Reg. No. : | | | | | | | | | | | |

T 3244

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

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 – Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Show that from the basic definitions, the power is the product of voltage and current.

2. Calculate the current though the 50Ω and 100 ohms resistor of circuit shown in the Fig.2

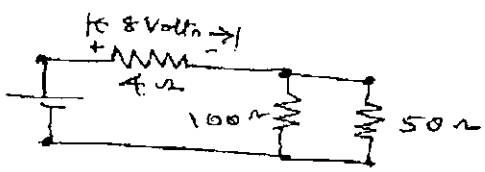

Fig. 2

3. Determine i(t) in the circuit of fig.3

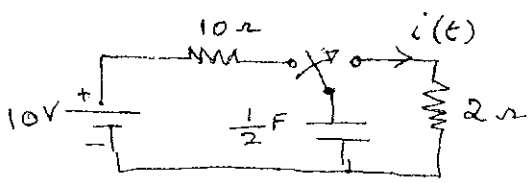

Fig. 3

4. Define complex frequency and determine the frequency for the function $f(t) = 10^{-3t}$.

5. The inductor in the circuit of Fig.5 obsorbs 80 VARS. Determine the active power and power factor of the circuit.

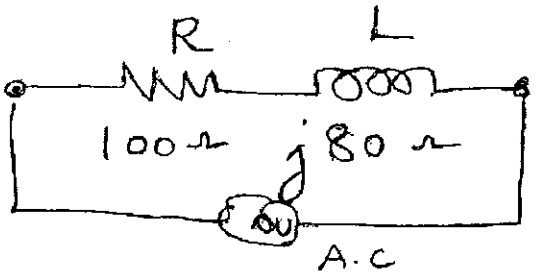

Fig. 5

6. Obtain the expression for the resonance frequency in a R-L-C series circuit.

7. Write down the admittance matrix for the network in the fig.7. All elements values are admittances.

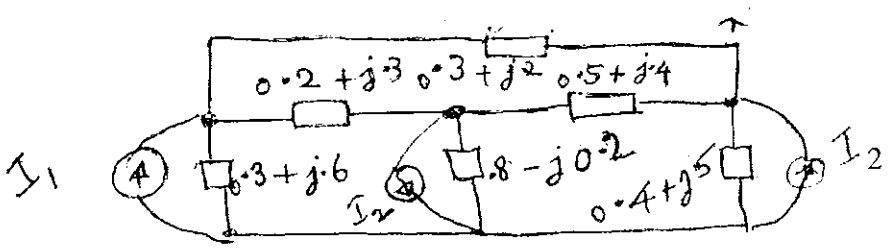

Fig. 7

8. State the superposition theorem.

9. What is co-efficient of coupling? Mention its significance.

10. Show that in a 3 phase Y or Δ connected network, the three phase active power is $\sqrt{3}\ V_L\ I_L \cos\phi$. Where V_L – Line voltage

I_L – Line current

$\cos\phi$ – power factor.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Show that the equivalent conductance of 'n' number of resistors connected in parallel is equal to the sum of the conductance of the each resistor. Mention the law applied for the proof. (6)

(ii) Determine the currents in all the resistors of the circuit of Fig.11(a) (ii). (10)

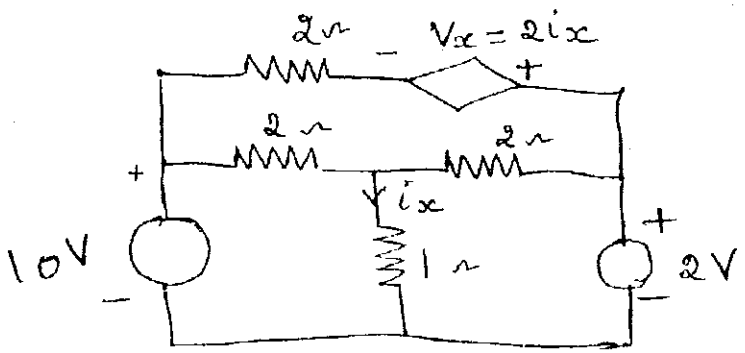

Fig. 11(a) (ii)

Or

(b) (i) Fig.11(b) (i) shows 6 resistors connected to form a circuit. Find the equivalent resistance between points M and N. (6)

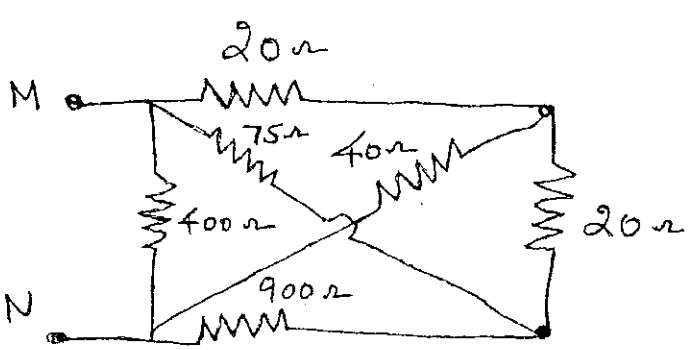

Fig. 11(b) (i)

(ii) A sinusoidal alternating current of frequency 50 Hz has an RMS value of 20Amp. What is the equation for its instantaneous value? Find its value at (i) 0.0025 sec, (ii) 0.0125 sec after passing through a positive maximum value. At what time measured from a positive maximum value will the instantaneous current be 14.14 amps? (10)

12. (a) (i) Derive the expression for the current i(t) and voltage v(t) of the circuits shown in the Fig.12(a) (i). The initial charge in the capacitor is zero and flux in the inductor is zero.

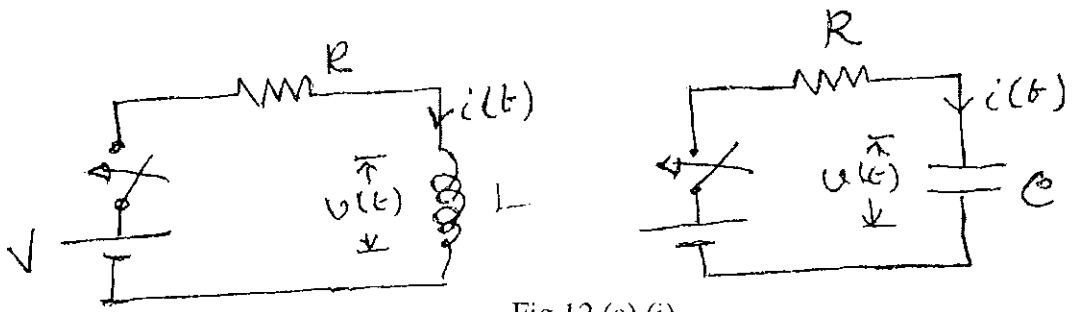

Fig.12 (a) (i) (7)

(ii) The operational impedance of a network is given by $Z(s)=\frac{2s^2+2\times10^5 s+10^4}{8s^2+0.1s+10^4}$. Find the frequency at which this network behaves as pure a reactance and find the value of the reactance. (9)

Or

(b) In the circuit of Fig.12 (b), switch S_1 is closed at t = 0 and then after 5 milliseconds, switch S_2 is opened. Find the transient currents. (16)

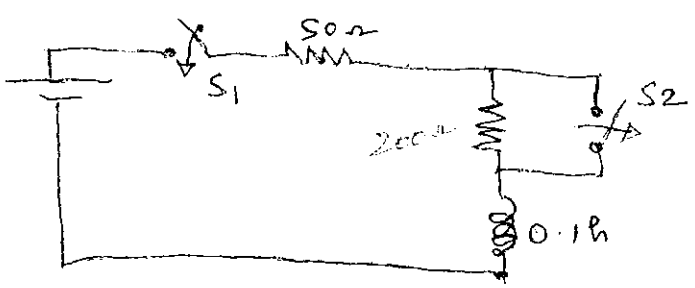

Fig. 12 (b)

13. (a) (i) Explain with neat diagram active, reactive and apparent power and power factor. (6)

(ii) A series R-L-C circuit with $R=10\Omega$, L = 1 mH and $C=1\mu F$ has an applied voltage of 200 volts 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. (10)

Or

(b) A voltmeter connected across the 5 ohm resistor in the Fig.13(b) reads 45 volts. Find the current I and power factor of the circuit. (16)

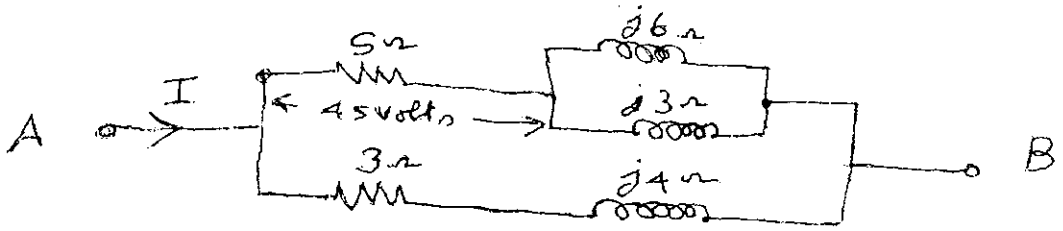

Fig.13(b)

14. (a) (i) State and prove the reciprocity theorem. (6)

(ii) Construct the impedance matrix and thereby solve for the mesh currents marked in the circuit of fig. 14(a) (ii). (10)

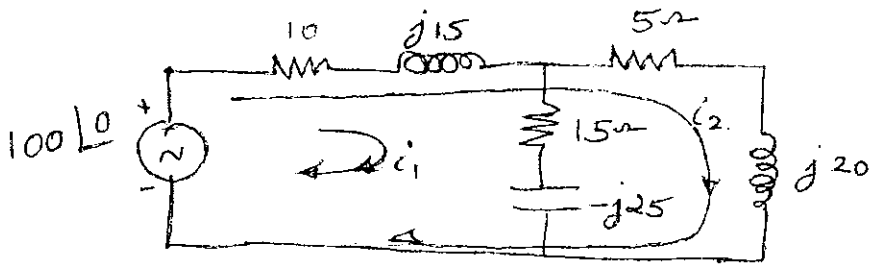

Fig. 14(a)(ii)

Or

(b) (i) State and prove the maximum power transfer theorem in A.C. circuit. (6)

(ii) In the network of Fig.14(b)(ii), the load across AB consists of a variable resistance R_L and a capacitive reactance, variable between 1.5 and 6 ohms. Determine the value of R_L and X_C for which the power transfer is a maximum and calculate the maximum power transferred to the load. (10)

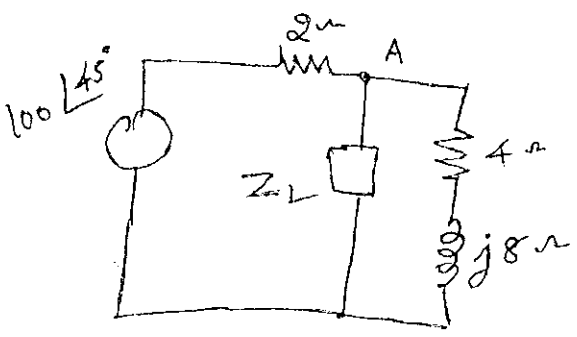

Fig. 14(b)(ii)

15. (a) (i) Two identical coupled coils in series has an equivalent inductance values of 0.080 H and 0.0354 H. Find the values of the inductance, mutual inductance and the co-efficient of coupling. (6)

(ii) Show that from the basic principle, the line voltage in a star connected network is equal to $\sqrt{3}$ times phase voltage. Draw the phasor diagrams. (10)

Or

(b) The three line voltages of a three phase unbalanced source are $V_{ab} = 40\,\text{V}$, $V_{bc} = -j40\,\text{V}$, and $V_{ca} = -40 + j40\,\text{V}$. The source is connected to star connected impedances.

$Z_a = 3 + j4$ ohms, $Z_b = 8 + j6$ ohms and $Z_c = 5 + j0$ ohms. Determine the currents I_a, I_b and I_c (16)