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Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, June 2017
(2013 Scheme)
13.605 : DESIGN OF MACHINE ELEMENTS – I (M)

Time : 3 Hours Max. Marks :100

PART – A

Answer **all** questions; **each** carries **4** marks :

1. Write short note on maximum strain energy theory.
2. Write Soderberg's equation and state its applications to different types of loadings.
3. Explain the design of hollow shafts subjected to twisting moment only.
4. Discuss the standard location of elements of a welding symbol.
5. Explain different types of springs. **(5×4=20 Marks)**

PART – B

Answer **any one** question from **each** Module; **each** carries **20** marks :

Module – I

6. A mild steel shaft of 50 mm diameter is subjected to a bending moment of 2000 Nm and a Torque T. If the yield point of the steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the shaft according to :
   1) The maximum principal stress
   2) The maximum shear stress
   3) The maximum distortion strain energy theory of yielding.
7. A machine component is subjected to a flexural stress which fluctuates between +300 MN/m^2 and –150 MN/m^2. Determine the value of minimum ultimate strength according to :
   1) Gerber relation
   2) Modified Goodman relation
   3) Soderberg relation.

   Take yield strength = 0.55 Ultimate strength; Endurance strength = 0.5 Ultimate strength and factor of safety = 2.

P.T.O.

Module – II

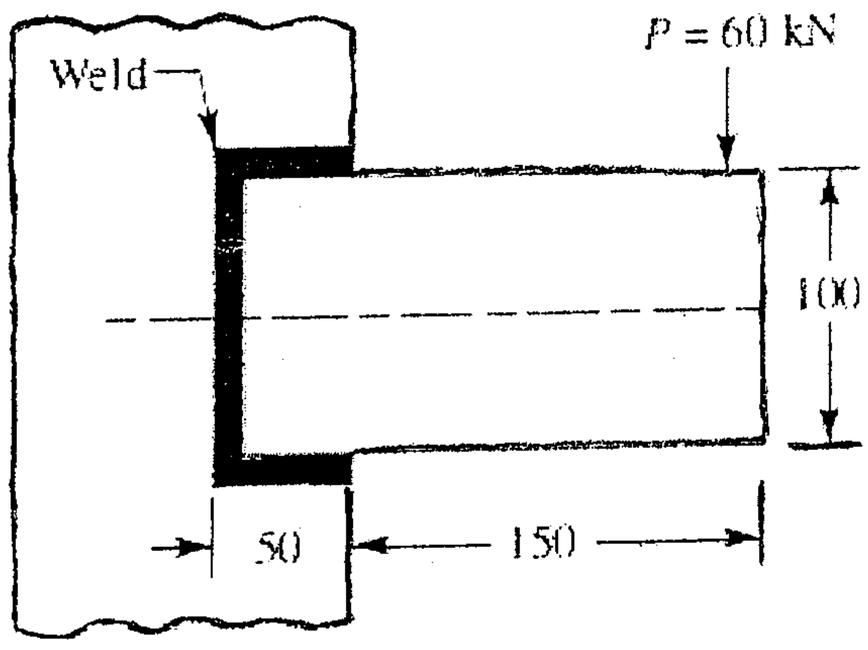
8. A steel solid shaft transmitting 15 k W at 200 rpm is supported on two bearings 750 mm apart and has two gears keyed to it. The pinion having 30 teeth of 5 mm module is located 100 mm to the left of the right hand bearing and delivers power horizontally to the right. The gear having 100 teeth of 5 mm module is located 150 mm to the right of the left hand bearing and receives power in a vertical direction from below. Using an allowable stress of 54 MPa in shear, determine the diameter of the shaft.

9. Design and draw a cast iron flange coupling for a mild steel shaft transmitting 90 kW at 250 rpm. The allowable shear stress in the shaft is 40 MPa and the angle of twist is not to exceed 1° in a length of 20 diameters. The allowable shear stress in the coupling bolts is 30 MPa.

Module – III

10. 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 90 MPa, compressive stress 140 MPa and shear stress in the rivet 56 MPa.

11. A rectangular steel plate is welded as a cantilever to a vertical column and supports a single concentrated load P, as shown in Fig. 1. Determine the weld size if shear stress in the same is not to exceed 140 MPa.



All dimensions are in mm

Fig. 1

Module – IV

12. Design and draw a valve spring of a petrol engine for the following operating conditions. Spring Load when the valve is open = 400 N, spring load when the valve is closed = 250 N, Maximum inside diameter of spring = 25 mm, Length of the spring when the valve is open = 40 mm, Length of the spring when the valve is open = 50 mm, Maximum permissible shear stress = 400 MPa.

13. A truck spring has 12 number of leaves, two of which are full length leaves. The spring supports are 1.05 m apart and the central band is 85 mm wide. The central load is to be 5.4 kN with a permissible stress of 280 MPa. Determine the thickness and width of the steel spring leaves. The ratio of the total depth to the width of the spring is 3. Also determine the deflection of the spring.