

Branch Name:	Mechanical Engineering
Semester/Year:	Semester V / Third Year
Subject Title:	Machine Design-I
Subject Code:	1ET1010503
Pre-requisite:	Mechanics of Solids, Machine Design & Industrial Drafting

Course Objectives:

1. To provide fundamental principles of design consideration for manufacturing.
2. To learn about the design procedure for springs.
3. To learn about the design procedure of Flat belt, V belt & Chain drives.
4. To learn design procedure and standards code for pressure vessels.
5. To learn design consideration of different types of clutches and brakes.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	01	00	04	70	30	00	20	120

Subject Contents			
Sr. No	Topic	Total Hours	Weightage (%)
1	Design Considerations: Manufacturing and assembly considerations, Design of components for casting, Welding, Forging, hot and cold working, machining, Welding etc. Thermal considerations, Wear considerations in design, Contact Stresses, Standardization and preferred numbers.	04	10
2	Fatigue Loading: Design for fluctuating stresses, Endurance limit, Estimation of Endurance strength, Goodman's line, Soderberg's line, Modified Goodman's line. Design for creep.	05	11
3	Design of Springs: Classification of springs, Helical Spring: Style of ends, Stresses, Correction Factors, and Deflection, Design against static and fluctuating loads, Concentric springs, surge phenomenon. Helical Torsion and Spiral Springs, Belleville spring, shot peening of springs. Multi-Leaf Spring: Terminology, Nipping, and Design of multi-leaf spring.	05	11
4	Belt and Chain Drives: Flat Belt Drive: Belt Construction, Flat Belt Drive: Length of the Belt: Open and Cross drive types, Ratio of Tensions on tight side to slack side, Condition for maximum power transmission, Creep phenomenon, Methods for tensioning, Selection of Belts from catalogues, Design of Pulley for flat belt drive. Timing belt selection. V-Belt Drive: Nomenclature, Selection of V-Belts from catalogues. Chain Drive:	08	20

	Nomenclature of roller chains, Length and power rating of chains, Design of chain drive.		
5	Pressure Vessels: Thin cylinders and spherical vessels, Wire wound cylinders. Thick cylinders: Principal stresses in cylinder subjected to internal/external pressure, Lamé's equation, Clavarion's and Bernie's equations, Autofrettage, Compounding of cylinders, Gasketed Joints, Thickness of cylindrical and spherical shells, Design of End closures, Area compensations for nozzles. Introduction to Design codes.	10	24
6	Design of clutches and brakes: Function , Classification, Material selection, Design of positive clutches, Friction clutches -cone, single, Multiple and centrifugal clutches, Design of band brake, External and internal shoe brakes, Internal expanding shoe brakes, Design of disc brakes.	10	24

Course Outcomes:

The student will be able to

1. Identify different consideration for manufacturing.
2. Adopt design procedure of springs for given application.
3. Know design procedure of Flat belt, V belt & Chain drives.
4. Explore standard practice codes used for pressure vessels.
5. Identify design consideration for clutches & brakes.

List of Reference Books:

1. Purohit, Kamlesh, and C. S. Sharma. Design of Machine Elements. PHI Learning Pvt. Ltd., 2002.
2. Sharma P. C. and Aggarval D. K. Machine Design “, S K Kataria Publishers.
3. Patel R.C., Sikh S.S, and Pandya A.,Machine Design, Vol-II, C. Jamnadas & Company Publishers.
4. Shigley J.,C. Mischke, Budynas R., Mechanical Engineering Design,Tata-McGraw Hill Publishers.
5. Norton R., Machine Design: An Integrated Approach, Pearson Education Publishers.
6. Bhandari V., Design of Machine Elements, Tata-McGraw Hill Publishers.
7. Sadhu Singh S., Machine Design , Khanna Publishers.
8. P.S. G. Design Data book (PSG College of Engg. & Tech.), DPV Printers, Coimbatore.
9. Mahadevan, K and Balveera Reddy K, Design Data Book , CBS Publishers & Distributors Pvt Ltd.

Note: Use of Design data book during the Lectures/Practical sessions is desirable.

List of Tutorials:

1. Exercise on material selection for given application.
2. Design of mechanical components subjected to fluctuating loads.
3. Design of springs.
4. Design of belt drives for given application.
5. Design of chain drives.
6. Study performance of a belt drive for different tension (tightening) levels.
7. Design of pressure vessels exercise should include demonstration of use of codes (ASME Section VIII Div 2 and IS 2825 (1969)).
8. Design of clutches and brakes.

E-Resources:

1. <http://nptel.ac.in/courses/112105125/>
2. <https://ocw.mit.edu/courses/mechanical-engineering/2-72-elements-of-mechanical-design-spring-2009/lecture-notes/>