

***B.Tech. Degree I & II Semester Supplementary Examination in
Marine Engineering May 2014***

MRE 107 FUNDAMENTALS OF ENGINEERING I

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

PART A: MECHANICAL ENGINEERING

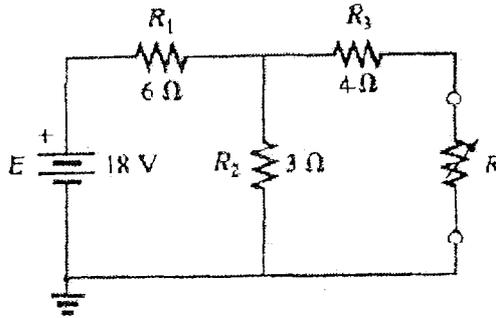
Time : 3 Hours

Maximum Marks : 100

- I. (a) Explain: (9)
- (i) Thermodynamic equilibrium
 - (ii) Quasi-static process
 - (iii) Concept of continuum
- (b) A vessel of cylindrical shape of 50cm diameter and 75cm height, contains 4 kg of gas. The pressure gauge mounted on the vessel indicates 620mm of Hg above atmosphere. If the barometer reading is 760mm of Hg, calculate the absolute pressure of gas in bar. Also determine the density and specific volume of the gas. (8)
- OR**
- II. (a) Explain: (9)
- (i) Kelvin – Planck statement
 - (ii) Clausius statement
 - (iii) Carnot statement
- (b) A reversible engine is supplied with heat from two constant temperature sources at 900K and 600K and rejects heat to a constant temperature sink at 300K. The engine develops work equivalent to 90KJ/s and rejects heat at the rate of 56KJ/s. Estimate (i) Heat supplied by each source (8)
(ii) Thermal efficiency of the engine
- III. (a) Sketch and explain the stages of an ideal diesel cycle and derive the expression for air standard efficiency. (10)
- (b) An engine, working on the Otto cycle, has a cylinder diameter of 150mm and a stroke of 225mm. The clearance volume is $1.25 \times 10^{-3} \text{ m}^3$. Find the air standard efficiency of this engine. Take $r = 1.4$. (7)
- OR**
- IV. (a) Explain the terms: (9)
- (i) Indicated power
 - (ii) Brake power
 - (iii) Frictional power
- (b) A diesel engine operating an air standard diesel cycle operates on 1kg of air with an initial pressure of 98kPa and a temperature of 36°C. The pressure at the end of compression is 35 bar and cut off is 6% of stroke. Determine. (8)
- (i) Thermal efficiency
 - (ii) Mean effective pressure
- V. (a) Explain the following terms with neat sketch. (8)
- (i) Triple point
 - (ii) Critical point
 - (iii) Dryness fraction
- (b) A boiler evaporates 3.6kg of water per kg of coal into dry saturated steam at 10 bar. The temperature of feed water is 32°C. Find the equivalent evaporation from and at 100°C as well as the factor of evaporation. (8)
- OR**
- VI. (a) How boilers are classified? List-out the essentials of a good steam boiler. (8)
- (b) Calculate the enthalpy of steam at 30 bar, if (i) its dryness fraction is 0.75 (ii) it is superheated at 400°C. (8)

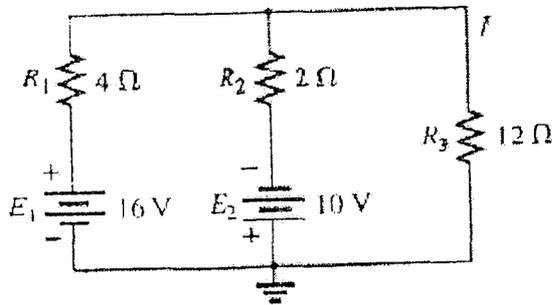
PART B: ELECTRICAL ENGINEERING

- I. (a) State and explain Thevenin's theorem. (6)
 (b) Find the Thevenin equivalent circuit for the network external to the resistor R in the following figure. Find the current through R when R is 2Ω , 30Ω and 100Ω . (10)
 (c) Differentiate between current source and voltage source. (2)



OR

- II. (a) State and explain superposition theorem. (8)
 (b) Using the superposition theorem, determine the current through the 12Ω resistor in the following figure. (10)



- III. (a) State and explain Coulomb's law. (4)
 (b) Differentiate between electric potential and energy. (4)
 (c) In a concentric cable, the diameters of inner and outer cylinders are 5mm and 15mm respectively. If the relative permittivity of the dielectric used is 4, find the capacitance of the cable. (8)

OR

- IV. (a) State and explain Lenz's law. (4)
 (b) Differentiate between self induction and mutual induction. (4)
 (c) A ring is made of two rods of ferromagnetic materials A and B with relative permeability's of 250 and 320 respectively. The lengths and cross-sectional areas are: $l_A=40\text{cm}$, $a_A=5\text{cm}^2$ and $l_B=25\text{cm}$, $a_B=7\text{cm}^2$. A coil of 250 turns is wound uniformly around A. Calculate (i) the total reluctance of the ring and (ii) the current required to produce a flux of 2.5mWb . (8)

- V. (a) Define r.m.s. value, average value, power factor and form factor. (8)
 (b) Explain the principle of generation of alternating current and voltage. (8)

OR

- VI. (a) A resistance of 6Ω , an inductive reactance of 10Ω and a capacitive reactance of 12Ω are connected in series across a 230V, 50Hz supply. Calculate the current through the circuit and the power consumed in the circuit. (8)
 (b) Derive the relationship between line voltage and phase voltage in a three phase star connected system with the help of vector diagrams. (8)