

SUBJECT CODE NO:- P-169
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E.(MECH/PROD) Examination MAY/JUNE-2016
Design of Machine Elements-I
(Revised)

[Time:Three Hours]

[Max Marks:80]

“Please check whether you have got the right question paper.”

- N.B
- i) Solve any three questions from each section.
 - ii) Use separate answer- book for each section.
 - iii) Figures to the right indicate full marks.
 - iv) Assume suitable data, if necessary and state them clearly.

Section A

- Q.1
- a) Define the following
 - i) Eccentric loading
 - ii) Mechanical Advantage
 - iii) Resilience
 - iv) Creep
 - b) Explain basic procedure of design of machine elements.
 - c) Explain in detail concurrent engineering.
- Q.2 Explain in detail the design procedure of a knuckle joint. 12
- Q.3
- a) Derive the expression for eccentric load parallel to axis bolt. 06
 - b) A C frame is subjected to a force of 25kN as shown in figure 1. It is made of grey cast iron FG 400 and factor of safety is 2. Determine the dimensions of the cross section of the frame. 06

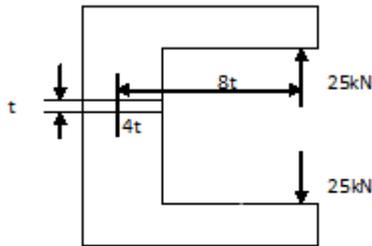


Fig.1

- Q.4 Derive the expressions for torque lifting of load and torque lowering of load by power screw. 12
- Q.5 Write short notes on the following (any four) 16
- a. Ergonomic consideration in design.
 - b. Design procedure of socket and spigot joint.
 - c. Selection and use of theories of failures.
 - d. Collar friction torque.
 - e. Recirculating ball screw.

Section B

- Q.6 A steel rod is subjected to a reversal axial load is 300kN. Find the diameter of the rod for a factor of safety 2. Neglect column action. The material has an ultimate tensile stress of 1070MPa and yield stress 910 MPa. The endurance stress in reverse bending is 50% of ultimate stress. The axial loading factor = 0.7, surface factor = 0.8; stress concentration factor = 1. 12

- Q.7 a) Explain low cycle and high cycle fatigue. 04
 b) A 50mm diameter shaft is made of carbon steel having ultimate tensile stress of 640MPa and yield stress is 520MPa. It is subjected to a torque which fluctuates from 2000Nm to -800Nm. Using soderberg method, calculate the factor of safety. The endurance stress in shear is 173.5 MPa and yield stress in shear is 255MPa. 08

- Q.8 A helical compression spring is required to deflect through approximately 20mm when the external force varies from 500N to 1000N. The spring index is 5. The spring has square and ground ends. There should be a gap of 1mm between the adjacent coils when subjected to maximum force 1000N. the spring is made of cold drawn steel wire with ultimate tensile strength of 1000MPa and permissible shear stress of 50% of ultimate tensile stress and ($G = 81370 \text{ MPa}$). Design the spring and calculate wire diameter, mean coil diameter, number of active coils, solid length, free length, required spring rate. 12

- Q.9 a) Derive the expression for eccentric load in the plane of welds. 04
 b) A bracket is attached to a vertical column by means of 4 identical rivets which is subjected to an eccentric load of 30kN as shown in figure 2. Determine the diameter of rivets, if the permissible shear is 80 MPa. 08

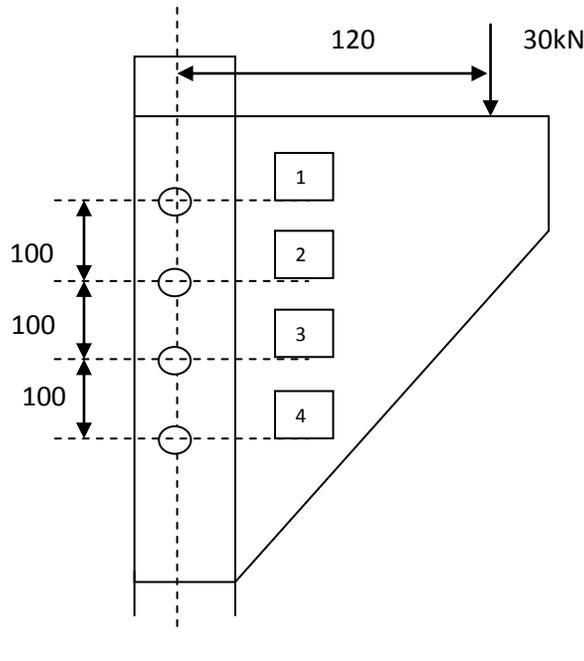


Fig.2

- Q.10 Write short notes (any four) 16
- Stress concentration causes and remedies.
 - Goodman's equation
 - Techniques for weld inspection
 - Cumulative fatigue damage
 - Series connection in helical compression spring.