BT MRE–VI(R/S)–04.21–0540 Reg. No. | | | | | | | | | |

A

B.Tech. Degree VI Semester Regular / Supplementary Examination in Marine Engineering April 2021

MRE 1606 MACHINE DESIGN AND DRAWING

(2013 Scheme)

Time: 3 Hours Maximum Marks: 100

(5 × 20 = 100)

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

(b) What are the important manufacturing considerations in design of castings and forgings? (10)

OR

II. (a) What is BIS system of designation of steels? Using the following chemical composition, designate the steel. Take the multiplying factor for both elements is 4. (10)

Carbon = 0.12–0.20%

Silicon = 0.15–0.35%

Manganese = 0.60–1.00%

Nickel = 0.60–1.00%

Chromium = 0.40–0.80%

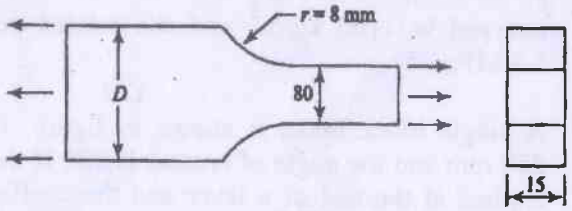
(b) Define machine design. Explain in detail the basic procedure of machine design. (10)

III. (a) (i) Define stress concentration factor. (10)

(ii) Write down the causes of stress concentrations.

(iii) What are the methods of reducing stress concentration?

(b) The load on the plate shown in the figure varies from 50,000 to 100,000 N. S_u = 480 Mpa, S_e= 240 Mpa, K_a = 0.67, K_b= 0.85, K_c correction factor for type of loading = 0.7, q = 0.95. Find the maximum value of D, F.S = 2. (10)



OR

IV. (a) (i) Define fatigue. (10)

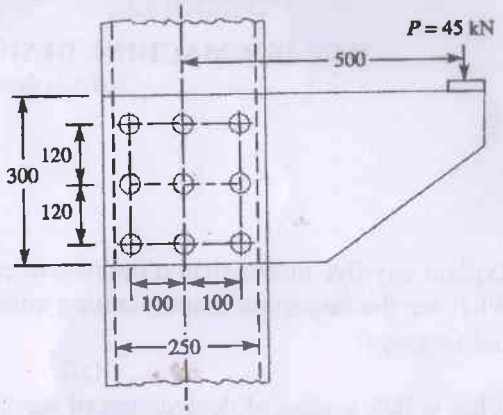
(ii) Write down the factors influencing fatigue.

(iii) Mention fatigue stress concentration factor.

(b) Determine the diameter of a circular rod made of ductile material with a fatigue strength (complete stress reversal), σ_e = 265 MPa and a tensile yield strength of 350 MPa. The member is subjected to a varying axial load from $W_{min} = -300 \times 10^3$ N to $W_{max} = 700 \times 10^3$ N and has a stress concentration factor = 1.8. Use factor of safety as 2.0. (10)

(P.T.O.)

V. The bracket as shown in Figure is to carry a load of 45 kN. Determine the size of the rivet if the shear stress is not to exceed 40 MPa. Assume all rivets of the same size (20)



OR

VI. (a) With neat sketches explain the strength of a transverse fillet weld, parallel fillet weld, and their combination. (10)

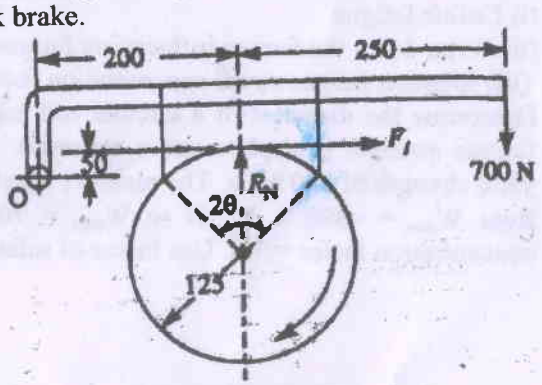
(b) A rectangular cross-section bar is welded to a support by means of fillet welds as shown in Figure. Determine the size of the welds, if the permissible shear stress in the weld is limited to 75 MPa. (10)

VII. (a) Find the diameter of a solid steel shaft to transmit 20 KW at 200 r.p.m. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 8. If a hollow shaft is to be need in place of the solid shaft, find the inside and outside diameter when the ratio of inside to outside diameters is 0.5. (10)

(b) A flat belt is required to transmit 30 KW from a pulley of 1.5 m effective diameter running at 300 r.p.m. The angle of contact is spread over 11/24 of the circumference. The coefficient of friction between the belt and pulley surface is 0.3. Determine, taking centrifugal tension into account, width of the belt required. It is given that the belt thickness is 9.5 mm, density of its material is 1100 kg/m^3 and the related permissible working stress is 2.5 MPa. (10)

OR

VIII. (a) A single block brake is shown in figure. The diameter of the drum is 250 mm and the angle of contact is 90°. If the operating force of 700 N is applied at the end of a lever and the coefficient of friction between the drum and the lining is 0.35, determine the torque that may be transmitted by the block brake. (10)



All dimensions in mm.

(Continued to 3)

(b) A plate clutch having a single driving plate with contact surfaces on each side is required to transmit 110 KW at 1250 r.p.m. The outer diameter of the contact surface is to be 300 mm. The coefficient of friction is 0.4. Assuming a uniform pressure of 0.17 N/mm^2; determine the inner diameter of the friction surfaces. (10)

IX. (a) With a neat sketch of a spur gear tooth, show the various loads acting on it and derive an expression for the beam strength of the gear. (5)

(b) Explain the general design procedure of a spur gear. (15)

OR

X. A gear drive is required to transmit a maximum power of 22.5 kW. The velocity ratio is 1:2 and RPM of the pinion is 200. The approximate centre distance between the shafts may be taken as 600 mm. The tooth has 20° stub involutes profiles. The static stress for the gear material (which is cast iron) may be taken as 60 MPa and face width as 10 times the module. Find the module, face width and number of teeth on each gear. Check the design for dynamic and wear loads. The deformation or dynamic factor in the Buckingham equation may be taken as 80 and the material combination factor for the wear as 1.4. (20)

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