B. Tech Degree I & II Semester Examination in Marine Engineering, May 2008

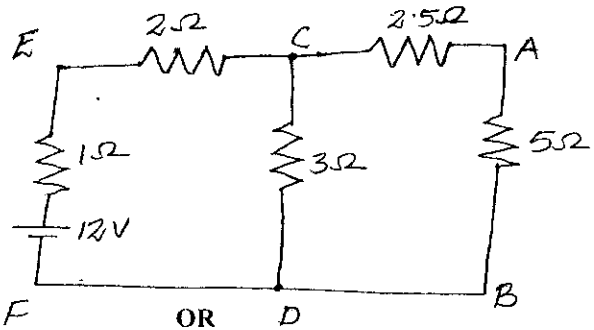
MRE 107 FUNDAMENTALS OF ENGINEERING I

(B) ELECTRICAL ENGINEERING

Time : 1 ½ Hours Maximum Marks : 50

I. (a) State and explain :
- (i) Kirchoff's current law
- (ii) Kirchoff's voltage law
- (iii) Ohm's law
- (iv) Norton's theorem. (10)

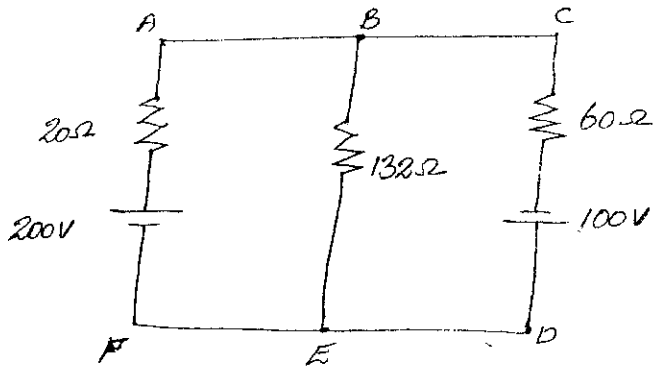
(b) Using Thevenin's theorem, calculate the current flowing through 5Ω resistor in the following circuit. (8)



OR

II. (a) State and explain :
- (i) Maximum power transfer theorem
- (ii) Super position principle. (10)

(b) For the network shown in the following figure, calculate the current in the 132Ω resistor and the potential difference across the 20Ω resistor by using Kirchoff's laws. (8)



III. (a) State and explain the Coulomb's law in electrostatics. (3)

(b) Define :
- (i) Capacitance
- (ii) Electric flux density
- (iii) Electric field strength. (3)

(Turn Over)

(c) A capacitor consists of two metal plates each 40 cm x 40 cm spaced 6 mm apart. The space between the metal plates is filled with a glass plate 5 mm thick and a layer of paper 1 mm thick. The relative permittivities of glass and paper are 8 and 2 respectively. Calculate –

(i) the capacitance

(ii) the potential gradient in each dielectric in KV/mm due to a potential difference of 10 KV between the metal plates. Neglect any fringing flux. (10)

OR

IV. (a) Define self induction and mutual induction. (4)

(b) State and explain Faraday's laws of electromagnetic induction. (4)

(c) A ring-shaped electromagnet, which is uniformly wound with a magnetizing coil of 500 turns, has an air gap 6 mm long and 20 cm^2 in area, the mean length of the core being 50 cm. A current of 5 A in the coil produces a flux density of 0.5 Wb/m^2 in the air gap. Find the relative permeability of iron at this flux density. (8)

V. (a) Define the following with respect to alternating current/voltage :

(i)	Frequency	(ii)	Phase difference
(iii)	RMS value	(iv)	Average value
(v)	Power factor	(vi)	Form factor

(9)

(b) Find vectorically the resultant of the following four voltages :

$e_1 = 25\sin wt$ $\qquad$ $e_2 = 30\sin\left(wt + \frac{\pi}{6}\right)$

$e_3 = 30\cos wt$ $\qquad$ $e_4 = 20\sin\left(wt - \frac{\pi}{4}\right)$

Express the answer in a similar form. (7)

OR

VI. (a) What is resonance? Explain the RLC series resonant circuit and derive the equation for resonant frequency. (6)

(b) An inductor of 0.5 H inductance and 90Ω resistance is connected in parallel with a $20\mu F$ capacitor. A voltage of 230 V 50 Hz is maintained across the circuit. Determine the total power taken from the source. (5)

(c) Three Δ - connected similar coils when supplied from a 416 V 50 Hz 3 phase 3 wire Supply, draw a line current of 5 A at a p.f. of 0.8 lag. Calculate the resistance and inductance of each coil. (5)

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