

Subject Code: 01ME0503

Subject Name: Machine Design - I

B.Tech. III Year – (Sem-5) Mechanical Engineering

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.

Teaching and Examination Scheme:

Teaching Scheme (Hours)			Credits	Evaluation Scheme					Total Marks
Theory	Tutorial	Practical		Theory Marks			Practical Marks		
				ESE (E)	IA	CSE	Viva (V)	Term Work (TW)	
4	0	2	5	50	30	20	25	25	150

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.
2. Carry out preliminary selection of materials for mechanical components.
3. Design mechanical components subjected to fatigue failure criteria.
4. Design mechanical springs with geometrical features and use the techniques, skills and modern tools necessary for the practice.
5. Design pressure vessels using conventional methods and understanding of standard codes.
6. Evaluate and design a Belt drive, Chain drive and Rope drive systems to meet desired needs in the field of mechanical engineering.

Sr. No.	Contents	Total Hours	Weightage
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	10 %
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 Infinite Life, Cumulative Damage in Fatigue, Soderberg and Goodman Lines, Modified Goodman Diagrams, Gerber Equation, Fatigue Design under Combined Stresses.	10	20 %
3	Design of Springs: 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.	8	20 %
4	Belt 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.	9	20 %

5	Chain Drives and Rope Drives: Chain Drives, Roller Chains, Geometric Relationships, Polygonal Effect, Power Rating of Roller Chains, Sprocket Wheels, Design of Chain Drive, Chain Lubrication, Silent Chain, Rope Drives, Construction and Lay of Wire Ropes, Stresses in Wire Ropes, Pulley System, Design of Sheave and drums.	5	10 %
6	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, Clavarino's Equation, Birnie's Equation, Cylinders Subjected to External Pressure, Autofrettage, Compound Cylinder, Gaskets, Gasketed Joint, Thickness of Cylindrical and Spherical Shells, End Closures, Introduction of design codes for pressure vessel.	10	20 %

Note: Use of Design data book should be permitted during the examination.

Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level	C Level
15	20	20	20	15	10

Legends: R: Remembrance; **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate and **C:** Create

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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 Juvinall, 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.

List of the Experiments:

1. Design and testing of different components undergoes to stress concentration.
2. Design of component considering fatigue failure criteria.
3. Design and testing of stresses and strains in a thick and thin cylinder.
4. Design and selection of Flat belt and V-belt using manufacturer's Catalogue.
5. Testing of belt drive for different tension (tightening) levels.
6. Design and testing of different types of springs.
7. Design and testing of chain drive.
8. Design and selection of wire rope.

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 Source Software / learning website:

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