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Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, May 2016
(2013 Scheme)
Branch : Mechanical Engineering
13.605 : DESIGN OF MACHINE ELEMENTS – I (M)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions; **each** carries **4** marks. **(4×5=20 Marks)**

1. Write short note on maximum shear stress theory.
2. Write a note on the influence of various factors of the endurance limit of a ductile material.
3. Explain different types of keys.
4. Explain the advantages and disadvantages of welded joints over riveted joints.
5. Explain nipping in leaf springs.

PART – B

Answer **any one** question from **each** Module, **each** carries **20** marks. **(4×20=80 Marks)**

Module – I

6. The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of bolt required according to 1) Maximum principal stress theory 2) Maximum shear stress theory 3) Maximum principal strain theory 4) Maximum strain energy theory 5) Maximum distortion energy theory. Take permissible tensile stress at elastic limit = 100 MPa and Poisson's ratio = 0.3.
7. A circular bar of 500 mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50 kN. Determine the diameter of bar by taking a factor of safety of 1.5, size effect of 0.85, surface finish factor of 0.9. The material properties of bar are given by : ultimate strength of 650 MPa, yield strength of 500 MPa and endurance strength of 350 MPa.

P.T.O.

Module – II

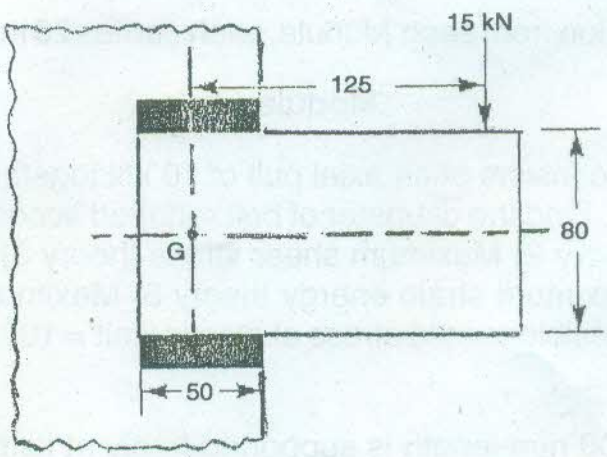
8. A shaft is supported by two bearings placed 1 m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. Determine the suitable diameter for a solid shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley.

9. Design a cast iron protective type flange coupling to transmit 15 kW at 900 rpm from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used. Shear stress for shaft, bolt and key material = 40 MPa; Crushing stress for bolt and key = 80 MPa; Shear stress for cast iron = 8 MPa. Draw a neat sketch of the coupling.

Module – III

10. Two lengths of mild steel tie rod having width 200 mm and thickness 12.5 mm are to be connected by means of a butt joint with double cover plates. Design the joint if the permissible stresses are 80 MPa in tension, 65 MPa in shear and 160 MPa in crushing. Make a sketch of a joint.

11. A bracket carrying a load of 15 kN is to be welded as shown in Fig. 1. Find the size of weld required if the allowable shear stress is not to exceed 80 MPa.



All dimensions are in mm

Fig. 1

Module – IV

12. Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity G = 84 kN/mm^2. Neglect the effect of stress concentration. Draw a fully dimensioned sketch of the spring, showing details of the finish of the end coils.

13. Design a leaf spring for the following specifications : Total load = 140 kN, Number of springs supporting the load = 4, Maximum number of leaves = 10, Span of the spring = 1000 mm, Permissible deflection = 80 mm. Take Young's Modulus, E = 200 kN/mm^2 and allowable stress in spring material as 600 MPa.