17610

15162

4 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory*.

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-Programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. (a) Attempt any THREE : **3 × 4 = 12**

(i) Draw stress-strain diagram for ductile material stating salient points.

(ii) Write the design procedure for turn buckle. (Any four steps)

(iii) State any four factors to be considered while selecting the coupling.

(iv) Why square threads are preferred over V-thread for power transmission ?

(b) Attempt any ONE : **1 × 6 = 6**

(i) What is stress concentration ? State the remedial measures to control the effect of stress concentration with neat sketches.

(ii) The shaft running at 125 r.p.m. transmits 440 kW. Find the diameter of shaft (d) if allowable shear stress in shaft material is 55 N/mm^2 and the angle of twist must not be more than 1° on a length of 16(d). The modulus of rigidity $G = 0.80 \times 10^5$ N/mm^2.

P.T.O.

2. Attempt any TWO : **2 × 8 = 16**

(a) (i) State any four factors that govern 'factor of safety'.

(ii) Why taper is provided on cotter ? State recommended values of taper.

(b) Draw neat sketch showing the details of cotter joint. State strength equations for each component with suitable failure cross-sectional area.

(c) A belt pulley is fastened to a 90 mm diameter shaft running at 300 r.p.m. by means of a key 20 mm wide and 140 mm long. Allowable stress for the shaft and key material are 40 N/mm^2 in shear and 100 N/mm^2 in crushing. Find the power transmitted and the depth of the key required.

3. Attempt any FOUR : **4 × 4 = 16**

(a) State any four advantages of standardization.

(b) Draw a neat sketch of bell crank lever. Enlist steps in designing the bell crank lever.

(c) Prove that, for a square key, the permissible crushing stress is twice the permissible shear stress.

(d) Why a coupling should be placed as close to a bearing as possible ?

(e) Describe 'bolt of uniform strength' with neat sketch.

4. (a) Attempt any THREE : **3 × 4 = 12**

(i) Define Endurance limit and draw typical S-N curve for steel.

(ii) State the effect of key-way on the strength of shaft with suitable diagram.

(iii) State any four applications of spring.

(iv) State any four advantages and disadvantages of welded joints over riveted joints.

(b) Attempt any ONE : **1 × 6 = 6**

(i) Describe the importance of aesthetic considerations in design related to shape, colour and surface finish.

(ii) State any six design considerations while designing the spur gear.

5. Attempt any TWO : **2 × 8 = 16**

(a) A screw jack is used to lift a load of 50 kN through a maximum lift of 200 mm. The material used for a screw is steel of allowable stresses in tension and compression as 100 N/mm^2 and 50 N/mm^2 respectively. The pitch of screw is 8 mm. The nut is made of phosphor bronze with allowable stresses as 50 N/mm^2 and 45 N/mm^2 in tension and crushing. The allowable shear stress for nut material is 40 N/mm^2. The allowable bearing pressure between nut and screw is not to exceed 20 N/mm^2. If the coefficient of friction between screw and nut is 0.14, design the screw and nut.

(b) A railway wagon having 1500 kg mass and moving at 1 m/s velocity dashes against a bumper consisting of two helical springs of spring index 6. The springs, which get compressed by 150 mm while resisting a dash made of spring steel having allowable shear stress of 360 N/mm^2 and modulus of rigidity 8.4×10^4 N/mm^2. Design the helical coil spring with circular cross-section of spring wire.

(c) (i) Show that the efficiency of self locking screw is less than 50%.

(ii) State any four advantages of ball bearings over plain journal bearings.

6. Attempt any FOUR : **4 × 4 = 16**

(a) Draw a neat sketch of leaf spring of semi-elliptical type and name its parts.

(b) State two applications each of Acme thread and Square thread along with neat sketch.

(c) Determine the size of bolt in the cylinder head of a steam engine. The engine cylinder has a bore of 400 mm and the maximum steam pressure to which the cylinder is subjected is 1.5 N/mm^2. Cylinder head is held on the cylinder by 16 number of bolts. The permissible tensile stress for the bolt material is 25 N/mm^2.

(d) State any four disadvantages of rolling bearings as compared to journal bearings.

(e) State one application each of

(i) Deep groove ball bearing

(ii) Taper roller bearing

(iii) Thrust roller bearing

(iv) Needle roller bearing