BT MRE-VI(S)-06-22-0759 Reg. No. | | | | | | | | |

B

B.Tech. Degree VI Semester Supplementary Examination in Marine Engineering June 2022

MRE 1606 MACHINE DESIGN AND DRAWING

(*2013 Scheme*)

Time: 3 Hours Maximum Marks: 100

(5 × 20 = 100)

I. (a) How do you classify materials for engineering use? (8)

(b) Define alloy steel. Discuss the effects of nickel, chromium and manganese on steel. (12)

OR

II. (a) Why are metals in their pure form unsuitable for industrial use? (8)

(b) How cast iron is obtained? Classify and explain different types of cast irons. (12)

III. (a) What is meant by 'stress concentration'? How do you take it into consideration in case of a component subjected to dynamic loading? (8)

(b) A 50 mm diameter shaft is made from carbon steel having ultimate tensile strength of 630 MPa. It is subjected to a torque which fluctuates between 2000 N-m to – 800 N-m. Using Soderberg method, calculate the factor of safety. (12)

OR

IV. (a) Explain how the factor of safety is determined under steady and varying loading by different methods. (8)

(b) A bar of circular cross-section is subjected to alternating tensile forces varying from a minimum of 200 kN to a maximum of 500 kN. It is to be manufactured of a material with an ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of bar using safety factors of 3.5 related to ultimate tensile strength and 4 related to endurance limit and a stress concentration factor of 1.65 for fatigue load. Use Goodman straight line as basis for design. (12)

V. Design a sleeve and cotter joint to resist a tensile load of 60 kN. All parts of the joint are made of the same material with the following allowable stresses: Tensile stress = 60 MPa; shear stress = 70 MPa; and crushing stress = 125 MPa. (20)

OR

VI. Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used: Shear stress for shaft, bolt and key material = 40 MPa, Crushing stress for bolt and key = 80 MPa, Shear stress for cast iron = 8 MPa. (20)

VII. (a) With the help of a figure explain the working of single plate clutch. (8)

(b) Determine the maximum, minimum and average pressure in a plate clutch when the axial force is 4 kN. The inside radius of the contact surface is 50 mm and the outside radius is 100 mm. Assume uniform wear. (12)

OR

(P.T.O.)

VIII. (a) With the help of a figure explain the working of simple band brake. (8)

(b) A vehicle of mass 1200 kg is moving down the hill at a slope of 1: 5 at 72 km/h. It is to be stopped in a distance of 50 m. If the diameter of the tyre is 600 mm, determine the average braking torque to be applied to stop the vehicle, neglecting all the frictional energy except for the brake. If the friction energy is momentarily stored in a 20 kg cast iron brake drum, What is average temperature rise of the drum? The specific heat for cast iron may be taken as 520 J/kg°C. Determine, also, the minimum coefficient of friction between the tyres and the road in order that the wheels do not skid, assuming that the weight is equally distributed among all the four wheels. (12)

IX. A helical cast steel gear with 30° helix angle has to transmit 35 kW at 1500 r.p.m. The 20° full depth involute gear has 24 teeth. The static stress for cast steel may be taken as 56 MPa. The width of face may be taken as 3 times the normal pitch. Determine: (20)

(i) Module

(ii) Pitch diameter

(iii) Face width

(iv) The end thrust on the gear

OR

X. A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4: 1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength. (20)

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