BT–MRE–VI-05.19-0878 Reg. No. | | | | | | | | |

A

B.Tech. Degree VI Semester Examination in Marine Engineering
May 2019

MRE 1606 MACHINE DESIGN AND DRAWING

(2013 Scheme)

(Machine design data book is permitted)

Time : 3 Hours Maximum Marks : 100

(5 × 20 = 100)

I. (a) Define any five mechanical properties of engineering materials. (10)

(b) Briefly explain the heat treatment process of steel. (10)

OR

II. (a) Define any five basic requirements of machine elements. (10)

(b) Draw a flow chart and explain the basic procedure of machine design. (10)

III. (a) Write short notes on the following: (10)

(i) Notch sensitivity

(ii) Reliability

(b) A grey cast iron FG 200 flat plate is subjected to a tensile force of 5 kN as shown in the fig. 1. Determine the thickness of the plate for a factor of safety of 2. (10)

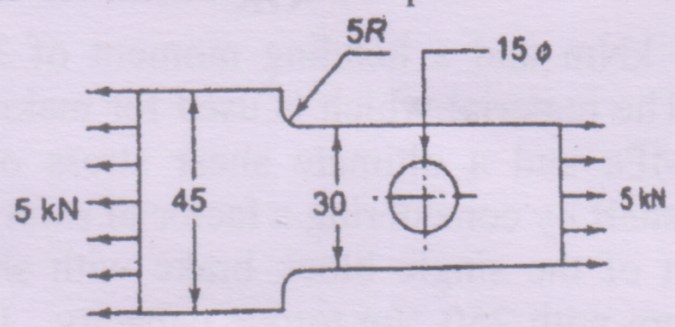

Figure 1: A flat plate subjected to tensile force

OR

IV. (a) Write short notes on the following: (10)

(i) Endurance limit

(ii) Stress concentration

(b) A 20 C8 steel plate ($S_{ut} = 440\ N/mm^2$) in hot rolled and normalized condition is shown in the fig 2. It is subjected to a completely reversed axial load of 30 kN. The notch sensitivity factor is 0.8 and the expected reliability is 90%. Factor of safety is 2. The size factor is 0.85. Determine the plate thickness for infinite life. (10)

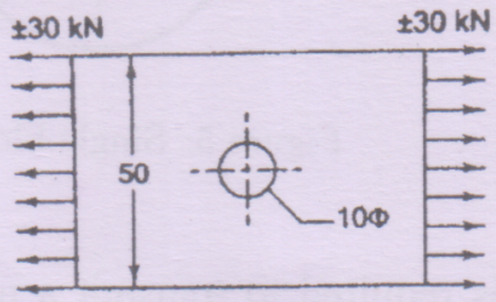

Figure 2: A flat plate subjected to reversed load

OR

V. Determine the weld size of the rectangular steel plate welded as a cantilever as shown in the fig. 3, if shear stress is not to exceed 140 MPa. (20)

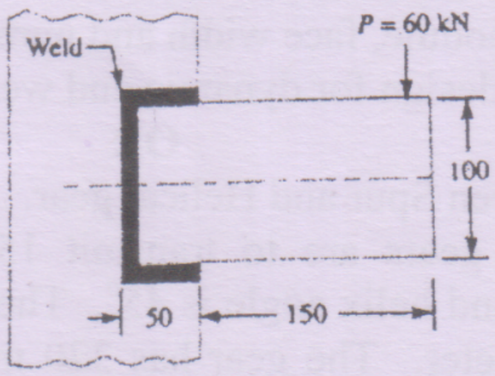

Figure 3: welded joint

OR

(P.T.O.)

VI. The four equal rivets of 20 mm diameter is riveted as shown in the fig. 4. Calculate the value of P for the joint based on a working shear stress of 100 MPa for the rivets. (20)

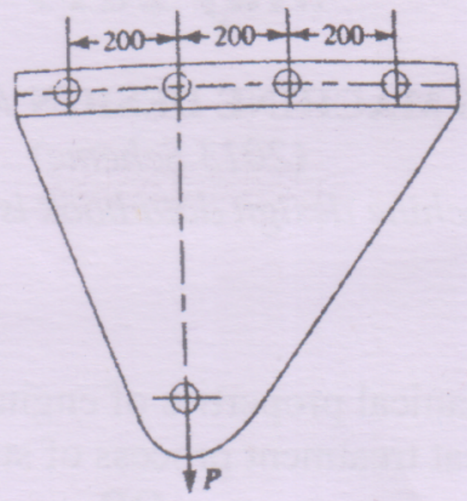

Figure 4: Riveted joint

VII. (a) Differentiate between Slip and Creep of the belt. (6)

(b) A multi-disc clutch has 3 discs on the driving shaft and 2 discs on the driven shaft. The inside diameter of the contact surface is 120 mm and the maximum pressure between the surface is limited to 0.1 N/mm^2. Assume uniform wear theory, design a multi-disc clutch for transmitting 25 kW at 1575 rpm. (14)

OR

VIII. (a) A torque of 10 kNm and a bending moment of 3 kNm is applied on a solid circular shaft. The material which is used for making shaft have ultimate tensile stress of 700 MPa and a ultimate shear stress of 500 MPa. Determine the diameter of the shaft by considering a factor of safety of 6. (10)

(b) The brake drum of the single block brake with short shoe shown in the Fig.5 rotates at 100 rpm with 250 Nm torque capacity. If the coefficient of friction is 0.35, then calculate the actuating force and hinge reaction for the clockwise rotation of the drum. (10)

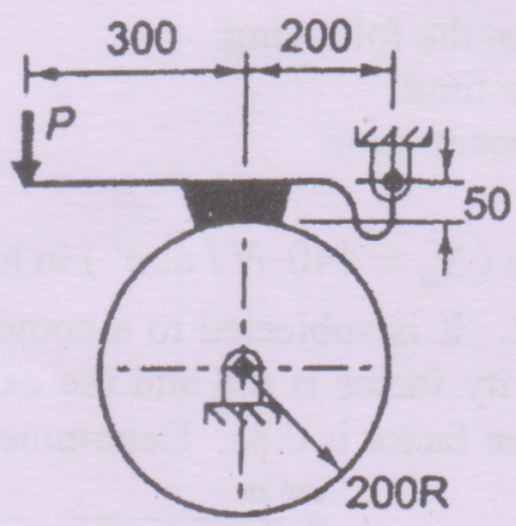

Figure 5: Single block brake

IX. A spur gear drive is required to transmit a maximum power of 22.5 kW. The velocity ratio is 1:2 and speed of the pinion is 200 r.p.m. The approximate centre to centre distance between the shafts are 600 mm. The teeth has 20° stub involute profiles. The static stress for the gear material (cast iron) may be taken as 60 MPa. The dynamic factor in the Buckingham equation can be taken as 80 and material combination factor for the wear as 1.4. (20)

(i) Find the module, face width and number of teeth on each gear.

(ii) Check the design for dynamic and wear loads.

OR

X. (a) Differentiate between Spur and Helical gear. (6)

(b) A pair of helical gears are to transmit 15 kW. The teeth are 20° stub in diametrical plane and helix angle is 45°. The pinion runs at 10000 r.p.m and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable strength of 100 MPa. Determine suitable module and face width. (14)

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