(Pages : 4) **E – 1950**

Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, May 2018
(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. Explain briefly the factors influencing the selection of Material for the design of Machine elements.

2. What do you mean by principal planes and principal stresses ? Write the expressions of the same for a 2-D element.

3. Derive Soderberg's equation for a member subjected to fatigue loading.

4. Obtain expressions for breadth and thickness of a rectangular parallel key based on strength.

5. Explain any four weld defects briefly. **(5×4=20 Marks)**

PART – B

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

Module – 1

6. a) A mild steel shaft of 60 mm diameter is subjected to a bending moment of 25×10^5 N-mm and torque M_t. If the yield point of steel in tension is 230 N/mm^2, find the maximum value of this torque without causing yielding of the shaft according to

   i) Maximum principal stress theory of failure.

   ii) Maximum shear stress theory of failure.

   iii) Maximum distortion energy theory of failure. Adopt a factor of safety of 1.5. **8**

b) A beam of SAE 2320 steel oil quenched (σ_u = 516.8 Mpa, σ_{-1} = 316.8 Mpa) is subjected to a load causing a bending stress of 200 N/mm^2. Find the factor of safety if,

i) The stress is varying between –150 N/mm^2 and 200 N/mm^2 with stress concentration factor 1.2.

ii) The stress is completely reversed.

Take load and size correction coefficients as 1 and 0.9 respectively. **12**

7. A round rod of diameter 1.2 d is reduced to a diameter d with a fillet radius of 0.1 d. This stepped rod is to sustain a twisting moment that fluctuates between + 2.5 kN-m and + 1.5 kN-m together with a bending moment that fluctuates between + 1kN-m and – 1 kN-m. The rod is made of carbon steel C40 (σ_y = 328.6 MPa, σ_u = 620 MPa). Determine a suitable value for 'd'. **20**

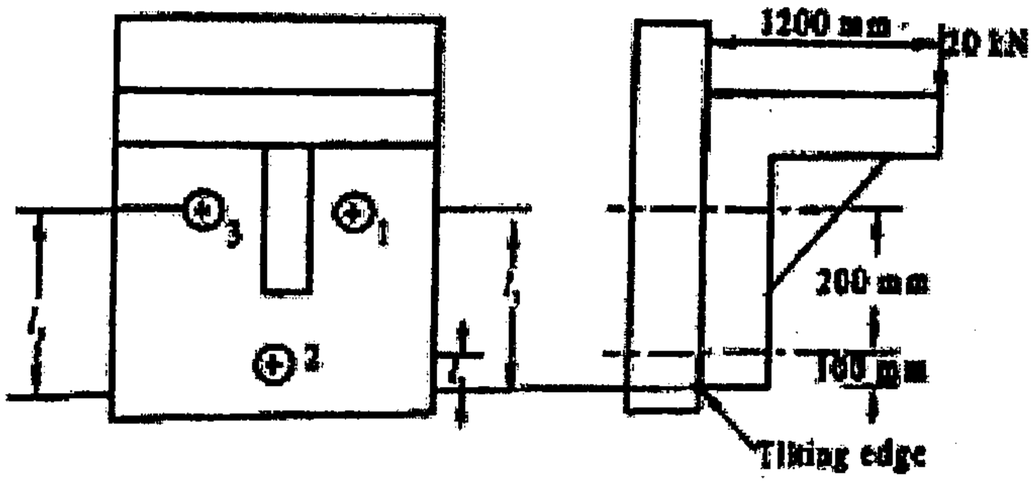
Module – 2

8. A horizontal piece of commercial shafting is supported by two bearings 1.5 m apart. A keyed gear 20° involute and 175 mm in diameter is located 400 mm to the left of the right bearing and is driven by a gear directly behind it. A 600 mm diameter pulley is keyed to the shaft 600 mm to the right of the left bearing and drives a pulley with a horizontal belt directly behind it. The tension ratio of the belt is 3 to 1, with the slack side on top. The drive transmits 45 kW at 330 rpm. Take k_b= K_t = 1.5. Calculate the necessary diameter of the shaft. Use allowable shear stress as 40 MPa. **20**

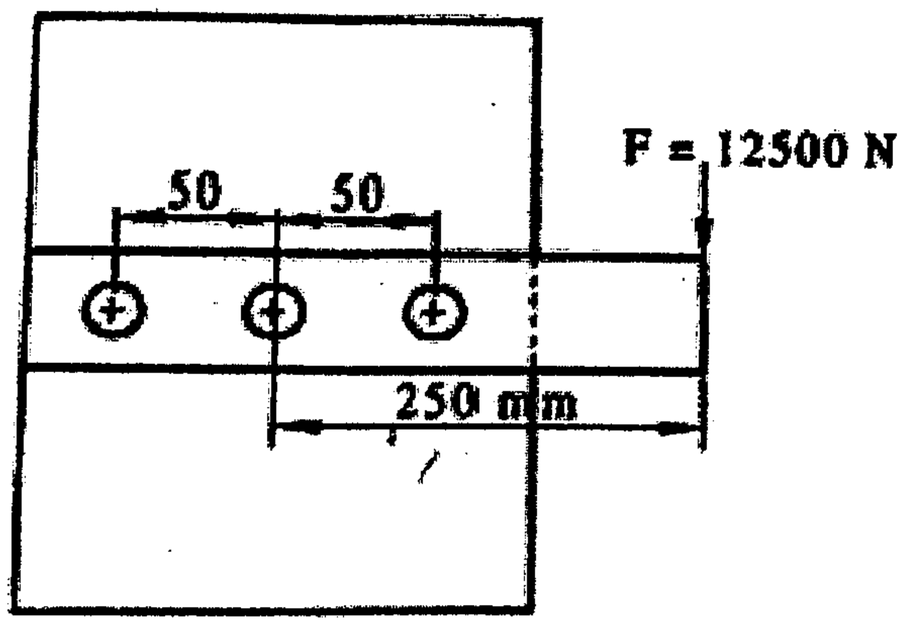
9. Design a cast iron flange coupling for a steel shaft transmitting 30 kW at 200 rpm. The allowable shear stress in the shaft and key material is 40 MPa. The maximum torque transmitted to be 20% greater than the full load torque. The allowable shear stress in the bolt is 60 Mpa and the allowable shear stress in the flange is 40 Mpa. **20**

Module – 3

10. a) Determine the diameter of rivet for a bracket riveted as shown in fig. below. The allowable normal and shear stresses are 120 N/mm² and 60 N/mm² respectively. **12**

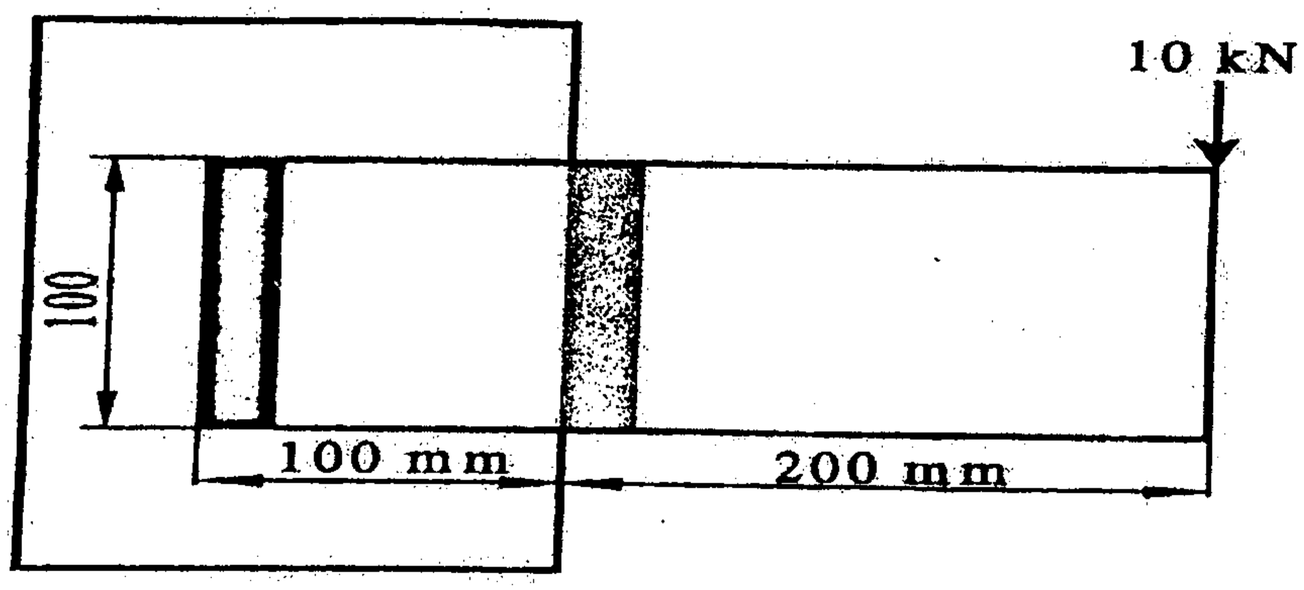


b) Find the diameter of the rivet shown in fig. below. The maximum shearing stress in the most heavily loaded rivet is 56 N/mm². **8**



11. a) A plate of 80 mm wide and 10 mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50 kN. Find the length of the weld so that maximum stress does not exceed 50 N/mm². Consider the joint under static loading and then under dynamic loading. **8**

b) A welded connection is shown in fig. below, if the allowable stress is 100 MPa determine the size of the weld. **12**



Module – 4

12. The spring loaded safety valve for a boiler is required to blow off at a pressure of 1.3 MPa. The diameter of the valve is 65 mm and the maximum lift of the valve is 17.5 mm. Design a suitable compression spring for the valve, assuming spring index to be 6 and providing initial compression of 30 mm. Take T = 0.45 GPa and G = 84 GPa. **20**
13. Design a leaf spring for the following specifications for a truck. Total load = 120 kN. Number of springs = 4. Material for spring is Chrome-Vanadium steel. Permissible stress is 0.55 GPa. Span of spring =1100 mm. Width of central band = 100 mm and allowable deflection = 80 mm. Number of full length leaves are 2 and graduated leaves 6. **20**