

2123  
B.E. (Mechanical Engineering)  
Fifth Semester  
MEC-501: Design of Machine Elements - I

Time allowed: 3 Hours

Max. Marks: 50

*NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit. Design Data Handbook is NOT allowed. However, if the paper is online then design data handbook can be used. Assume suitably the missing data, if any. Supplement your answer with neat and labeled sketches wherever required.*

x-x-x

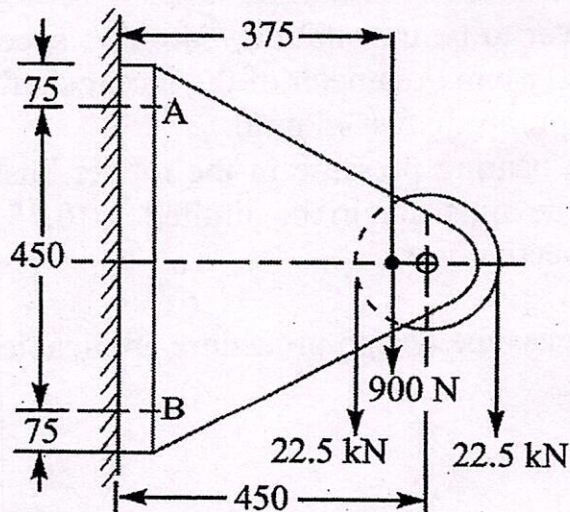
- I
- (i) How do you classify materials for engineering use?
  - (ii) Define the terms load, stress and strain. Discuss the various types of stresses and strain.
  - (iii) Distinguish clearly between direct stress and bending stress.
  - (iv) What information do you obtain from Soderberg diagram?
  - (v) Sketch and describe the Lozenge joint.

(5x2)

UNIT - I

- II
- Design a foot brake lever from the following data:  
Length of lever from the centre of gravity of the spindle to the point of application of load = 1 m  
Maximum load on the foot plate = 800 N  
Overhang from the nearest bearing = 100 mm  
Permissible tensile and shear stress = 70 MPa

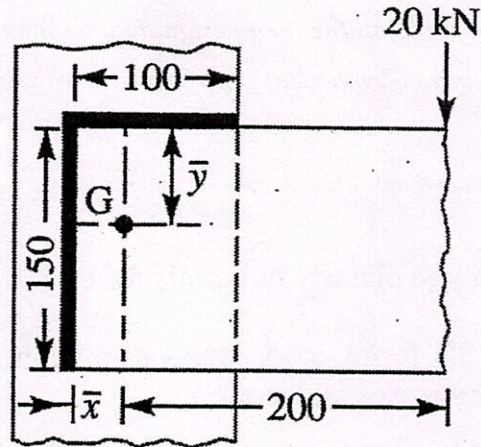
- III
- A pulley bracket, as shown next, is supported by 4 bolts, two at A-A and two at B-B. Design the bolts using an allowable shear stress of 25 MPa for the material of the bolts.



All dimensions in mm.

(2)

- IV Next figure shows a welded joint subjected to an eccentric load of 20 kN. The welding is only on one side. Design the weld on the entire length of two legs. Take permissible shear stress for the weld material as 80 MPa.



All dimensions in mm.

(2x10)

UNIT - II

- V A machine shaft, supported on bearings having their centres 750 mm apart, transmitted 185 kW at 600 r.p.m. A gear of 200 mm and  $20^\circ$  tooth profile is located 250 mm to the right of left hand bearing and a 450 mm diameter pulley is mounted at 200 mm to right of right-hand bearing. The gear is driven by a pinion with a downward tangential force while the pulley drives a horizontal belt having  $180^\circ$  angle of contact. The pulley weighs 1000 N and tension ratio is 3. Design the shaft system, if the allowable shear stress of the material is 63 MPa.
- VI Design a bushed-pin type flexible coupling for connecting a motor shaft to a pump shaft for the following service conditions:  
 Power to be transmitted = 40 kW; speed of the motor shaft = 1000 r.p.m.; diameter of the motor shaft = 50 mm; diameter of the pump shaft = 45 mm.  
 The bearing pressure in the rubber bush and allowable stress in the pins are to be limited to  $0.45 \text{ N/mm}^2$  and 25 MPa respectively.
- VII Discuss the design procedure applicable for designing a screw jack.

(2x10)