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***B.Tech. Degree VI Semester Examination in Marine Engineering
May 2018***

**MRE 1606 MACHINE DESIGN AND DRAWING
(2013 Scheme)**

Time : 3 Hours

Maximum Marks : 100

(5 × 20 = 100)

- I. (a) Briefly describe the important design considerations to be adopted while designing engineering systems. (7)
- (b) Explain the advantages of using preferred sizes in design. (7)
- (c) What are the symbols used for surface roughness and illustrate its application on engineering drawing? (6)

OR

- II. (a) Briefly explain the various performance characteristics required for materials used in design process. (7)
- (b) Explain the various methods used for evaluating the material selection process. (7)
- (c) List out and explain the design process steps followed in system design. (6)
- III. (a) Explain how the factor of safety is determined under steady and varying load. (6)
- (b) A hot-rolled rod of carbon steel having $\sigma_u = 595 \text{ MN/m}^2$ and $\sigma_y = 385 \text{ MN/m}^2$ is to be subjected to a cyclic torque varying from +300 to -100 Nm. The crank is attached to the rod by a sled runner keyway. Determine the diameter of the rod if the factor of safety is to be 1.8. (14)

OR

- IV. (a) What is meant by stress concentration? Illustrate with a sketch, the stress concentration developed due to hole or notch in a plate. (6)
- (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 the 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. (14)
- V. (a) Sketch two views of a knuckle joint and discuss the strength of the joint for the most probable modes of failure. (6)
- (b) A circular steel bar 50 mm diameter and 200 mm long is welded perpendicularly to a steel plate to form a cantilever to be loaded with 5 kN at the free end. Determine the size of the weld, assuming allowable stress in the weld as 100 MPa. (14)

OR

(P.T.O.)

- VI. (a) Draw an eccentrically loaded riveted joint and explain the method adopted for design. (6)
- (b) Two lengths of a mild steel tie rod $190\text{ mm} \times 12\text{ mm}$ are to be connected together by means of a lap joint, using only four rivets. Determine the diameter of the rivets, when the rods are subjected to tensile loading. Indicate the arrangement of the rivets to give the strongest joint. The allowable stresses are $\sigma_1 = 90\text{ MN/m}^2$, $\tau = 75\text{ MN/m}^2$ and $\sigma_c = 150\text{ MN/m}^2$. (14)
- VII. (a) What is meant by hydrodynamic lubrication? Explain with a neat sketch. (6)
- (b) A journal bearing is to support a 80 mm belt-driven shaft, transmitting 90 kW at 225 rpm . The belt pulley lies very close to the bearing and has a diameter of 1250 mm . Determine the length and clearance of the bearing. Also determine the equilibrium temperature. (14)
- OR**
- VIII. (a) What are the advantages of chain drive over belt drives? (6)
- (b) A single plate clutch, both sides effective has disc with inner diameter 100 mm . The torque requirement is 1470 Nm . The disc material is having a coefficient of friction of 0.31 , with standing a pressure of 2.2 MPa . Design the clutch. (14)
- IX. (a) Draw the profile of involute and cycloidal gear teeth and mention their advantages and disadvantages. (6)
- (b) The power transmitted by a pair of helical gears with 30° helix angle is 45 kW at 1800 rpm . If the gear has 20 teeth, determine the necessary module and face width for 20° full depth teeth. The width of face may be taken as five times the normal pitch. Design a gear and pinion for the above purpose. (14)
- OR**
- X. (a) With a neat sketch, explain the force acting on worm and worm gears. (6)
- (b) A 30 kW , 750 mm motor is required to drive a centrifugal pump continuously at 250 rpm by means of straight bevel gears connected at 90° shaft angle. The starting torque is 20% greater than the rated torque. Design the bevel gears. (14)
