

(03 Hours)

Total marks - 80

- N.B.:**
1. Question No 1 is **compulsory**
 2. Attempt any **Three** questions from the remaining five questions.
 3. Assume any **suitable data** if necessary with justification.
 4. Figures to the right indicate full marks.
 5. Use of design data books such as PSG, Mahadevan are permitted.
 6. Draw neat sketches to support your answer wherever necessary.

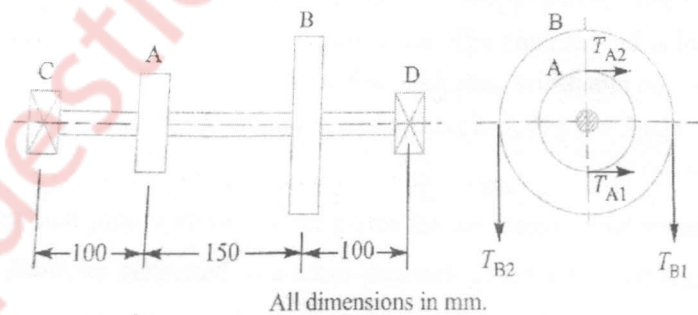


Q1. Attempt any **four** of the following questions. 20

- (a) Discuss factor of safety in detail.
- (b) Write a short note on bolts of uniform strength
- (c) Explain Aesthetic and ergonomic considerations in design.
- (d) Explain different modes of failure of riveted joint with appropriate sketches.
- (e) Explain different types of keys with its applications.

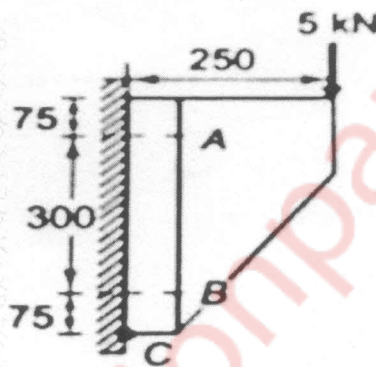
Q2. (a) The shaft as shown in figure driven by pulley B from an electric motor. Another belt drive from pulley A is running a compressor. The belt tensions for pulley A are 1500 N and 600 N. The ratio of belt tensions for pulley B is 3.5. The diameter of pulley A is 150 mm and the diameter of pulley B is 480 mm. Selecting suitable material and stresses determine the shaft diameter. 14

Take $K_b=2$ and $K_t=1.5$.



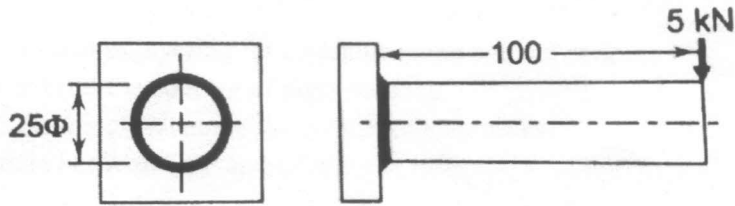
- (b) A cast iron cylinder of internal diameter 340 mm and thickness 40 mm is subjected to pressure of 6 N/mm^2 . Calculate the tangential and radial stresses at the inner, middle and outer surfaces of the cylinder. 06

- Q3. (a) Design a socket and spigot type of cotter joint to resist a tensile load of 50 kN. Take suitable material and stresses for different parts of the joint. 15
- (b) What is a spring index of a helical spring? Give its significance in the design of helical spring. 05
- Q4. (a) Selecting suitable material design a protected type of flange coupling to connect the output shaft of an electric motor to the shaft of centrifugal pump. The motor delivers a power of 20kW at 960 rpm. The overall torque for motor is 20 % of mean torque. 10
- (b) The bracket is fixed to the steel column by means of four identical bolts, two at A and two at B as shown in Figure. The maximum load that comes on the bracket is 5 kN acting vertically downward at a distance of 250 mm from the face of the column. The bolts are made of steel 40C8 ($S_{yt} = 380 \text{ N/mm}^2$) and the factor of safety is 5. Determine the size of the bolts on the basis of maximum principal stress theory. 10



- Q5. (a) A truck spring has 12 numbers of leaves 2 of which are full length leaves. The spring supports are 1m apart and the central band is 70 mm wide. The central load is to be 6 kN with permissible stress of 200 MPa. Determine the thickness, width and deflection of the spring leaves if the total depth to which ratio of spring is 3, use $E = 210 \text{ GPa}$. 10
- (b) Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm^2 . Assume joint efficiency as 75 %, allowable tensile stress in the plate 80 MPa, Compressive stress 130 MPa and shear stress in the rivet 55 MPa. 10

- Q6. (a) A circular shaft, 25 mm in diameter, is welded to a support by means of a fillet weld 10
 as shown in Figure. Determine the size of weld, if the permissible shear stress in the
 weld material is limited to 95 N/mm^2 .



(All Dimensions are in mm)

- (b) The parallel sides of the trapezoidal cross section of a crane hook of capacity 110KN 10
 are 75mm and 25 mm, the depth of section being 100mm. The radius of curvature of
 the inner fiber is 90mm. Determine the total stresses at the extreme fibers of the
 section.
