

17610

16117

4 Hours / 100 Marks

Seat No.

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- 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 of the following: 12
- (i) What is stress concentration? State its significance in design of machine elements.
 - (ii) Write the design procedure of knuckle joint.
 - (iii) Draw a neat sketch of flexible flange coupling and label its main components.
 - (iv) Draw neat labeled sketches of Acme and square thread profile and state its relative characteristics.
- b) Attempt any ONE of the following: 6
- (i) State and explain main considerations in machine design.
 - (ii) A hollow shaft is required to transmit 50 kW power at 600 rpm. Calculate its inside and outside diameters if its ratio is 0.8. Consider yield strength of material as 380N/mm² and factor of safety as 4.

P.T.O.

- 2. Attempt any TWO of the following:** **16**
- a) Explain with the help of neat sketches three basic types of lever. State one application of each type.
 - b) Explain with the help of neat sketches, the design procedure of a square sunk key.
 - c) (i) State applications of maximum shear stress theory and principal normal stress theory.
(ii) State two applications each of cotter joint and knuckle joint.
- 3. Attempt any FOUR of the following:** **16**
- a) State the composition of the materials 30 Ni 16 Cr5, 40C8, FeE230 X15Cr25Ni 12
 - b) Design single cotter joint to transmit 200 kN. Allowable stresses for the material are 75 MPa in tension and 50 MPa in shear.
 - c) State the 'Lewis equation' for spur gear design. State SI unit of each term in the equation.
 - d) Explain why bolts of uniform strength are preferred. Draw sketches of two different types of bolts of uniform strength.
 - e) Prove that for a square key $\sigma_c = 2\tau$ where σ_c = crushing stress
 τ = shear stress.
- 4. a) Attempt any THREE of the following:** **12**
- (i) State four examples of ergonomic considerations in the design of a lathe machine.
 - (ii) Write the equation with Wahl's factor, used for design of helical coil spring. State the SI unit of each term in the equation.
 - (iii) State four important modes of gear failure.
 - (iv) State four disadvantages of screwed joints.

b) Attempt any ONE of the following:

6

- (i) Explain the design procedure of shaft on the basis of torsional rigidity. State the equation with SI units. State two applications of this approach.
- (ii) Draw S-N curve. Explain the concept of endurance limit and its need in design of machine elements.

5. Attempt any TWO of the following:

16

- a) A power screw on a machine has single start square thread with a non rotating bronze nut. Axial force on the screw is 15 kN. Allowable stresses for screw material in compression and shear are 85 MPa and 37 MPa respectively. Allowable bearing pressure for the screw nut pair is 5 MPa. Find
 - (i) Core diameter of screw
 - (ii) Length of the nut
 - (iii) Efficiency of power screw in coefficient of friction between screw and nut is 0.12.
 - (iv) Shear stresses in the threads of screw and nut.
- b) Design a helical compression spring with ground ends. The spring index is 12. Maximum load on the spring is 100N and deflection under maximum load is 15 mm. Allowable shear stress of the material is 100 MPa and modulus of rigidity is 4 MPa. Find wire and spring diameters, number of coils and stiffness of spring.
- c)
 - (i) State the steps involved in selection of a proper ball bearing from a manufacturer's catalogue.
 - (ii) State two engineering applications of each of Acme and Buttress thread profiles with neat sketches.

6. Attempt any FOUR of the following:**16**

- a) Derive strength equation for parallel fillet weld subjected to tensile load.
 - b) State two applications of leaf spring. Draw neat sketch of leaf spring.
 - c) A steam engine cylinder has effective diameter of 250 mm. It is subjected to maximum steam pressure of 1.5 MPa. The cylinder cover is fixed to the cylinder with the help of 12 bolts. The pitch circle diameter of bolts is 400 mm. Permissible tensile stress of the bolt material is 30 MPa. Determine nominal diameter of the bolts.
 - d) Differentiate between sliding contact and rolling contact type bearings.
 - e) A taper roller bearing has a dynamic load capacity of 26 kN. The desired life for 90% of the bearing is 8000 hr. and speed is 300 rpm. Calculate equivalent radial load that the bearing can carry.
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