C 31678 (Pages : 5)

Name.....

Reg. No.....

COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2007

A1 2K 109—BASIC ELECTRICAL ENGINEERING

(Common to EE, EC, IC, BM, BT)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions. Assume missing data.*

I. (a) Give the characteristics of a series and parallel circuit.

(b) Obtain the equation for the voltage across any resistance in a series circuit having '*n*' number of different resistance.

(c) Explain the terms : m.m.f., flux and reluctance in connection with a magnetic circuit. Derive the relationship among them.

(d) What is coefficient of coupling ? How can it be varied ? Derive an expression for the same.

(e) Derive expressions for voltage, current and power in a capacitor supplied with a sinusoidal voltage.

(f) Define : admittance, conductance and suspectance. Derive expressions for all these for a series RC circuit.

(g) State :

(i) Thevenin's Theorem.

(ii) Superposition Theorem.

(iii) Maximum power transfer Theorem. and

(iv) Substitution Theorem.

(h) A series RLC circuit with R = 10 ohms, L = 10 mH and C = 1 μF has an applied voltage of 200 V at resonant frequency. Calculate the resonant frequency, the current in the circuit and the voltage across the elements at resonance. Find also the quality factor and bandwidth.

(8 × 5 = 40 marks)

II. (a) Determine the equivalent resistance between terminals A and B of Fig.1.

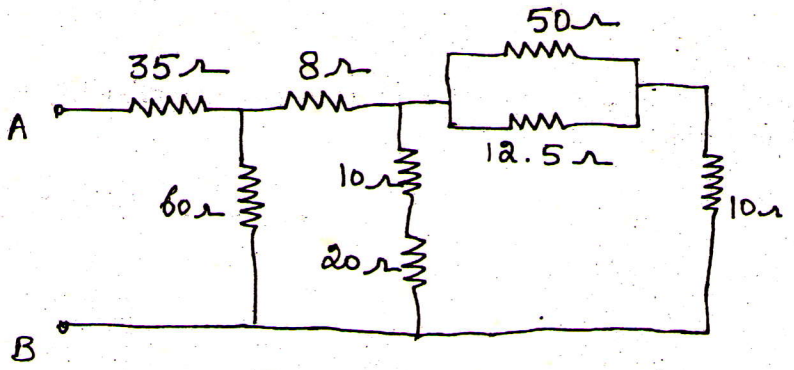


Fig. 1

(7 marks)

Turn over

(b) Find the currents I_1, I_2 and I_3 and the voltages V_a and V_b in the network shown in Fig. 2

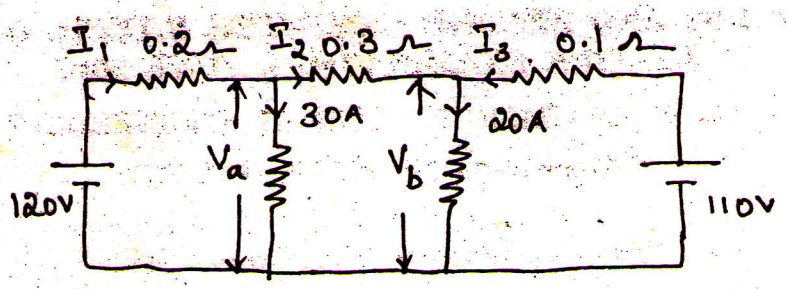


Fig. 2

(8 marks)

Or

(c) .The combined inductance of two coils connected in series is 0.6 H or 0.1 H, depending on the relative directions of the currents in the coils. If one of the coils when isolated has a self inductance of 0.2 H, calculate the mutual inductance and the coefficient of coupling.

(7 marks)

(d) Find the Norton's equivalent at terminals AB in the circuit of Fig.3.

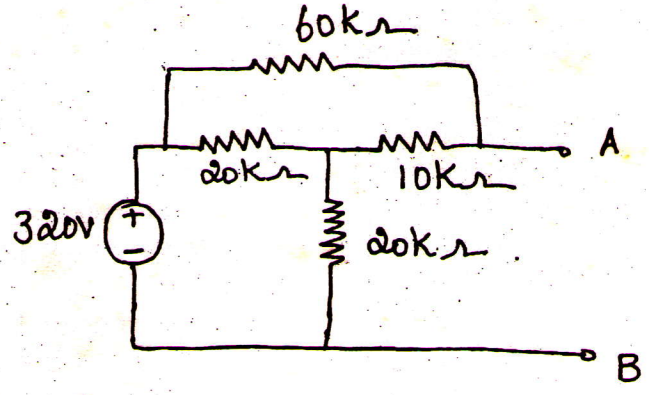


Fig. 3

(8 mark

III. (a) Consider the circuit shown in Fig. 4. It is required to replace the impedance element Z_{ab} by an independent source.

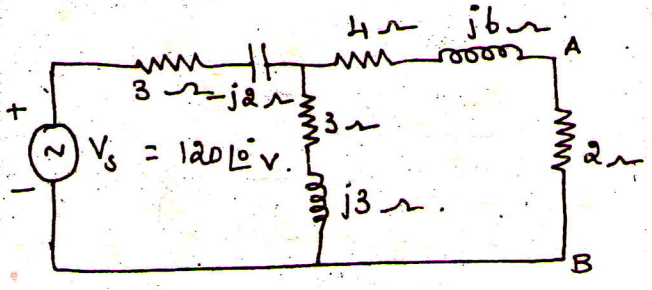


Fig. 4

(8 marl

(b) The number of turns in a coil is 250. When a current of 2 A flows in this coil, the flux in the coil is 0.3 m wb. When this current is reduced to zero in 2 milli seconds, the voltage induced in a coil lying in the vicinity of coil is 63.75 volts. If the coefficient of coupling between the coil is 0.75. Find self inductance of the two coils, mutual inductance and number of turns in the second coil. (7 marks)

Or

(c) (i) Determine the effective values of the parameters shown in Fig. 5.

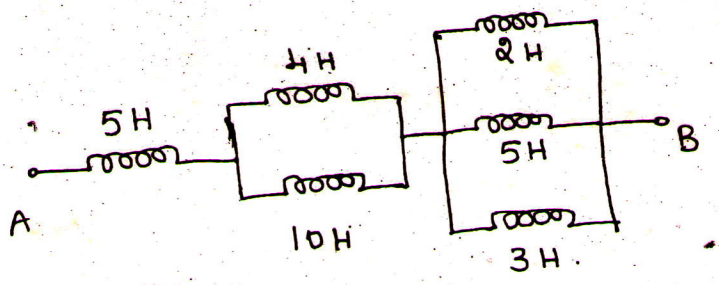


Fig. 5

(ii) Determine the effective values of the parameters shown in Fig.6 between A and B.

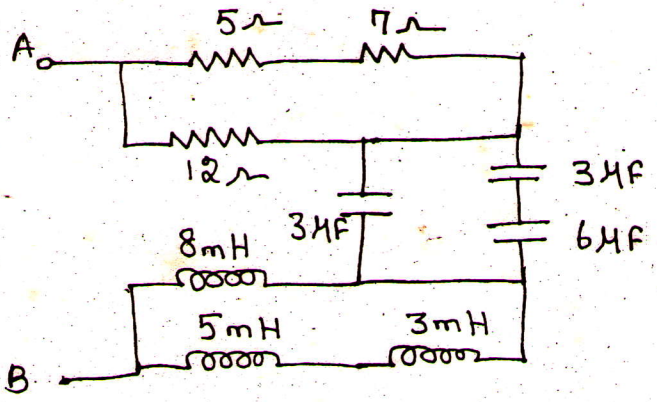


Fig. 6 (8 marks)

(d) A conductor 10 cm. long and carrying a current of 60 A lies perpendicular to a field of strength 1000 A/m. Calculate (a) the force acting on the conductor ; (b) the mechanical power to move this conductor against this force with a speed of 1 m/s and (c) e.m.f. induced in the conductor. (7 marks)

IV. (a) Write brief note on V–I relationships of R, L and C. (7 marks)

(b) The switch in the circuit of Fig. 7. has been closed for a long time when it is opened at $t = 0$. Find a solution for the inductor currents for $t > 0$.

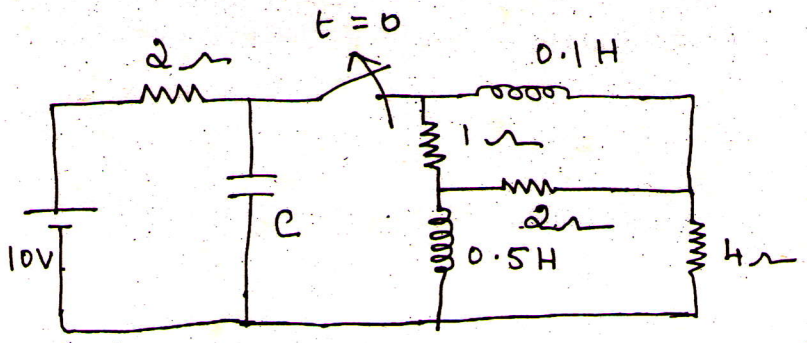


Fig. 7

(8 marks)

Or

(c) A coil of resistance 10 Ω and inductance 0.5 H is connected in series with a capacitor. On applying sinusoidal voltage, the current is maximum when the frequency is 50 Hz. A second capacitor is connected in parallel with this circuit ; what capacitance must it have so that the combination acts like a non-inductive resistor at 100 Hz ? Calculate the total current supplied in each case if the applied voltage is 220 V.

(7 marks)

(d) Use superposition theorem to calculate current i_x for the network shown in Fig. 8.

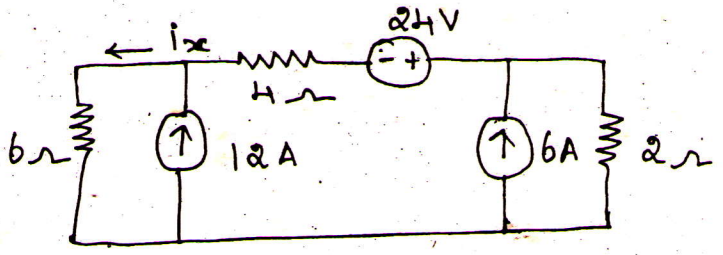


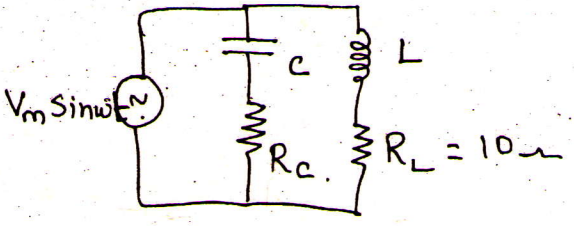
Fig. 8

(8 marks)

V. (a) A balanced star-connected load of $8 + j6$ Ω per phase is connected to a 3-phase 230 V supply. Find the line current, power factor, power, reactive volt-amperes and total volt-amperes.

(8 marks)

(b) Derive the expression for the resonant frequency for the circuit shown in Fig. 9. Also calculate the resonant frequency and the equivalent resistance and resonance condition if $R_C = 8$ Ω, $R_L = 10$ Ω, L = 2 mH and C = 50 μF.



(7 marks)

Fig. 9

Or

(c) The power supplied to the load R and the voltage across it in Fig. 10 are 500 W and 100 V. Determine (i) the value of V_S ; (ii) The power dissipated in each resistor. Also confirm that the power delivered by the source equals the total power dissipated elsewhere.

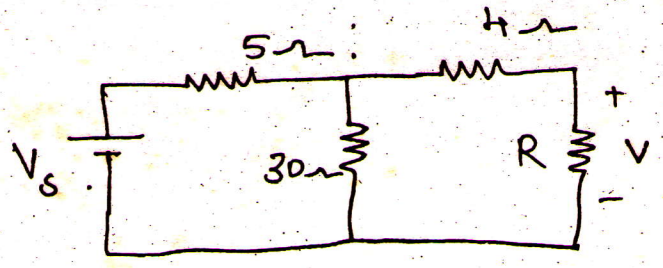


Fig. 10

(8 marks)

(d) Find effective and average values for the following waveform shown in Fig. 11.

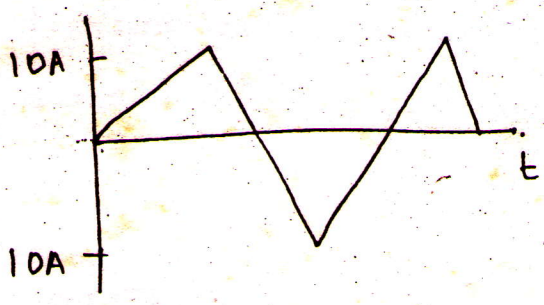


Fig. 11

(7 marks)

[4 × 15 = 60 marks]