# 22564

**11920**

**4 Hours / 70 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. Attempt any FIVE of the following:** **10**

a) Define factor of safety for ductile and brittle material.

b) List four properties desirable for spring material.

c) List four applications of knuckle joint.

d) Name four types of keys.

e) List any four applications of power screw.

f) Classify springs.

g) Give four applications of gear drive.

**Marks**

**2. Attempt any THREE of the following:** **12**

a) Write the meaning of following material designation.

(i) 40C8

(ii) SG 700/2

(iii) Fe E200

(iv) X10Cr18Ni9

b) Explain failure of cotter in bending with suitable sketch and strength equation.

c) Write Lewis equation for strength of gear tooth. Give meaning of each term.

d) Draw freehand sketches of thread profiles (any four) with full details.

**3. Attempt any THREE of the following:** **12**

a) Explain maximum principal stress theory and maximum shear stress theory with their uses.

b) Write general design procedure of the bell crank lever. (any four steps)

c) State any four applications of spring.

d) Define stress concentration. Explain any four methods to reduce it with neat sketch.

e) Define the following terms with respect to spring:

(i) Free length

(ii) Solid length

(iii) Spring index

(iv) Spring rate

**Marks**

**4 Attempt any TWO of the following :** **12**

a) Explain importance of shape and size in aesthetic design.

b) The pull in the tie rod of a roof truss is 44 kN. Design a suitable adjustable screw joint. The permissible tensile and shear stresses are 75 MPa and 37.5 MPa respectively.

c) A lathe receives power from an overhung shaft situated exactly above the lathe pulley by meance of the belt drive. A pulley weighing 400 N and of diameter 270 mm is fixed on the shaft at a distance of 300 mm to the right of the left hand bearing. The centre to centre distance between the two shaft supporting bearing is 900 mm. The maximum power required by machine is 5 kW at 200 rpm. The belt tension ratio is 2.5. Determine the diameter of shaft.

Allowable shear stress for shaft material is 40 $N/mm^2$.

**5. Attempt any TWO of the following :** **12**

a) A flanged protective type coupling is required to transmit 7.5 KW at 720 r.p.m. Assume the following stresses for the coupling components.

Permissible shear stress for shaft, bolt and key material = 33 $N/mm^2$

Permissible crushing stress for bolt and key material = 60 $N/mm^2$

Find:

(i) Diameter of shaft

(ii) Dimensions of key

(iii) Diameter of bolt

b) The lead screw of lathe has Acme thread of 60 mm outside diameter and 8 mm pitch. It supplies drive to a tool carriage which need an axial force of 2000 N. A collar bearing with inner and outer radius as 30 mm and 60 mm respectively is provided. The coefficient of friction for the screw thread is 0.12 and for collar it is 0.10. Find the torque required to drive the screw and the efficiency of the screw.

c) State the steps involved in selection of proper ball bearing from manufacturer's catalogue.

**Marks**

**6. Attempt any TWO of the following :** **12**

a) A plate 75 mm wide and 12.5 mm thick is to be joined with another plate by single transverse and parallel fillet weld, Maximum tensile and shear stresses are 70 N/mm$^2$ and 56 N/mm$^2$ respectively. Find the length of each parallel fillet weld if joint is subjected to 90 kN.

b) Design helical compression spring for - maximum load of 1000 N for deflection of 25 mm using value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 kN/mm$^2$

Take Wahl's factor, $K = \frac{4c-1}{4c-4} + \frac{0.615}{c}$

Where c = spring index.

c) A hollow transmission shaft having inside diameter 0.6 times the outside diameter, is made of plain carbon steel 40C8 and having permissible shear stress equal to 65 MPa. A belt pulley, 1000 mm in diameter is mounted on the shaft, which overhangs the left hand bearing by 250 mm. The belts are vertical transmit power to the machine shaft below the pulley. The tension on tight and slack side of the belt are 3 kN and 1 kN respectively, while the weight of the pulley is 500 N. The angle of wrap of the belt on pulley is 180°. Calculate outside and inside diameter of the shaft.