



***B. Tech. Degree I & II Semester Examination in  
Marine Engineering May 2016***

**MRE 1107 FUNDAMENTALS OF ENGINEERING I**

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

Time: 3 Hours

Maximum Marks: 100

**SECTION A : MECHANICAL ENGINEERING**

- I. (a) Explain the equivalence of the Kelvin-Planck and Clausius statements of the second law of thermodynamics. (8)
- (b) A thermodynamic steady flow system receives 6 kg/min of working fluid with an inlet pressure of 2 bar, density 27 kg/m<sup>3</sup>, velocity 150 m/s and internal energy of 800 kJ/kg. The exit conditions are pressure 8 bar, density 5 kg/cubic m, velocity 200 m/s and internal energy 900 kJ/kg. During the process the fluid receives 80 kJ/kg of heat. Calculate the work interaction of the system with surroundings. (8)
- OR**
- II. (a) Explain the construction and working of battery ignition system of a 4 stroke SI engine. (8)
- (b) 10 kg of air occupying a volume of 10 cubic m at a pressure of 10 bar is compressed adiabatically in a non flow process till the pressure becomes 50 bar. Determine the final volume, temperature and work of compression. (8)
- III. (a) Derive an expression for the Air Standard Efficiency of the diesel cycle in terms of compression ratio "r" and cut off ratio "a". (7)
- (b) An Otto cycle has a compression ratio of 8. The compression begins at 1 bar, 300 K, 0.5 cubic m, and the maximum temperature of the cycle is 2000 K. Determine for the cycle (i) air standard efficiency (ii) heat input to the cycle. (10)
- OR**
- IV. (a) Explain: (i) brake power (ii) indicated power (iii) frictional power (iv) specific fuel consumption. (7)
- (b) A heavy oil engine develops a brake power of 10 kW, and consumes 3 kg per hour of fuel having calorific value of 45000 kJ/kg. The frictional power at this load was observed to be 2.8 kW. Calculate the following for the engine (i) brake thermal efficiency (ii) indicated thermal efficiency (iii) mechanical efficiency (iv) specific fuel consumption. (10)

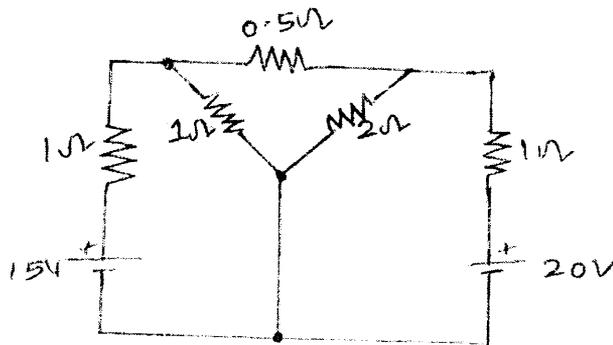
- V. (a) What is meant by triple point of water? Explain the significance. (7)  
 (b) A sample of steam is at a pressure of 12 bar and 0.96 dry. Calculate (10)  
 for the steam (i) specific volume (ii) specific enthalpy (iii) internal energy  
 (iv) saturation temperature.

OR

- VI. (a) Why are boiler mountings used in boilers? Explain with a neat sketch any (7)  
 one mounting.  
 (b) A boiler generates 400 kg per hour of steam at 10 bars, saturated using (10)  
 feed water available at 60 C, 1.2 bar. The boiler consumes 2000 kg per hour  
 of fuel with a calorific value of 12000 kJ/kg. Determine for the boiler  
 (i) thermal efficiency (ii) equivalent evaporation.

### SECTION B : ELECTRICAL ENGINEERING

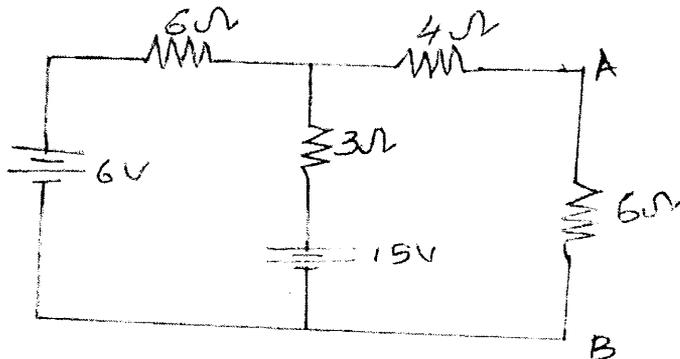
- I. (a) Two resistances  $20\Omega$  and  $30\Omega$  respectively are connected in parallel. (6)  
 These two parallel resistances are connected in series with a resistance of  
 $15\Omega$ . If the current through the  $15\Omega$  resistance is 3 A. Find (i) the currents  
 through  $20\Omega$  and  $30\Omega$  resistances (ii) voltage across the whole circuit  
 (iii) the total power consumed.  
 (b) Find the current in the  $0.5\Omega$  resistor in the network shown below, by using (6)  
 superposition theorem.



- (c) State and explain ohm's law. (4)

OR

- II. (a) State and explain Norton's theorem. (8)  
 (b) Determine the current through  $6\Omega$  resistance connected across AB terminals (8)  
 in the electric circuit using Thevenin's theorem.



- III. (a) Find the force of interaction between two charges spaced 10 cm apart in a vacuum. The charges are  $4 \times 10^{-8}$  and  $6 \times 10^{-5}$  coulomb respectively. If the same charges are separated by the same distance in Kerosine ( $\epsilon_r = 2$ ), what is the corresponding force of interaction. (6)
- (b) A capacitor of capacity 1 microfarad is charged to 10 kV and then discharged through a wire. Find the heat produced in the wire. (5)
- (c) Capacitors of capacitances  $4 \mu F$  and  $2 \mu F$  are jointed in series with dc voltage of 100 V. Then connections are broken and like terminals of the capacitors are joined. Find the total charge before and after parallel connection on each capacitor. (6)

**OR**

- IV. (a) Give comparison between electric and magnetic circuits. (5)
- (b) A coil of 300 turns and resistance of  $10 \Omega$  is wound uniformly over a steel ring of mean circumference 30 cm and cross sectional area  $9 \text{ cm}^2$ . It is connected to a supply of 20 V dc. If the relative permeability of ring is 1500. Find (i) the magnetising force (ii) the reluctance (iii) the mmf and (iv) the flux. (12)

- V. (a) Explain the terms rms value and average value of ac sinusoidal current. Also drive the rms value of ac sinusoidal current having  $I_m$  as maximum value. (7)
- (b) A balanced star connected load of  $(8 + j6) \Omega$ / phase is connected to a balanced three phase 400 V ac supply. Find the line current, power factor, active power, reactive power and total voltamperes. (10)

**OR**

- VI. (a) Explain various types of domestic wiring and write their area of application. (10)
- (b) What is the effect of electric shock? (3)
- (c) Differentiate the fuse and a circuit breaker. (4)