

ME301 Design of Machine Element – I										
L	T	P	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0	2	4	DCC		15	25	20	40	-

Objective: To enable the students to formulate and analyze the stresses and strains in various machine elements under static and dynamic loads. Students will be able to select a suitable material and factor of safety depending upon the design parameters.

Syllabus		Contact Hours
Unit-1	Introduction to Mechanical Engineering Design, design process, Interaction between design process elements, Design-economics, Uncertainty, Stress and strength, Codes and Standards, Factors of safety (FOS), selection of FOS, Probabilistic approach to Design, Engineering materials-ferrous and non-ferrous, Designation of steels as per IS and ASTM standards. Selection of materials- the basics, selection strategy, computer aided selection. Manufacturing considerations in design, interchangeability, Limits, Fits, and Tolerances as per Indian Std. System.	8
Unit-2	Failures resulting from static loading, static strength, and stress concentration. Failures resulting from variable loading, introduction to fatigue in metals, Strain life relationship, stress life relationship. Endurance limit modifying factors, stress concentration and notch sensitivity, Goodman, Soderberg and Gerber criteria, Cumulative damage in fatigue, design factors in fatigue.	6
Unit-3	Design of Cotter joints and knuckle joints. Riveted joints: Stresses in riveted joints; failure analysis on strength basis; Riveted joints in boilers and pressure vessels; structural riveted joints, eccentric loading of structural rivets. Threaded fasteners and joints: Thread standards; stresses in screw threads; preloading of bolts; bolted joints; eccentric loading; design of power screws and screw jack.	8
Unit-4	Springs: Stresses in helical springs; deflection of helical springs; extension, compression and torsion springs; design of helical springs for static and fatigue loading; critical frequency of helical springs; design of concentric springs, stress analysis and design of leaf springs.	6
Unit-5	Design of shafts: Design for static loads; torsional and lateral rigidity, reversed bending and steady torsion; Stresses in solid and hollow shafts; design for strength and deflection; design of shafts under fatigue loading; Design of keys, pins and couplings: rigid and flexible couplings.	8
Unit-6	Pipe joints: Design of Oval, square and round flanged pipe joints under low and high pressure. Welded joints: Types of welded joints; stresses in butt and fillet welds; torsion and bending in welded joints; welds subjected to fluctuating loads	6
Total		42

Reference Books:	
1	Mechanical Engineering Design, Shigley, J. E., Mischke, C. R. and Budynas, R. G., McGraw Hill, 7th Edition, 2004. International.
2	Fundamental of Machine Component Design, " Juvinall, R. C., and Marshek, K. M., John Wiley and Sons, 2000.
3	Fundamentals of Machine Elements Hamrock, B. J., Jacobson, B. Schmidt, S. R., McGraw Hill, 1999.
4	An Integrated Approach, Norton, R. L., Machine Design: Pearson Education, Indian Reprint-2001.
5	Design of machine elements 5th edition, Bhandari
6.	Machine Design D. K. Aggarwal and P. C. Sharma DhanpatRai

Course Outcomes

CO1	To define and understand suitable materials for various machine elements
CO2	To understand and estimate allowable loads in machine elements using failure theories
CO3	To analyze steady and variable stresses induced in machine elements for different applications
CO4	To describe screws, keys, riveted joints, pipes and pipe joints for specific applications
CO5	To design Keys and couplings for specific applications
CO6	To design Mechanical springs for specific applications

CO-PO/PSOMatrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2