BT-MRE-I&II-05.18-1024 Reg. No. | | | | | | | | |

B

B.Tech. Degree I & II Semester Examination in Marine Engineering May 2018

MRE 1107 FUNDAMENTALS OF ENGINEERING I

(2013 Scheme)

(Use separate answer books for Section A and Section B)

Time: 3 Hours Maximum Marks: 100

SECTION A
MECHANICAL ENGINEERING

I. (a) Explain the concept of perpetual motion machine of first kind PMM 1. (8)

(b) An air compressor takes in 50 m^3/min of air at 1 bar, 25°C and delivers it at 5 bar, 100°C. The cooling water circulated around the cylinder absorbs 20 kJ/kg of heat. The inlet and exit velocities are 25 m/s and 10 m/s respectively. Find the shaft work per kg of air required for compression. (8)

OR

II. (a) Compare and contrast the principle of operation of a 4 stroke and a 2 stroke SI engine. (8)

(b) Air at a pressure of 8 bar, and volume of 0.1 m^3, is expanded to 0.5 m^3, 1.2 bar in a polytropic process. Determine the work of expansion and heat transfer. (8)

III. (a) Derive the expression for the air standard efficiency of the diesel cycle. (7)

(b) An engine works on the Otto cycle with a compression ratio of 8. The engine takes in air at 1 bar, 27°C, and the heat addition to the engine is 2000 kJ/kg. Calculate the cycle efficiency, maximum pressure and temperature and mean effective pressure of the cycle (C_P = 1005 J/kg K, C_v = 718 J/kg K, for air) (10)

OR

IV. (a) Define the terms (i) Indicated power (ii) Brake power (iii) Frictional power. (7)

(b) An oil engine consumes 50 kg of fuel per hour, of calorific value 4400 kJ/kg, and develops a brake power of 80 kW, and has a mechanical efficiency of 0.75. Calculate for the engine (i) Indicated power (ii) Frictional power (iii) Brake specific fuel consumption. (10)

V. (a) What is meant by critical properties of water? Explain. (7)

(b) Steam at 15 bar is having a dryness fraction of 0.95. Determine (i) specific volume (ii) specific enthalpy (iii) specific entropy. (10)

(at 15 bar, v_f = 0.00104 m^3/kg, v_g = 10.02 m^3/kg, h_f = 225.85 kJ/kg, h_g = 2599.36 kJ/kg, s_f = 0.7543 kJ/kg K, s_g = 8.0091 kJ/kg K for steam).

OR

VI. (a) What are the differences between fire tube boiler and water tube boiler? (7)

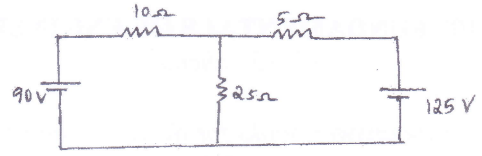
(b) With neat sketches explain the construction and working of one boiler mounting and one boiler accessory. (10)

(P.T.O.)

SECTION B
ELECTRICAL ENGINEERING

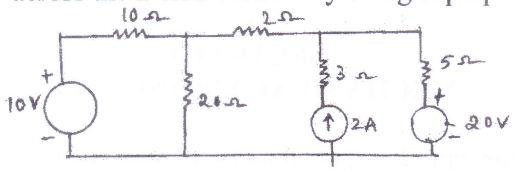
I. (a) Define constant voltage source and constant current source. Explain how a voltage source can be converted into a current source. (6)

(b) Calculate the current supplied by the two batteries in the network given below by Maxwell's circulation of current method. (10)



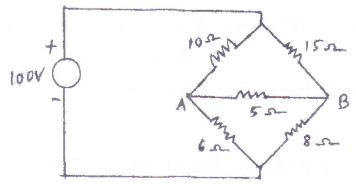
OR

II. (a) Find the voltage across the 2 ohm resistor by using superposition theorem. (7)



(b) State maximum power transfer theorem. (3)

(c) Use Thevenin's theorem to find the current through the 5 ohm resistor in the below figure. (6)



III. (a) Define electric field strength and electric flux density. (4)

(b) A ring of cast steel has mean diameter of 25 cm and square cross section with 5 cm side. Inside, across the ring, a mild steel bar of size 20 cm × 5 cm × 2 cm is fitted with negligible gap. If a winding, having 500 turns and carrying a current of 1.0 amp, is provided on one half of the ring, find the flux in the other half and in the mild steel bar. Take the relative permeabilities for cast steel and mild steel as 1000 and 2000 respectively. (12)

OR

IV. (a) State Faraday's laws of electromagnetic induction. (5)

(b) Derive the energy stored in a magnetic field. (5)

(c) The self inductance of a coil of 500 turns is 0.25 H. If 60% of the flux is linked with a second coil of 10, 500 turns, calculate (i) the mutual inductance between the two coils and (ii) emf induced in the second coil when current in the first coil changes at the rage of 100 A/s. (6)

V. (a) Define and find the rms value, average value and form factor of the full wave rectified sine wave. (8)

(b) Define active power, apparent power and reactive power. (3)

(c) A series circuit consists of a 300 ohm non-inductive resistor, a 7.95 μF capacitor and a 2.06 H inductor of negligible resistance. If the supply voltage is 250 V at 50 Hz. Calculate (i) the circuit current (ii) the phase angle (iii) the voltage drop across each element. (7)

OR

VI. (a) Derive the relation between line and phase currents for a star connected connection with the help of phasor diagram. (6)

(b) Explain the two watt meter method for power measurement in three phase circuits with the help of phase diagram. (6)

(c) Write a short note on different types of fuses. (6)

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