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# Question Paper Code : 21390

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Second Semester

Electrical and Electronics Engineering

EE 2151/EE 25/EE 1151/080280005/10133 EE 205 — CIRCUIT THEORY

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

(Regulation 2008 / 2010)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. State the limitations of Ohm's law.

2. Distinguish between mesh and loop of an electric circuit.

3. State the voltage division principle for two resistor in series and the current division principle for two resistors in parallel.

4. State Maximum power transfer theorem.

5. Define band width of a resonant circuit.

6. Give the applications of tuned circuits.

7. Find the time constant of RL circuit having R = 10 $\Omega$ and $L = 0.1$ mH.

8. A RLC series circuit has $R = 10\ \Omega$. L = 2 H. What value of capacitance will make the circuit critically damped?

9. What is phase sequence of a 3-phase system?

10. A delta connected load has $(30 - j40)\ \Omega$ impedance per phase. Determine the phase current if it is connected to a 415 V, 3-phase, 50 Hz supply.

PART B — (5 × 16 = 80 marks)

11. (a) (i) State and explain Kirchoff's laws. (6)

(ii) Using mesh analysis, determine the current through 1 Ω resistor in the circuit shown in Fig. Q. 11 (a) (ii). (10)

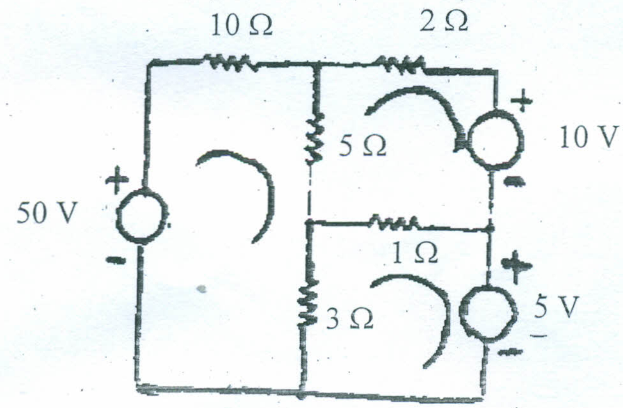


Fig. Q. 11 (a) (ii)

Or

(b) (i) Three loads A, B and C are connected in parallel to a 240 V source. Load A takes 9.6 KW, Load B takes 60 A and Load C has a resistance of 4.8 Ω. Calculate (1) $R_A$ and $R_B$ (2) the total current (3) the total power, and (4) equivalent resistance. (6)

(ii) By applying nodal analysis for the circuit shown in Fig. Q 11 (b) (ii), determine the power output of the source and the power in each resistor of the circuit. (10)

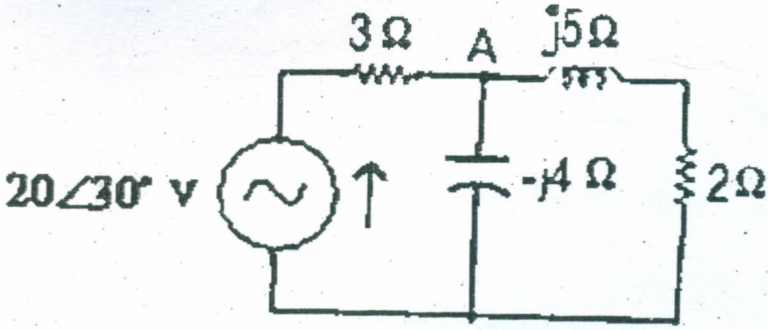


Fig. Q 11 (b) (ii)

12. (a) (i) Explain the source transformation technique. (6)

(ii) Use the superposition theorem to find the current through 4 Ω resistor in the circuit shown in Fig. Q12. (a) (ii). (10)

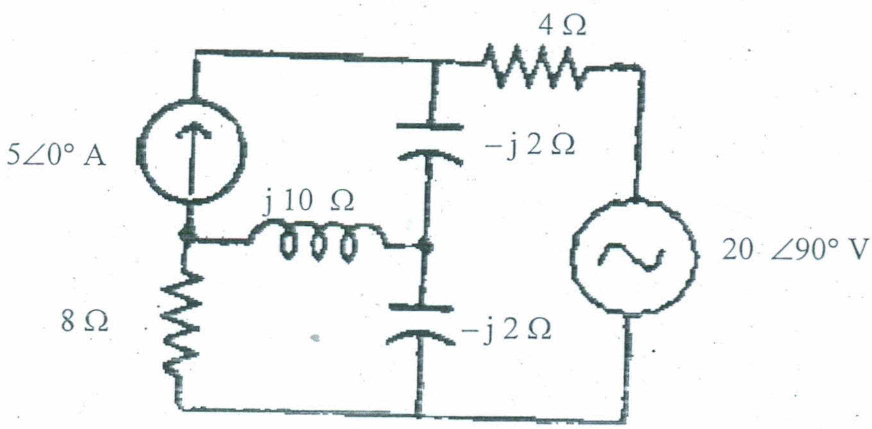


Fig. Q 12 (a) (ii)

Or

(b) (i) Derive expression for star connected resistances in terms of delta connected resistances. (8)

(ii) Find the current through branch a-b of the network shown in Fig. Q.12 (b) (ii) Using Thevenin's theorem. (8)

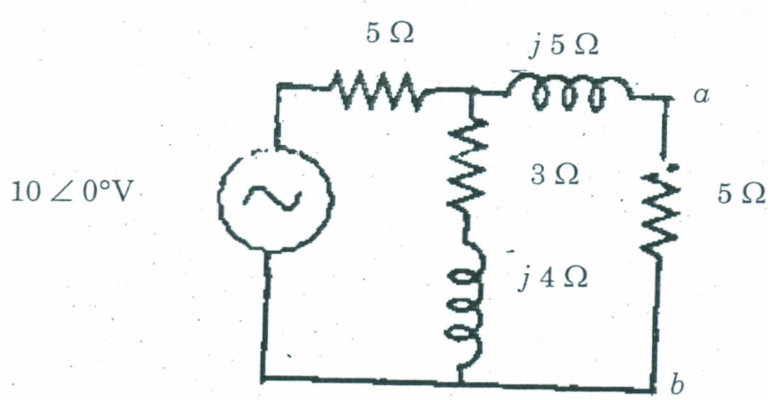


Fig. Q. 12 (b) (ii)

13. (a) (i) Derive the resonance frequency '$f_r$' for the circuit shown in Fig. 13 (a) (i). (8)

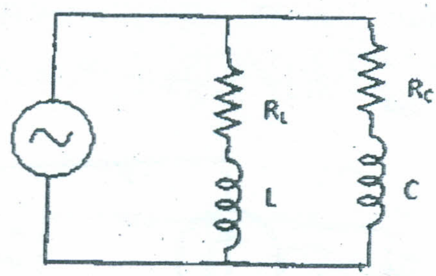


Fig. Q. 13 (a) (i)

(ii) A series circuit with $R = 10\ \Omega$, $L = 0.1$ H and $C = 50\ \mu F$ has an applied voltage $V = 50\angle 0°$ V with a variable frequency. Find (1) the resonant frequency, (2) the value of frequency at which maximum voltage occurs across inductor (3) the value of frequency at which maximum voltage occurs across capacitor. (4) the quality factor of the coil. (8)

Or

(b) (i) Derive the expression for coefficient of coupling in terms of mutual and self inductances of the coils. (8)

(ii) Consider the single tuned circuit shown in Fig. 13 (b) (ii) and determine (1) the resonant frequency (2) the output voltage at resonance, and (3) the maximum output voltage. Assume : $R_S >> \omega_r L_1$ and $K = 0.9$. (8)

14. (a) Derive the step responses of RL and RC circuits. Compare their performances. (16)

Or

(b) Derive an expression for the current response of RLC series circuit with sinusoidal excitation. Assume that the circuit is working in critical damping condition. (16)

15. (a) (i) What are the advantages of three-phase system? (4)

(ii) The two wattmeter method produces wattmeter readings $P_1 = 1560$ W and $P_2 = 2100$ W when connected to a delta connected load. If the line voltage is 220 V, calculate : (1) the per-phase average power (2) the per-phase reactive power (3) the power factor, and (4) the phase impedance. (12)

Or

(b) (i) Prove that the total instantaneous power in a balanced three-phase system is constant and is equal to the average power whether the load is star or delta connected. (10)

(ii) An unbalanced star-connected load has balanced voltages of 100 V and RBY phase sequence. Calculate the line currents and the neutral current.

Take : $Z_A = 15\ \Omega$, $Z_B = (10 + j5)\ \Omega$, $Z_C = (6 - j\ 8)\ \Omega$. (6)