B.Tech. Degree I & II Semester Examination in Marine Engineering May 2019

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)   Derive an expression for the isothermal work done.   (8)

    (b)   0.3 m³ of gas at 120 °C and 1 bar pressure is compressed adiabatically to 0.05 m³.   (8)
Determine (i) the mass of gas compressed (ii) final pressure (iii) final temperature (iv) increase in internal energy. Take $\gamma = 1.4, R = 295\,J/KgK$

OR

II. (a)   Describe the working of a 4 stroke diesel engine with neat sketches.   (8)

    (b)   Write short notes on (i) Carburetor (ii) MPFI system (iii) Diesel fuel pump   (8)
(iv) Cooling system of engine.

III. (a)   Derive an expression for air standard efficiency of Otto cycle.   (8)

    (b)   An engine of 250 mm bore and 375 mm stroke works on Otto cycle. The clearance   (9)
volume is 0.00263 m³. The initial temperature and pressure are 50°C and 1 bar. If the maximum pressure is limited to 25 bar, find (i) the air standard efficiency of the cycle (ii) the mean effective pressure for the cycle. Take $\gamma = 1.4$.

OR

IV. (a)   Derive an expression for air standard efficiency of Diesel cycle.   (8)

    (b)   A diesel engine has a compression ratio of 15 and heat addition at constant pressure   (9)
takes place at 6% of the stroke. Find the air standard efficiency of the engine. Take $\gamma = 1.4$.

V. (a)   Define (i) sub cooled liquid   (ii) saturated liquid (iii) saturated vapour   (8)
              (iv) superheated vapour (v) dryness fraction.

    (b)   Find the enthalpy, entropy, specific volume of 0.5 m³ of steam at 10 bar pressure and   (9)
0.9 quality.

OR

VI. (a)   Explain the working of a Cochran boiler with a neat sketch.   (8)

    (b)   Write short notes on (i) boiler thermal efficiency (ii) equivalent evaporation of   (9)
boiler.

(P.T.O.)

SECTION B
ELECTRICAL ENGINEERING

I. (a) Define SI units of voltage, current, power and energy. (7)

(b) What is resistance? What are the laws of resistance? (5)

(c) A 100 W, 250 V lamp is connected in series with a 100 W, 200 V lamp across 250 V supply. Calculate (i) Circuit current and (ii) Voltage across each lamp. Assume the lamp resistances to remain unaltered. (5)

OR

II. (a) State and explain Thevenin's theorem and Norton's Theorem. (8)

(b) Find current in 1 Ω resistance in the circuit applying superposition theorem. (9)
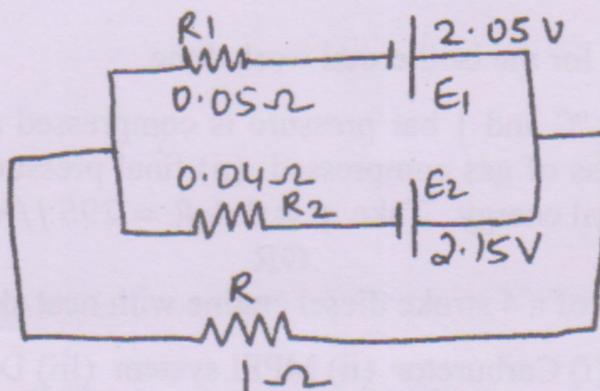
III. (a) State (i) Coulomb's laws of Electrostatics
            (ii) Faraday's laws of Electromagnetic Induction (6)

(b) Derive the expression for capacitance of a parallel plate capacitor. (5)

(c) A parallel plate capacitor has a plate area of 20 cm^2 and the plates are separated by 3 dielectric layers each 1 mm thick and of relative permittivity 2, 4 and 5 respectively. Find the capacitance of the capacitor. (5)

OR

IV. (a) Explain the phenomenon of Hysteresis in ferromagnetic materials. (8)

(b) An air-cored toroidal coil has 450 turns and a mean diameter of 30 cm and a cross-sectional area of 3 cm^2. Calculate (i) Inductance of the coil (ii) Average EMF induced, if a current of 2A is reversed in 0.04 seconds. (8)

V. (a) Define the following terms with respect to an alternating quantity :
        (i) Cycle (ii) Time period (iii) Frequency (iv) Average value (v) RMS value. (10)

(b) Derive the relationship between line and phase voltage and currents in a 3- phase star connected system. What is the expression for power? (7)

OR

VI. (a) The input power to a 3-phase motor was measured using 2 wattmeters. The readings were 5.2 KW and -1.7 KW, and the line voltage was 415 V. Calculate (i) the total active power (ii) the power factor (iii) the line current. (9)

(b) Write short note on : (i) Earthing (ii) Fuses and materials for fuses. (8)

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