266M311

Candidate's Seat No : _____

GUJARAT UNIVERSITY

B.E. Sem IV (Mech./Auto.) (New) Examination

Industrial Drafting & Machine Design

Thursday, 26th June, 2008] **[Time : 4 Hours Max. Marks : 100**

Instructions : (1) Attempt **all** questions.
(2) Answer to the two sections must be written in **separate** answer books.
(3) Figures to the right indicate **full** marks.
(4) Assume suitable additional data, if necessary.

SECTION I

1 (a) (i) How compressive stress, crushing stress and bearing stress (pressure) differs? Explain with the help of illustrative sketches. **18**

(ii) Define factor of safety. State the factors affecting its selection.

(b) 6 mm thick plates are joined by a single rivetted lap joint with 20 mm diameter rivets having a pitch of 50 mm. Design stress for plate in tension is 120 MPa. Rivets have shear stress of 90 MPa and crushing stress of 180 MPa. What is the load carrying capacity of joint ? What is the efficiency of joint ?

2 Design and draw a sketch of cotter joint (socket and spigot end type) to withstand a static load of 40 kN in tension or in compression. socket end, spigot end and cotter are made of mild steel having design stresses σ_t = 80 MPa, τ = 40 MPa, σ_{cr} = 100 MPa. **16**

OR

2 A bracket is fixed to a steel column by means of two rows of bolts. There are three bolts in each row. Bracket is subjected to a vertical load of 20 kN and due to load bracket is likely to tilt about lower edge of bracket . The distance of lower row of bolt from lower edge of bracket is 100 mm and that of upper row of bolt is 600 mm. Bolt axes are perpendicular to load. Find the size of bolt if design stresses for bolt material are $\sigma_t = 80$ N/mm^2 and $\tau = 40$ N/mm^2. Eccentricity of vertical load from steel column is 500 mm. What should be the thickness bracket near bolt if height of bracket is 500 mm. Design stress for bracket material $\sigma_t = 60$ N/mm^2. **16**

3 (a) Classify keys and coupling (only give names. Do not explain. Do not draw sketches). **16**

(b) Design and draw a sketch of flange coupling to transmit 50 kW power at 300 r.p.m. The design stresses are as under

For shafts, keys and bolts material : τ = 40 MPa, σ_{cr} = 100 MPa.

For C.I. flanges material : τ = 15 MPa, σ_{cr} = 100 MPa.

OR

3 (a) What is the difference among shaft, spindle and axle ? Explain with suitable illustrations. **16**

(b) Compare weight, strength (Torque T) and torsional stiffness (T/θ) of a hollow shaft of the same external diameter as that of solid shaft. The inside diameter of hollow shaft is half the external diameter. Both the shafts have the same material and length. Comment on the results.

SECTION II

4 (a) What is lever ? State its functions. State five applications of lever. **16**

(b) A lever loaded safety valve is 50 mm in diameter and is to be designed for a boiler to blow-off at a pressure of 2 MPa gauge. The distance of weight from fulcrum is 900 mm and of pin connecting valve is 100 mm. Design the rectangular cross section of lever (h = 4t) and pins at fulcrum and at valve made of mild steel having design stresses σ_t = 80 MPa, τ = 40 MPa, p_b = 25 MPa. Take length to diameter ratio for pins as 1.25.

]P.T.O.

5 (a) State functions of springs and give two applications for each function. **16**

(b) Design and draw (sketch) a compression helical valve spring for a petrol engine for following operating requirements.

Spring load when the valve is open	= 400 N
Spring load when the valve is closed	= 300 N
Inside diameter of spring	= 25 mm
Length of spring when the valve is open	= 40 mm
Length of the spring when the valve is closed	= 50 mm
Maximum permissible shear stress	= 400 MPa
Spring index	= 6
Modulus of rigidity of spring material	= 80×10^3 MPa

OR

5 (a) A truck spring has 12 leaves, two of which are full length leaves. The spring supports are 1050 mm apart and the central band is 90 mm wide. The central load is 6 kN. Maximum permissible stress for spring material is 280 MPa and modulus of elasticity of material is 210×10^3 MPa. Width of leaves is four times its thickness. Determine width, thickness and deflection of spring. **16**

(b) The maximum load on a petrol engine push rod of length 320 mm is 1500 N. Push rod is hollow having outer diameter 1.5 times inner diameter. Assume end conditions as both ends are hinged. Modulus of elasticity of push rod is 210×10^3 MPa. Find the size of push rod if factor of safety is 3. Use Euler's formula.

6 Draw a sketch of screw jack. Design screw, nut and handle of screw jack to lift a load of 60 kN through a height of 400 mm. Design stresses for screw material are σ_t = 80 MPa, σ_c = 100 MPa, τ = 40 MPa, σ_{br} = 18 MPa and σ_y = 200 MPa, E = 210×10^3 MPa. Design stresses for nut are σ_t = 50 MPa, σ_c = 45 MPa, τ = 30 MPa, σ_{br} = 18 MPa. Handle material has permissible tensile stress of 100 MPa. Take co-efficient of friction as 0.14. **18**

OR

6 (a) State merits and demerits of square thread and Acme (trapezoidal) thread for applications in power screws. **18**

(b) Draw sketch of C-clamp. How cross section of C can be found out ? Explain with necessary design equations.

(c) State the names of different components of toggle jack. Give the name of type of failure in which component will fail (For any two components).