COURSE TITLE	**MACHINE DESIGN-I**
COURSE CODE	**01ME2503**
COURSE CREDITS	**5**

Objective:

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

1 Apply 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 Evaluate and design a belt drive and rope drive systems to meet desired needs in the field of mechanical engineering.

5 Design pressure vessels using conventional methods and understanding of design of gasketed joints.

6 Evaluate mechanical designs by integrating techniques and modern tools to meet industrial and ergonomic requirements.

Pre-requisite of course: Machine Design & Industrial Drafting

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	2	0	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Machine Design Introduction** 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.	6

Contents : Unit	Topics	Contact Hours
2	**Design for Fluctuating Loads** 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 In?nite Life, Cumulative Damage in Fatigue, Soderberg and Goodman Lines, Modified Goodman Diagrams, Gerber Equation, Fatigue Design under Combined Stresses	10
3	**Design of Springs** Introduction, Types of Springs, Terminology of Helical Springs, Styles of End, Stress and Defection 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.	8
4	**Belt Drives and Rope Drives** 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.	10
5	**Design of Cylinders and Pressure Vessels** Thin and Thick Cylinders, Design of Thin Cylindrical Vessels, Design of Thin-Walled Spherical Vessels, Design of Thick Cylinders, Lame's Equation, Clavrino’s Equation, Birnie's Equation, Cylinders Subjected to External Pressure, Autofrettage, Gaskets, Gasketed Joint, Thickness of Cylindrical and Spherical Shells, End Closures	8
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Selection of material for machine elements and design considerations** Selection of material for machine elements and design considerations	2
2	**To determine the preferred series for mechanical components** To determine the preferred series for mechanical components	2
3	**Design of different components subjected to stress concentration** Design of different components subjected to stress concentration	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
4	**Design of components subjected to fatigue failure** Design of components subjected to fatigue failure	2
5	**Design of Flat belt** Design of Flat belt	2
6	**Design of V – belt** Design of V – belt	2
7	**Design of wire rope for crane** Design of wire rope for crane	2
8	**Design of different compression and tension springs** Design of different compression and tension springs	2
9	**Design of Leaf springs** Design of Leaf springs	2
10	**Design of Thin and Thick cylinders** Design of Thin and Thick cylinders	2
11	**Design of gasket and gasketed joints** Design of gasket and gasketed joints	2
12	**Design and Prepare 3D model of mechanical Spring** Design and Prepare 3D model of mechanical Spring	2
Total Hours		**24**

Textbook :

1 Design of Machine Elements, V B Bhandari, McGraw Hill, 2003

2 Machine Design Data Book, V. B. Bhandari, McGraw Hill Education, 2010

References:

1 Fundamentals of Machine Component Design, Fundamentals of Machine Component Design, R C Juvinall, Wiley, 2001

2 Machine Design Vol. - I, II, Machine Design Vol. - I, II, Farazdak Haideri, Nirali Prakashan, 2000

3 Machine Design: Fundamentals and Applications, Machine Design: Fundamentals and Applications, P C Gope, PHI, 1999

4 Fundamentals of Machine Component Design, Fundamentals of Machine Component Design, R C Juvinall, Wiley, 2010

5 Machine Design an Introduction, Machine Design an Introduction, R L Norton, Pearson, 2014

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	15.00	30.00	20.00	10.00	10.00

Instructional Method:

1 Power Point Presentation

Supplementary Resources:

1 https://ocw.mit.edu
2 www.nptel.ac.in
3 https://cosmolearning.org
4 http://ekeeda.com