11920

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 of the following : **12**

(i) Explain Factor Of Safety (FOS). Write four factors on which FOS depends.

(ii) Explain the purpose of turn buckle. State its application.

(iii) A shaft is required to transmit 1 MW power at 240 rpm. The shaft must not twist more than 1 degree on a length of one meter. If the modulus of rigidity for the material of shaft is 80 kN/mm^2. Find the diameter of shaft and shear stress induced on it.

(iv) Explain self locking and over-hauling of power screws.

(b) Attempt any ONE : **06**

(i) State & explain the steps involved in general design procedure.

(ii) A flange coupling is used to transmit 20 kW power at 700 rpm. The flanges are of cast iron and other parts are of mild steel. Determine diameter of shaft, diameter of bolts assuming number of bolts are 6 and flange dimension.

Take – (1) Shear stress for mild steel = 40 N/mm^2

(2) Shear stress for cast iron = 10 N/mm^2

(3) Tensile & crushing stress = 100 N/mm^2

2. Attempt any TWO of the following : **16**

(a) Design a knuckle joint to transmit 150 kN power. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression.

(b) Compare the weight, strength and stiffness of a hollow shaft of the same external diameter as that of solid shaft. The inside diameter of hollow shaft being half the external diameter. Both the shaft have the same material and length.

(c) (i) Define :

(1) Ductility (2) Stiffness (3) Elasticity (4) Malleability **4**

(ii) Draw a neat sketch of hand lever. Why levers are tapered at the ends ? **4**

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

(a) Suggest suitable material for the following machine parts :

(i) Crank shaft

(ii) Helical spring

(iii) Bushes for knuckle pin

(iv) Lathe bed

(b) Why taper is provided on cotter ? State its normal value. Write two application of cotter joint.

(c) Write design procedure for sunk key.

(d) Compare welded joints with screwed joint. (any four points)

(e) Explain the gear tooth failure modes : (i) scoring (ii) pitting

4. (a) Attempt any THREE of the following : **12**

(i) Define Ergonomics. State area covered under ergonomics.

(ii) Define following terms with respect to springs : (1) Free length (2) Solid length (3) Spring stiffness (4) Spring index

(iii) How the keys are classified ? State the function of keys.

(iv) State any four advantages & disadvantages of welded joint over riveted joint.

(b) Attempt any ONE of the following : **06**

(i) Write design consideration for spur gear.

(ii) Define endurance limit. Draw and explain typical S – N curve for steel.

5. Attempt any TWO of the following : **16**

(a) The lead screw of a lathe has square threads of 24 mm outside diameter and 5 mm pitch. In order to drive the tool carriage, the screw exerts an axial thrust of 2.5 kN find the efficiency of the screw and the power required to drive the screw if it is rotate at 30 rpm. Neglect the bearing friction. Assume co-efficient of thread friction as 0.12.

(b) Design a helical compression spring for maximum load of 800 N for a deflection of 25 mm. The spring index is 5 and Wahl's correction factor is 1.3. The maximum permissible shear stress for the spring wire is 400 MPa. and modulus of rigidity is 84 kN/mm^2.

(c) (i) Give classification of bearing. **4**

(ii) Draw different types of thread profiles used for power screw. Write one application of each. **4**

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

(a) A wall bracket is attached to a wall by means of four bolts, two at a distance of 50 mm from the lower edge and remaining two at a distance of 450 mm from the lower bolts. It supports a load of 50 kN at a distance of 500 mm from the wall. Find the diameter of bolts. Assume working stress in tension as 80 N/mm^2.

(b) Explain with neat sketch construction details of leaf spring.

(c) Explain with neat sketch the bolts of uniform strength.

(d) Explain the procedure of selection of ball bearing using manufacturer's catalogue.

(e) Define the following terms related to ball bearing :

(i) Basic static load rating

(ii) Basic dynamic load rating
