Design of Machine Elements ME-503 Contracts: 4L Credits- 4

Module 1

Objective and scope of Mechanical Engineering Design; Design considerations; Review and selection of materials and manufacturing processes; codes and standards; [5]

Module 2

Modes of failure; Design/allowable stress; Factor of safety (FoS); **Theories of failure – maximum normal stress theory, maximum shear stress theory, Distortion energy theory**. Choice of Failure criteria; **Design for stability : buckling analysis – Johnson and Euler columns** [6]

Module 3

Fatigue in metals; S-N curve; Endurance limit and fatigue strength; Stress concentration factors – effect of discontinuity, fillets and notches; Effect of size, surface finish, stress concentration and degree of reliability on endurance limit; Design for finite and infinite life; Goodman, modified Goodman and Soderberg diagrams with respect to fatigue failure under variable stresses;

Cumulative fatigue damage – Miner's equation. [6]

Module 4

Design of (i) Cotter joint; (ii) Knuckle joint and (iii) Fillet Welded joint of brackets under different types of loading. [6]

Module 5

Bolted joints : Metric thread, standard sizes, use of lock nuts and washers; Applications in structures including brackets, turn buckle; Pre-stressed bolts;

Riveted joints : Unwin's formula; Brief discussion on single, double and triple row lap joints, butt joints with single or double strap / cover plate; simple strength design; joint efficiencies. [6]

Module 6

Design of :

(i) Solid and hollow shafts, strength design of shafts, design based on torsional rigidity;
(ii) Shaft coupling-rigid, pin-bush and geared flexible type, alignment of coupling;
(iii) Belt drives-geometrical relations, derivation of torque and power transmission by flat and V-belt drives, selection of belt from manufacturers' catalogues, pulley
(iv) Chain drives –roller chains, polygonal effect, power rating, sprocket wheel, silent chain [10]

Module 7

Design of:

(i) Transmission screw, Screw jack,
 (ii) Helical compression spring - stress and deflection equations, stiffness, curvature effect : Wahl's factor, springs in parallel and series;
 (iii) Multi-leaf springs : load-stress and load-deflection equations, Nipping [9]

Note for Teachers :

1. Stress should be given in explaining different concepts.

- 2. Use and application of different machine elements should be highlighted.
- 3. Numerical problems should be worked out in class as well as through home assignment.

Note to Examination Paper Setter :

1. at least one question should be set from each module.

2. approx 50% marks should be allotted to numerical problems.

Books Recommended :

1. Design of Machine Elements by V. B. Bhandari, TMH

- 2. Mechanical Engineering Design by Shigley and Mischke, TMH
- 3. Theory and Problems of Machine Design by Hall, Holowenko and Laughlin, TMH
- 4. Machine Design by T.H. Wentzell, Cenage Learning.
- 5. Design of Machine Elements by M. F. Spotts, Prentice Hall