

## Design of Machine elements

### Important questions

#### Unit I

1. Design a sleeve and cotter joint to transmit a tensile load of 60kN, assuming that all the parts are made of the same materials. The permissible stresses are  $60\text{N/mm}^2$  in tension,  $125\text{N/mm}^2$  in bearing and  $70\text{N/mm}^2$  in shear.
2. Design a sleeve and cotter joint to withstand a tensile load of 60kN. All parts of the joint are made of the same material and the permissible stresses are given below.  
 $f_t = 60\text{N/mm}^2$ ,  $f_c = 125\text{N/mm}^2$ ;  $f_s = 70\text{N/mm}^2$ .

#### Unit II

1. A line shaft is driven by an electrical motor placed vertically below it. The pulley on the line shaft is 1.5m in diameter. The belt tensions are 5.4kN and 1.8kN on the tight and slack sides of the belt respectively. Both these tensions may be assumed to be vertical. If the pulley be overhang from the shaft, the distance of the centre line of the pulley from the centre line of the bearing being 400mm, determine the diameter of the shaft. Assume maximum allowable shear stress as 42MPa.
2. Design a protective type flange coupling to connect two shafts to transmit 7.5kW at 720rpm. The permissible shear stress for the shaft, bolts and key materials is  $33\text{N/mm}^2$ , permissible crushing strength for bolt and key material is  $60\text{N/mm}^2$  and permissible shear stress for cast-iron is  $15\text{N/mm}^2$ .

#### Unit III

1. Select a flat belt from manufacturer's catalogue to transmit power of 15kW at 1200rpm. The speed of the driven pulley is 450rpm. Maximum centre distance between the shaft is 2m. Assume steady load.
2. Design a V-belt drive based on manufacturer's data to the following specifications:

Dia. Of driven pulley	=600mm
Dia. Of driving pulley	=200mm
Centre distance between pulleys	=1000mm(approx.)
Speed of driven pulley	=400rpm
Speed of driving pulley	=1200rpm
Power transmitted	=10kW
Service-heavy duty	=16 hours/day

#### Unit IV

1. A journal bearing is proposed for a centrifugal pump. The diameter of the journal is 150mm and the load on it 40kN and its speed is 900rpm. Design and give the complete calculations for the bearing.
2. A 80mm long journal bearing supports a load of 2800N on a 50mm diameter shaft. The bearing has a radial clearance of 0.05mm and the viscosity of the oil is 0.021kg/ms at the operating temperature. If the bearing is capable of dissipating 80J/s, determine the maximum safe speed.

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**Unit V**

1. Design a hand lever of rectangular section subjected to a maximum load of 250N at the end of moment arms of 1.2m. The thickness of the lever is constant and is equal to 0.375 times the width of lever near the boss. Permissible shear stress for the shaft material is  $40\text{N/mm}^2$  and permissible bending stress for the lever material is  $80\text{N/mm}^2$ .
2. A pinion runs at 600rpm drives a gear at a speed ratio of 4:1. Allowable static stress of pinion and gear material is  $85\text{N/mm}^2$ . Pinion has 16 teeth of module 8mm. Teeth are  $20^\circ$  FD system. Face width is 90mm. Find the power transmitted.