification of machine design, Design Procedure of Machine Elements, Manufacturing considerations in Design, Aesthetic Considerations in Design, Ergonomic Considerations in Design, Concurrent Engineering, Selection of Preferred Sizes, Selection of Material, BIS System of Designation of Steels, Cast Irons, Alloy Steels.	06

<b>2</b>	<p><b>Design for Fluctuating Loads:</b> Stress Concentration, Stress Concentration Factors, Reduction of Stress Concentration, Fluctuating Stresses, Fatigue Failure, Endurance Limit, Low cycle and High cycle Fatigue, Notch Sensitivity, Endurance Limit - Approximate Estimation, Reversed Stresses - Design for Finite and Infinite Life, Cumulative Damage in Fatigue, Soderberg and Goodman Lines, Modified Goodman Diagrams, Gerber Equation, Fatigue Design under Combined Stresses.</p>	<b>04</b>
<b>3</b>	<p><b>Design of Springs:</b> Introduction, Types of Springs, Terminology of Helical Springs, Styles of End, Stress and Deflection Equations, Series and Parallel Connections, Spring Materials, Design of Helical Springs, Spring Design – Trial and Error Method, Concentric Springs, Optimum Design of Helical Spring, Surge in Spring, Helical Torsion Springs, Spiral Springs, Multi-Leaf Spring, Nipping of Leaf Springs, Introduction of Belleville Spring, Shot Peening.</p>	<b>08</b>
<b>4</b>	<p><b>Belt Drives and Rope Drives:</b> Belt Drives, Belt Constructions, Geometrical Relationships, Analysis of Belt Tensions, Condition for Maximum Power, Characteristics of Belt Drives, Selection of Flat-belts from Manufacturer's Catalogue, Pulleys for Flat Belts, Arms of Cast-iron Pulley, Working of Timing belt, V-belts, Selection of V-belts, V-grooved Pulley, Belt-Tensioning Methods, Ribbed V-belts. Rope Drives, Construction and Lay of Wire Ropes, Stresses in Wire Ropes, Pulley System, Design of Sheave and drums.</p>	<b>10</b>
<b>5</b>	<p><b>Design of Cylinders and Pressure Vessels:</b> Thin and Thick Cylinders, Design of Thin Cylindrical Vessels, Design of Thin-Walled Spherical Vessels, Design of Thick Cylinders, Lame's Equation, Clavrin's Equation, Birnie's Equation, Cylinders Subjected to External Pressure, Autofrettage, Gaskets, Gasketed Joint, Thickness of Cylindrical and Spherical Shells, End Closures.</p>	<b>08</b>

### Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>20</b>	<b>25</b>	<b>25</b>	<b>10</b>	<b>10</b>

**Legends: R:** Remember; **U:** Understand; **A:** Apply; **N:** Analyze; **E:** Evaluate; **C:** Create

### List of Experiments :

1. Selection of materials for machine elements and design considerations
2. To determine the preferred series for Mechanical Components.
3. Design and selection of Flat belt and V-belt using manufacturer's Catalogue.
4. Testing of belt drive for different tension (tightening) levels.
5. Design and testing of stresses and strains in a thick and thin cylinder
6. Design of Gasket and Gasketed Joints for Pressure Vessels

7. Design and testing of different components undergo to stress concentration
8. Design and selection of wire rope for crane applications.
9. Design of component considering fatigue failure criteria for engine component
10. Design of a Leaf Springs for Automobile.
11. Design and testing of different types of springs for shock absorbers in automobile.
12. To make 3D model of the Mechanical Springs.

### Reference books :

1. Abdulla Shariff, Design of Machine Elements, 1/e, Dhanpat Rai Publications.
2. V B Bhandari, Design of Machine Elements, 3/e, McGraw Hill.
3. Farazdak Haideri, Machine Design Vol. - I, II, 1/e, Nirali Prakashan.
4. P C Gope, Machine Design: Fundamentals and Applications, 1/e, PHI.
5. R C Juvinal, Fundamentals of Machine Component Design, 4/e, Wiley.
6. R L Norton, Machine Design an Introduction, 1/e, Pearson.\

### Design Data Book :

1. V. B. Bhandari, Machine Design Data Book, 1/e, McGraw Hill Education.
2. Data Book of Engineers by PSG College, Kalaikathir Achchagam, Coimbatore.

### Design based Problem / Open Ended Problem :

1. Design of Pressure vessel using software.

### Major Equipment :

1. Digital Fatigue Testing Machine
2. Combined Coil and Belt Friction apparatus
3. Thick and Thin cylinder apparatus
4. Chain drive apparatus

### List of Open Base Software / learning website :

1. <https://ocw.mit.edu>
2. [www.nptel.ac.in](http://www.nptel.ac.in)
3. <https://cosmolearning.org>



4. <http://ekeeda.com>