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Question Paper Code : Q 2215

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Second Semester

(Regulation 2004)

Electrical and Electronics Engineering

EE 1151 — ELECTRIC CIRCUIT ANALYSIS

(Common to Electronics and Instrumentation Engineering and Instrumentation and Control Engineering)

(Common to B.E. (Part-Time) – First Semester – Electrical and Electronics Engineering – Regulation 2007)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. From the basic definition of an inductor, show that the voltage across an inductor of 'L' Hendry will be equal to $L\frac{di}{dt}$ where i is he current flowing through the inductor.

2. Determine the current flowing through he resistor R_1 and R_3 of he circuit in the Fig. Q. 2.

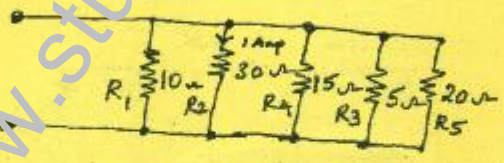

Fig.Q.2

3. What is meant by free and forced responses?

4. Define the complex frequency of a time varying function $f(t)$.

5. In a 50 Hz A.C. Circuit, the current lags the voltage lay 2.5 milliseconds. Determine the phase difference between the voltage and current.

6. In a R-L-C series circuit, the supply voltage is 250 volts, at resonance, the voltages across L and C are equal to 500 volts. If R = 500 Ω, determine the current in the circuit and quality factor.

7. Mention the rules for constructing nodal admittance matrix.

8. Determine the current in the circuit of fig. Q. 8 at which power transferred from the source to the load is maximum.

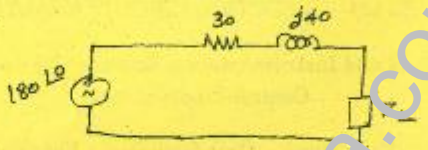

Fig.Q. 8

9. Two inductors $L_1 = 0.5$ h and $L_2 = 1$ h are coupled and their coupling coefficient is 0.05. Find the value of mutual inductance.

10. Write down the expression for 3-phase power in a balanced and unbalanced 3 phase circuit.

PART B – (5 × 16 = 80 marks)

11. (a) (i) State the Kirchhoff's current law. Prove it by using the basic definition of current. (6)

(ii) Determine the supply voltage, current through the resistors of the circuit of Fig. 11(a) (ii). (10)

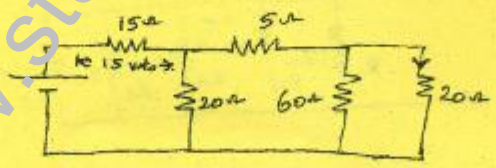

Fig. Q.11 (a) (ii)

Or

(b) (i) Determine the voltages across each of the conductance in Fig. 11 (b) (i). (8)

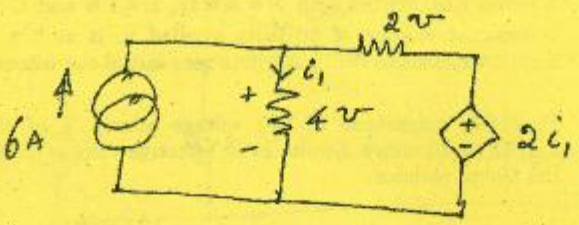

Fig. 11 (b) (i)

(ii) Find the equivalent resistance between M and N of the circuit in Fig. 11 (b) (ii). (8)

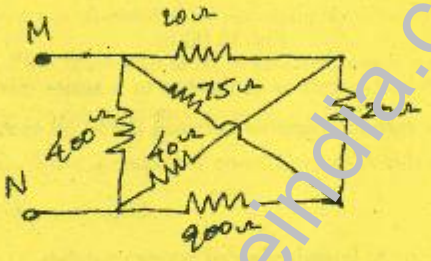

Fig. 11 (b) (ii)

12. (a) (i) Derive the expression for the voltage across a capacitor in a R-C series circuit which is excited by a D.C source of 'V' volts. (6)

(ii) Determine $i(t)$, $i_1(t)$, $i_2(t)$ in the circuit of Figure 12(a) (ii) when switch is moved from 'a' to 'b' at time t= 0. (10)

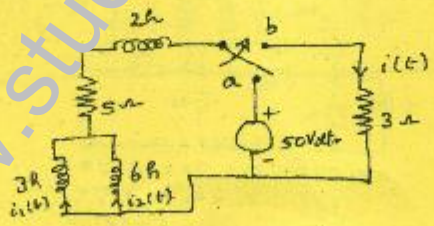

Fig. 12 (a) (ii)

Or

(b) (i) Given $I(s) = \dfrac{s+3}{s^2+4s+8}$ find the initial and final values of $i(t)$. (6)

(ii) A series RLC circuit with $R = 300\ \Omega$, L = 1 h and C = 100 μF has a constant voltage of 50 volts applied to it at t = 0. Find the maximum current value. Assume zero initial conditions. (10)

13. (a) (i) Find the magnitude of the voltage source V of the circuit in Fig. 13 (a) (i) which results in an effective voltage of 20 volts across the 5 ohm resistor. (8)

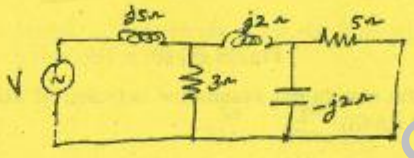

Fig. 13 (a) (i)

(ii) A 220 volt source is connected to a series circuit of $X_L = 40$ ohms and a resistor variable between 8 and 80 ohms. Draw the current locus. (8)

Or

(b) (i) Explain the impedance and power triangles. (6)

(ii) Show that in a series R-L-C circuit, $f_1 f_2 = f_r^2$ where f_r is the resonant frequency and f_1, f_2 are the half power frequencies. Derive the expression for f_1 and f_2 and then proceed. (10)

14. (a) Form the Admittance matrix and solve for the currents in each branch if the circuit in Fig. 14 (a). (16)

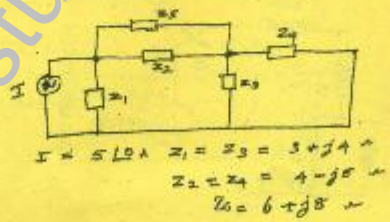

Fig. 14 (a)

Or

(b) (i) Obtain the Thevenin's equivalent of circuit of Fig. 14 (b) (i). (10)

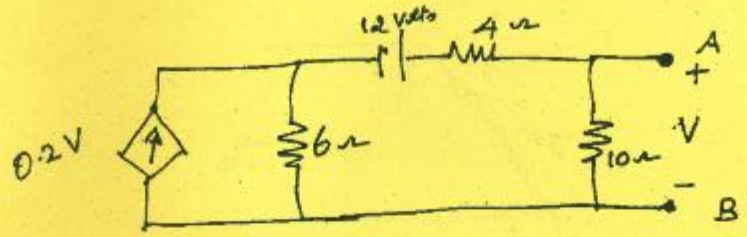

Fig. 14 (b) (i)

(ii) A battery of 120 volts e.m.f and internal resistances 0.1 ohm supplies a load resistor R_L through two wires of resistance 0.45 ohm each. Find the value of R_L which consumes maximum power. Also determine the maximum power. (6)

15. (a) (i) Derive the expression for co-efficient of coupling between two coils. State the assumptions. (8)

(ii) Find the vector values of the currents in the network of Fig. 15(a) (ii). Find also the power supplied by each source. (8)

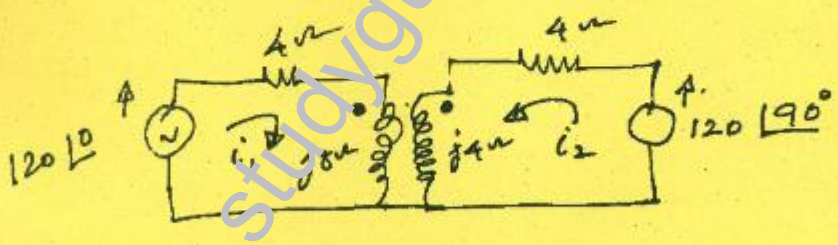

Fig. 15(a) (ii)

Or

(b) Determine the line currents for the unbalanced delta connected load if the phase sequence is (i) RYB and (ii) RBY in the fig 15 (b).

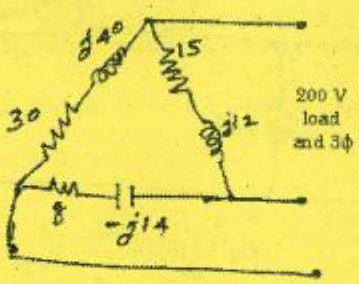

Fig. 15 (b)