

Oct-22/TE/Insem-575

T.E. (Mechanical/Mechanical Sandwich)

DESIGN OF MACHINE ELEMENTS

(2019 Pattern) (Semester - I) (302043)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates :

- 1) Answer Q.1 or Q.2, Q.3 or Q.4.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

UNIT - I

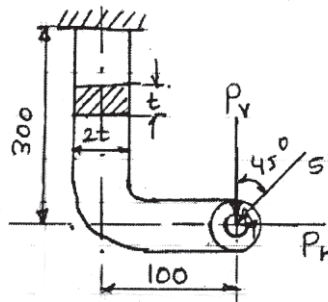
Q1) a) Design a cotter joint to connect two mild steel rods for a pull of 30 kN. The maximum permissible stresses in the tension are 55 MPa, in shear 40 MPa and in crushing 70 MPa. [8]

b) Design a Knuckle joint to transmit 150 kN for tensile stress 75 MPa, Crushing Stress 150 MPa, Shear stress 60 MPa. [7]

OR

Q2) a) The effective length of hand lever is 1 meter. The effective overhang from the nearest bearing is 150 mm. The lever and the shaft are made of alloy steel for which tensile for yield strength is 460 MPa. If the maximum force exerted at the handle is 300 N. Design the lever and the shaft with a $FOS = 4$. [8]

b) A frame is subjected to a force of 5 kN is as shown in figure. It is made by grey CI with permissible tensile stress is 55 N/mm^2 . Determine Dimensions of cross section of the bracket. Also find Direct and bending stress. [7]



P.T.O.

UNIT - II

Q3) a) A 15 kW, 960 rpm motor has a mild steel shaft of 40 mm diameter and 75 mm length. Take $\tau = 56 \text{ MPa}$ and $\sigma_t = 112 \text{ MPa}$. Design the keyway in the motor shaft extension. Also check shear strength of the key against normal strength of the shaft. [5]

b) A counter shaft with the bearings 800 mm apart receives 20 kW power at 500 rpm through a pulley 300 mm in diameter and mounted at an overhang of 200 mm. A 360 mm diameter pulley mounted midway span between two bearings. Both pulleys have vertically downwards belt tensions.

Take $\mu = 0.3$, $\theta = 180^\circ$, $FOS = 3$; $S_{ut} = 700 \frac{N}{\text{mm}^2}$, $S_{yt} = 460 \frac{N}{\text{mm}^2}$

Determine diameter of solid shaft. Also determine diameter of hollow shaft for above same data if diameter ratio of 0.6. Calculate ratio of weight of hollow shaft to solid shaft. Consider maximum shear stress theory of failure. [10]

OR

Q5) a) It is required to design a bushed-pin type of flexible coupling to connect a output shaft of electric motor to shaft of centrifugal pump. The motor drives 20 kW at 720 rpm. The overall torque is 50 percent more than rated / mean torque. Number of pins 6. Design a bushed type flexible coupling. Take;

For shaft material $S_{yt} = 380 \text{ (N/mm}^2\text{)}$, $FOS = 2$

For key material $S_{yt} = 400 \left(\frac{N}{\text{mm}^2} \right)$, $S_{yc} = 1.5, S_{yt}, FOS = 2$

For flange material $S_{ut} = 200 \text{ (N / mm}^2\text{)}$, $FOS = 6$

For Pin material $\tau = 35 \text{ (N/mm}^2\text{)}$, $\sigma_t = 200 \text{ (N/mm}^2\text{)}$ [10]

b) Explain the steps for design of muff or sleeve coupling. [5]

