B.Tech. Degree VI Semester Examination in Marine Engineering June 2015

MRE 606 MACHINE DESIGN AND DRAWING

Time: 3 Hours   Maximum Marks: 100

I.   (a)   Explain the step by step procedure in design process with an example. What is meant   (10)
             by ergonomic considerations in design.
       (b)   Briefly explain failure criterias in mechanical design.   (10)

OR

II.   Write notes on:
       (a) BIS system of designation of steels.   (6)
       (b) Selection of preferred numbers.   (6)
       (c) Heat treatment processes.   (8)

III.   (a)   What are the factors to be considered for the selection of materials for the design of (6)
             machine elements?
       (b)   A circular bar 400 mm long is supported freely at its two ends. It is acted upon by a   (14)
             central concentrated cyclic load having minimum value of 40 KN and a maximum
             value of 100 KN. Determine the diameter of bar by taking a factor of safety = 1.5.
             Assume size factor = 0.85 and surface finish factor = 0.9. Ultimate strength of the
             material = 650 MPa, yield strength = 500 MPa and endurance strength = 350 MPa.

OR

IV.   (a)   Illustrate with sketch how the stress concentration in a component can be reduced.   (6)
       (b)   Determine the diameter of a circular rod made of ductile material with a fatigue   (14)
             strength 265 MPa and a tensile yield strength of 350 MPa. The member is subjected to
             a varying axial load from $-300000N$ to $700000N$ and has a stress concentration
             factor = 1.8. Use factor of safety as 2.

V.   (a)   Explain unilateral tolerance and bilateral tolerance, with sketch.   (6)
       (b)   Design a Knuckle joint to transmit 150 Kn. The design stresses are 75 MPa in tension, (14)
             60 MPa in shear and 150 MPa in compression.

OR

VI.   (a)   Compare welded joint with riveted joint. Draw the sketches of different welds and   (10)
             their conventional representations.
       (b)   A plate 100 mm wide and 12.5 mm thick is to be welded to another plate by means of   (10)
             parallel fillet welds. The plates are subjected to a load of 50 KN. Find the length of
             the weld so that the maximum stress does not exceed 56 MPa. Consider the joint first
             under static loading and then under fatigue loading.

VII. (a) What are the design criteria of brakes?   (5)

      (b) Discuss the various stresses induced in belts.   (5)

      (c) A 60 mm diameter pulley driven by a horizontal belt transmits power to a 200 mm   (10)
diameter pinion. The pulley has a mass of 90 kg, $K_m = 2$, $K_t = 1.5$ and shear stress $= 40$ MPa. Find the diameter of the shaft.

OR

VIII. (a) Compare belt and chain drives.   (5)

      (b) Write notes on thick film and thin film lubrication.   (5)

      (c) A journal bearing 160 mm long and 45 mm diameter supports a radial load of 8000 N.   (10)
The shaft speed is 160 rpm, oil used is SAE 60 at 25°C inlet temperature. Using clearance ratio of 600, find the rise in temperature, maximum film pressure and minimum film thickness.

IX. (a) Discuss the applications of helical gears and compare it with spur gear.   (5)

      (b) A pair of helical gear has 20° stub teeth in the diametral plane. Helix angle is 45°. The   (15)
pinion rotates at 8000 rpm and transmits 12 KW. Gear ratio is 4:1. Safe static stress for the material for pinion and gear is 100 MPa. The BHN for pinion is 300 and that of gear is 200. Find the module and face width, if the centre distance is 200 mm.

OR

X. (a) Compare bevel gear with helical gear.   (5)

      (b) A pair of straight teeth bevel gear is used for transmitting 7.5 KW at 900 rpm of   (15)
pinion. Pinion has 20 teeth and module at the outer radius of 5 mm. Find the face width and check it for wear and dynamic load. Gear ratio = 3:1.

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