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1 copy

Max. Marks: 100

Time: 3 hrs.

Note: 1. Answer any FIVE full questions selecting atleast TWO from each part.
2. Missing data may be assumed.
3. Use data-hand book, if necessary.

Fifth Semester B.E. Degree Examination, Dec.2014/Jan.2015
Marine Machinery and System Design

PART - A

- 1 a. What are the methods of manufacturing? Write the design consideration during forging. (10 Marks)
- b. A multi cylinder engine is to run at a constant load and at a speed of 600rpm. On drawing the crank effort diagram to a scale of 1mm = 250 N-m and 1mm = 3°, the areas in mm² above and below the mean torque line are as follows, +160, -172, +168, -191, +197, -162mm². The speed is to be kept within 1% of the moment of the flywheel. Determine suitable dimensions of cast iron flywheel, with a rim whose breadth is twice its radial thickness. The density of cast iron is 7250 kg/m³ and working stress in tension is 6MPa. Assume that the rim contributes 92% of the flywheel effect. (10 Marks)
- 2 a. A shaft is supported by two bearings placed 1m apart. A 600mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25kN. Another pulley 400mm diameter is placed 200mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. Determine the suitable diameter for a solid shaft, allowing working stress of 63MPa in tension and 42MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that of the other pulley. (12 Marks)
- b. A hollow shaft of 0.5m outside diameter and 0.3m inside diameter is used to drive a propeller of a marine vessel. The shaft is mounted on bearings 6m apart and its transmit 5600 kW at 150rpm. The maximum axial propeller thrust is 500 kN and the shaft weighs 70 kN. Determine: i) The maximum shear stress developed in the shaft; ii) The angular twist between the bearings. (08 Marks)
- 3 a. Design a connecting rod for an I.C. engine running at 1800rpm, and developing a maximum pressure of 3.15 N/mm². The diameter of the piston is 100mm; mass of reciprocating parts per cylinder 2.25kg; length of connecting rod 380mm; stroke of piston 190mm, and compression ratio 6:1. Take a factor of safety of 6 for the design. Take length to diameter ratio for big end bearing as 1.3 and small end bearing as 2 and the corresponding bearing pressure as 10 N/mm² and 15N/mm². The density of material of the rod may be taken as 8000 kg/m³ and the allowable stress in the bolts as 60 N/mm² and in cap as 80 N/mm². The rod is to be of I-section for which you can choose your own proportions. Use Rankine's formula for which the numerator constant may be taken as 320 N/mm² and the denominator constant as 1/75000. (12 Marks)
- b. A single cylinder double acting steam engine delivers 185kW at 100 rpm. The maximum fluctuation of energy per revolution is 15% of the energy developed per revolution. The speed variation is limited to 1% either way from the mean. The mean diameter of the rim is 2.4m Design a suitable fly-wheel. (08 Marks)

- 4 a. Define spring index and stiffness of the spring. (06 Marks)
 b. Design a helical compression spring for a maximum load of 1000N for a deflection of 25mm using the value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 kN/mm². Take Wahl's factor,

$$K = \frac{4C-1}{4C-4} + \frac{0.615}{C}$$
 where C = spring index. (06 Marks)
 Give a brief design of engine room overhead crane. (08 Marks)

PART – B

- 5 a. Explain with neat sketch, the pump used in water cooling system. (10 Marks)
 b. Write a short note on intermediate shaft and Tail-end shaft. (10 Marks)
- 6 a. Explain with neat sketch electrohydraulic 4-ram steering gear system. (10 Marks)
 b. Explain with neat line diagram, lubricating oil system of main engine. (10 Marks)
- 7 a. With neat sketch, explain construction and working of needle valve type fuel injector. (10 Marks)
 b. Explain with neat sketch, suction and spill controlled fuel pump. (10 Marks)
- 8 a. With neat sketch, explain Air-start valve. (08 Marks)
 b. Explain with neat sketch starting air receiver. (06 Marks)
 c. Explain start-air pilot valve with neat sketch. (06 Marks)
