

Con. 6175-11.

(4 Hours)

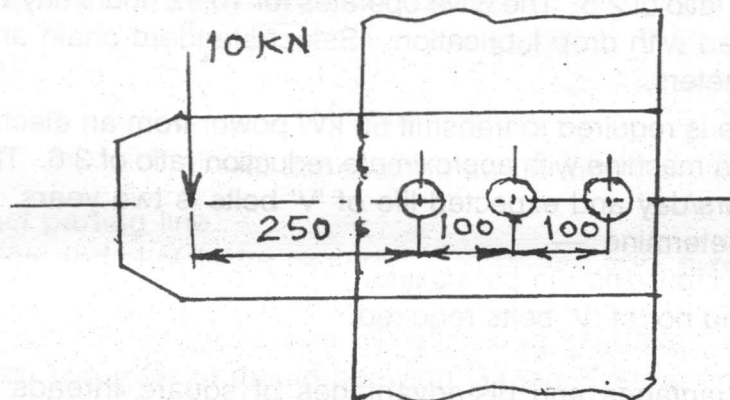


MP-3502

[Total Marks : 100]

- N.B. :** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions from the remaining **six** questions.
 (3) Use of Design Data books is permitted.
 (4) Assume **suitable** data wherever **necessary** but with proper **justification**.

1. (a) What is factor of safety ? Discuss various factors to be considered while selecting the factor of safety. 20
 (b) Write a short note on 'Aesthetic considerations in design'.
 (c) Explain different modes of failure of mechanical components.
 (d) Explain chordal action in case of a chain drive.
 (e) Explain the mechanism of fatigue failure.
2. (a) Design a spigot and socket type cotter joint to transmit reversible load of 50 kN. Select suitable materials and design stresses for various parts of the joint. 12
 (b) A steel plate subjected to a force of 10 kN and fixed to another plate by means of three identical bolts is shown in **figure**. The bolts are made from C-40 material. Factor of safety is 3. Specify the size of the bolts. 8



3. (a) Explain four important type of keys with their specific uses. 5
 (b) Design a flexible type Bush-Pin coupling for the shaft transmitting 30 kW power at 960 rpm. Assume suitable material and design stresses for various parts. 15
4. The input shaft of a machine is supported in bearings at A and D. It receives 40 kW power through a flat belt pulley 400 mm. diameter located at B from a pulley located vertically below. The angle of lap is 225° and the coefficient of friction between the belt and the pulley is 0.25. The shaft rotates at 400 rpm in the anticlockwise direction when viewed from D and delivers power through a pinion having 20 teeth and 6 mm module having pressure angle of 20° , located at C. It transmits power to a gear located horizontally in front. The material for the shaft is IS-C-45 and factor of safety is 4. $AB = 250$ mm, $BC = CD = 200$ mm. Determine the shaft diameter. 20

[TURN OVER]

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5. (a) A helical compression spring is subjected to a force of 500 N with corresponding deflection of 20 mm. The spring index is 6. The spring material has UTS of 1000 N/mm². The permissible shear stress for the spring wire is 50% of UTS. Modulus of rigidity is 8×10^4 N/mm². Design the spring and determine :—
- Wire dia
 - Mean coil diameter
 - No. of active turns
 - Free length
 - Pitch of the coils.
- (b) A semi-elliptical multi-leaf spring is used for the suspension of rear axle of a truck. It consists of two extra full length leaves and ten graduated leaves including the master leaf. The centre to centre distance between the spring eyes is 1.2 m. The material for the spring has $S_{yt} = 1500$ N/mm² and modulus of elasticity is 2×10^5 N/mm². Factor of safety is 2.5. The spring is to be designed for a maximum force of 30 kN. The leaves are pre-stressed so as to equalize stresses in all leaves. Determine :—
- The thickness of the leaves if width is 60 mm.
 - Deflection.
6. (a) A chain drive is required to transmit 5 kW power from a shaft running at 400 rpm with reduction ratio of 2.8. The drive operates for 10-12 hours/day with heavy shocks and is provided with drop lubrication. Select standard chain and determine the sprocket diameters. 8
- (b) A 'V' belt drive is required to transmit 50 kW power from an electric motor rotating at 960 rpm to a machine with approximate reduction ratio of 3.6. The drive operates for 12-14 hours/day and expected life of 'V' belts is two years. Select standard section and determine :— 12
- size of input and out-put pulleys
 - size and no. of 'V' belts required.
7. (a) State the advantages and dis-advantages of square threads over trapezoidal threads. 4
- (b) A screw jack is required to lift a load of 80 kN through a height of 300 mm. Selecting suitable material and design stresses, design :— 16
- Screw
 - Nut
 - Body
 - Handle.