B – 5948

(Pages : 3)

Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, April 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. What is factor of safety ? And mention the various factors to be considered while selecting the factor of safety.
2. State and explain briefly any two theories of failure.
3. Prove that a square key is equally strong in shear and crushing.
4. What is stress concentration ? Explain briefly any two causes and remedies for stress concentration.
5. What are the modes of failure of riveted joints ? Explain with neat sketches.

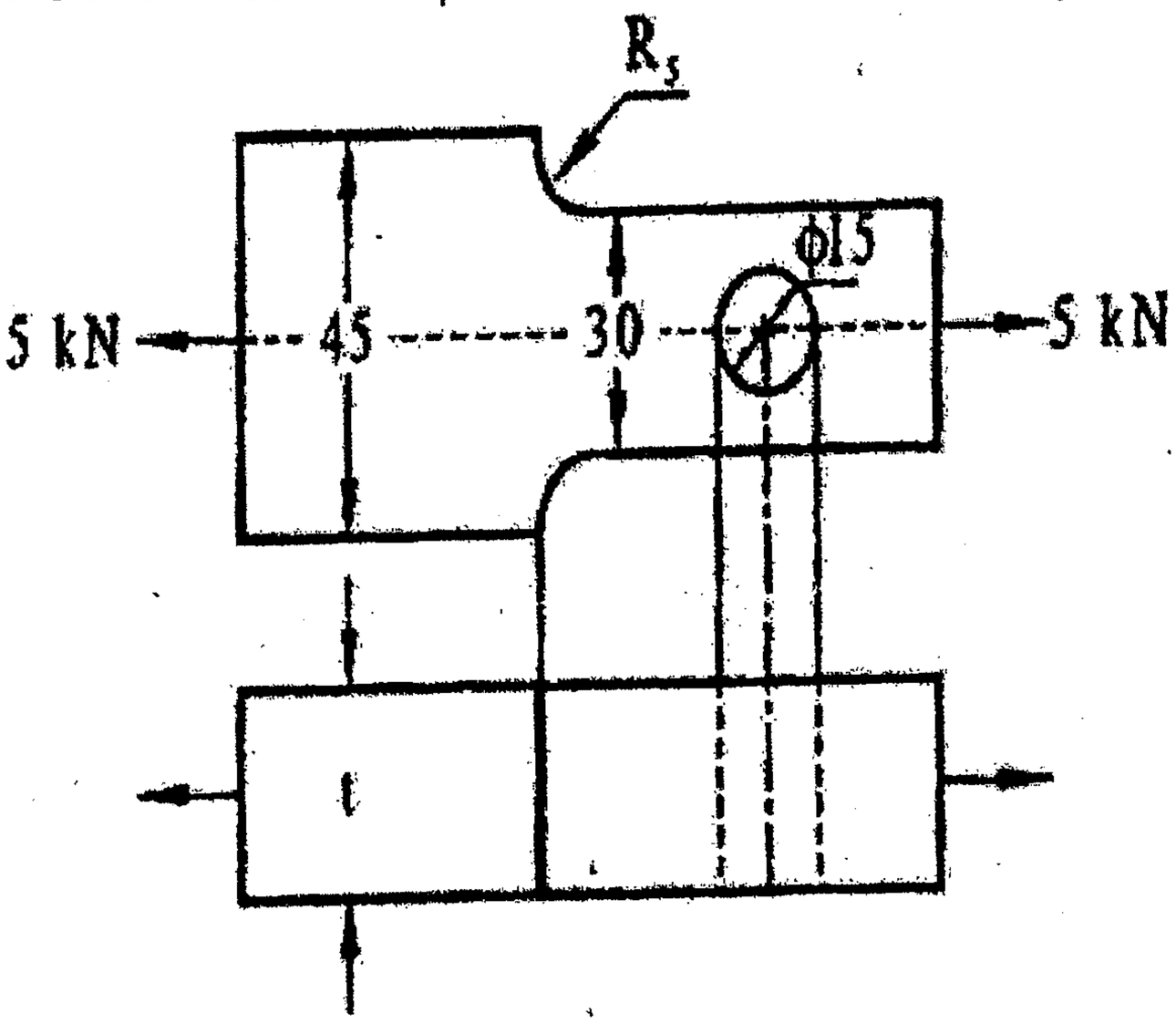
(5×4=20 Marks)

PART – B

Answer **one full** question from **each** Module, **each** carries **20** marks :

MODULE – I

6. a) A flat plate subjected to a tensile force of 5 kN is shown in Fig. The material is grey cast iron having an ultimate tensile strength of 200 MPa. Determine the thickness of the plate and take factor of safety as 2.5. **14**



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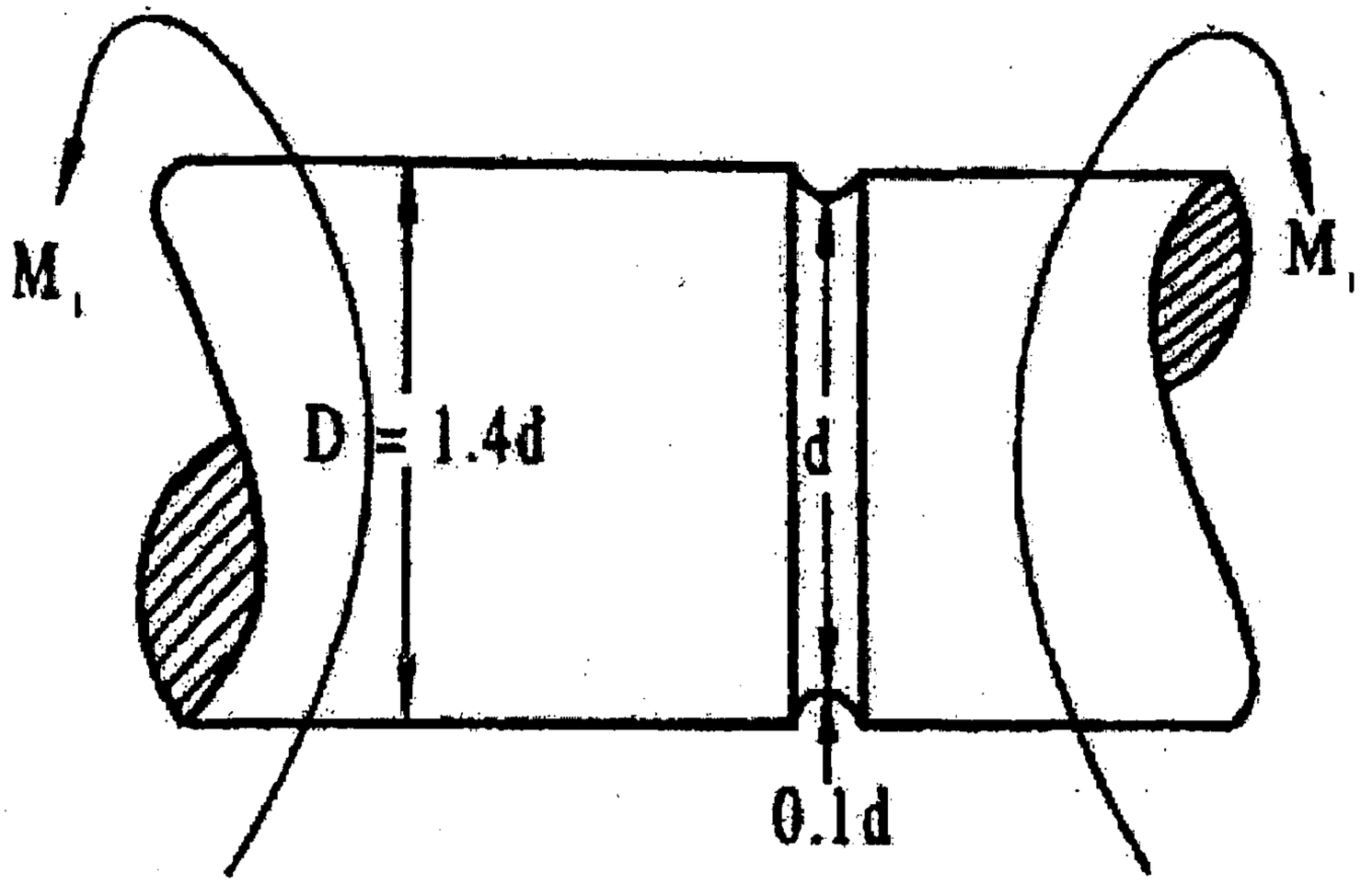
b) A grooved shaft shown in Fig. is to transmit 5 kW at 120 rpm. Determine diameter of shaft taking σ_u = 460 MPa and factor of safety 2.5. **6**



7. A shaft of circular section is subjected to a turning moment that fluctuates between 800 kNm and 600 kMm and also a bending moment that fluctuates between + 500 kNm and – 300 kNm. The material selected for the shaft has a shear stress value of 100 MPa at endurance limit and shear stress value of 120 MPa at the yield point. Determine the diameter of the solid circular shaft taking a value of 2.5 for the factor of safety. Surface factor, size factor and load factor can be taken as 0.9, 0.85 and 1 respectively. Shear stress concentration factor is 1.8 and the notch sensitivity is 0.95. **20**

MODULE – II

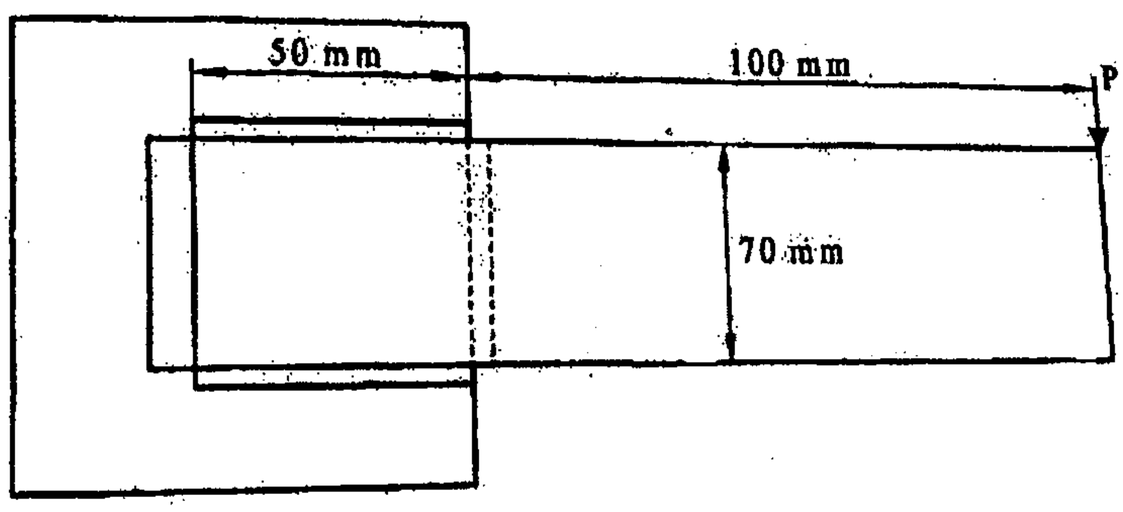
8. A solid steel shaft running at 600 rpm is supported on bearings 600 mm apart. The shaft receives 40 kW through a 400 mm diameter pulley weighing 400 N located 300 mm to the right of the left bearing by a vertical flat belt drive. The power is transmitted from the shaft through another pulley of diameter 600 mm weighing 600 N located 200 mm to the right of right bearing. The belt drives are at right angle to each other and ratio of belt tension is 3. Determine the size of shaft necessary if the allowable shear stress in the shaft material is 40 MPa and the load are steady. **20**

9. Design a protected type flange coupling to transmit power between two shafts of 40 mm diameter. The allowable shear stress for the shaft is taken as 50 N/mm^2 and allowable shear stress for bolt and key may be taken as 45 N/mm^2. Allowable crushing stress for the key is 120 N/mm^2 and allowable shear stress for the flange is 10 N/mm^2. **20**

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 1 MPa. Assume the joint efficiency of 75%, allowable tensile stress in plate 83 MPa; compressive stress 138 MPa and shear stress in rivet 55 MPa. **20**

11. A bracket supporting a load P = 3000 N is welded to a vertical member by four fillet welds as shown in fig. Calculate the size of the weld if the stress in the throat section is not to exceed 85 MPa.



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MODULE – IV

12. Design a 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, permissible shear stress of 420 MPa and modulus of rigidity of 84 kN/mm^2. **20**

13. A truck spring has 12 number of leaves, 2 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 5400 N with a permissible stress of 0.28 GPa. The ratio of total depth to width of spring is 3 and modulus of elasticity = 210 GPa. Determine

a) Thickness and width of steel spring

b) Maximum deflection. **20**