DESIGN OF MACHINE ELEMENTS

Course Code	20ME3503	Year	III	Semester	I
Course Category	Programme core	Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Pre-requisites	Strength of Materials
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course outcomes: At the end of the course, the student will be able to:

CO	Statement	Skill	BTL	Units
CO1	Understand the Design Procedure and design considerations of various machine elements.	Understand	L2	1,2,3,4,5
CO2	Apply the principles of static and fatigue failure theories to estimate the size of machine elements	Apply	L3	2
CO3	Design the temporary and permanent joints required to assemble the machine elements	Analyze	L4	3,4
CO4	Design the required spring for the given application	Analyze	L4	5

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H:High, M: Medium, L:Low)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1						1		2	3	1
CO2	3	3	1	1						1		2	3	1
CO3	3	3	1	1						1		2	3	1
CO4	3	3	1	1						1		2	3	1

Syllabus		
UNIT	Contents	Mapped CO
I	**Mechanical Engineering Design:** Machine Design, Basic Procedure of Machine Design, Basic Requirements of Machine Elements, Design of Machine Elements, Traditional Design Methods, Design Synthesis, Use of Standards in Design, Selection of Preferred Sizes, Aesthetic Considerations in Design, Ergonomic Considerations in Design. Mechanical Properties of Engineering Materials, BIS System of Designation of Steels, Selection of Material, Selection of Manufacturing Method.	CO1
II	**Design Against Static Loads:** Modes of failure, Factor of Safety, design of components subjected to axial, bending, torsional loads. Theories of Elastic failure, Maximum Principal Stress theory, Maximum Shear Stress Theory, Distortion-Energy Theory **Design Against Fluctuating Load:** 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	CO1, CO2

	Damage in Fatigue, Soderberg and Goodman Lines and modified Goodman criterion for fatigue failure.	
III	**Riveted Joints:** Types of riveted joints, Types of Failure, efficiency of riveted joint, Caulking and Fullering, Longitudinal Butt Joint for Boiler Shell, Circumferential Lap Joint for Boiler Shells, Eccentrically Loaded Riveted Joint. **Welded Joints:** Types of welded joints, Strength of Parallel Fillet welds, Strength of Transverse Fillet welds, Axially Loaded Unsymmetrical Welded Joints, Eccentric Load in the Plane of Welds, Welded Joint Subjected to Bending Moment, Welded Joint Subjected to Torsional Moment.	**CO1, CO3**
IV	**Bolted Joints:** Load on bolt due to initial tightening, external loading, combined loading, eccentrically loaded bolted joints in shear, Eccentric load perpendicular to axis of bolt. **Cotter Joints:** Types of cotter joints, Design of Socket and Spigot Joint, Design of Sleeve and Cotter Joint, Design of Gib and Cotter Joint, knuckle joint	**CO1, CO3**
V	**Springs:** Types of springs, Terminology of Helical Springs, Styles of End, Stress and Deflection Equations, Series and parallel Connections, Design of Helical springs, Design against Fluctuating load, Concentric Springs Leaf springs, Design of Leaf spring, nipping of Leaf Spring	**CO1, CO4**

Learning Resources
Text Book(s):
1. V.B. Bhandari, Design of Machine Elements, 3/e, Tata McGraw Hill, 2010.
References:
1. J.E. Shigley, Mechanical Engineering Design, 2/e, Tata McGraw Hill, 1986. 2. R.L. Norton, Machine Design an Integrated approach, 2/e, Pearson Education, 2004. 3. M.F.Spotts and T.E.Shoup, Design of Machine Elements, 3/e, Prentice Hall (Pearson education), 2013.