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# Question Paper Code : 90192

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Second Semester

Electrical and Electronics Engineering

EE 8251 – CIRCUIT THEORY

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

(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Calculate the average power absorbed by an impedance Z = (30 – j70) Ω, when voltage of 100 $V_s$ = 100∠0° is applied across it.
2. State current division rule and voltage division rule.
3. Define Millman theorem.
4. What is the purpose of reciprocity theorem ?
5. The RC series circuit shown in Figure 5 below has an initial charge $Q_0 = 2 \times 10^{-3}$ coloumb. Find the transient current if the switch is closed at t = 0.

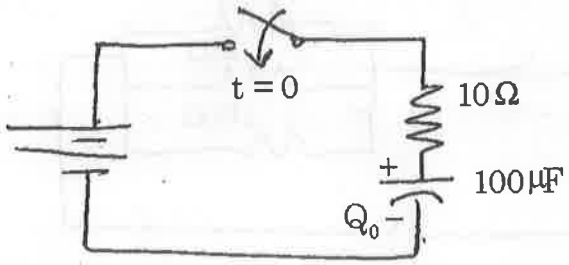


Figure 5

6. A DC voltage is applied to a series RL circuit by closing a switch. The voltage across L is 100 volts at t = 0 and drops to 13.5 volts at t = 0.02 sec. If L = 0.1 H, find the value of R.

7. Define coefficient of mutual coupling.

8. Compare series resonance and parallel resonance.

9. What is the relationship between line current and line voltage in a delta connected circuit ?

10. A line to line voltage applied to star connected primary of a transformer is 220 V (balanced). If the line current drawn from the primary side is 20 A, find the phase voltage and phase currents.

PART – B **(5×13=65 Marks)**

11. a) i) Find the supply voltage V in the circuit shown below in Fig. 11 (a) (i) which drives a current zero in the 10Ω resistor employing nodel analysis. **(6)**

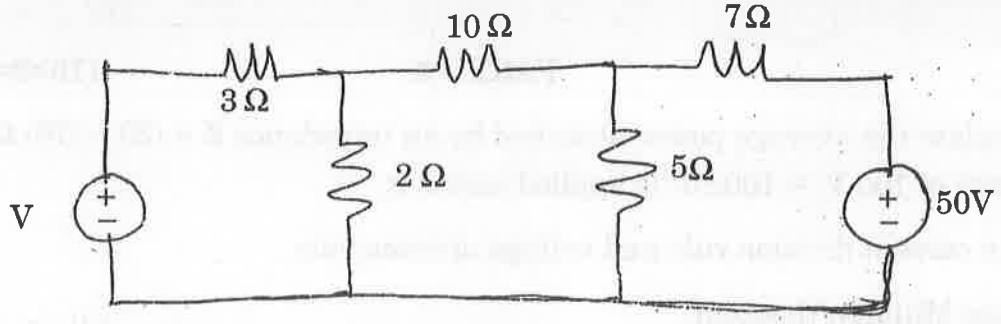


Fig. 11 (a) (i)

ii) Current in the 5Ω resistor of the circuit shown in Fig. 11 (a) (ii) is 5A. Find the current in the 10Ω resistor and also power consumed by 5Ω resistor. **(7)**

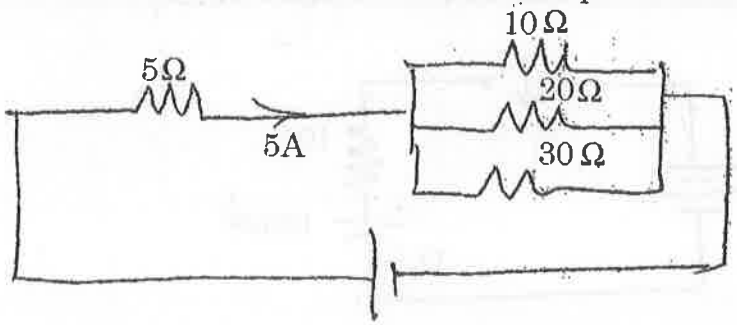


Fig. 11 (a) (ii)

(OR)

b) i) Determine the current in the 10Ω resistor in the circuit shown in Fig. 11 (b) (i) and find the voltage across terminal AB. **(7)**

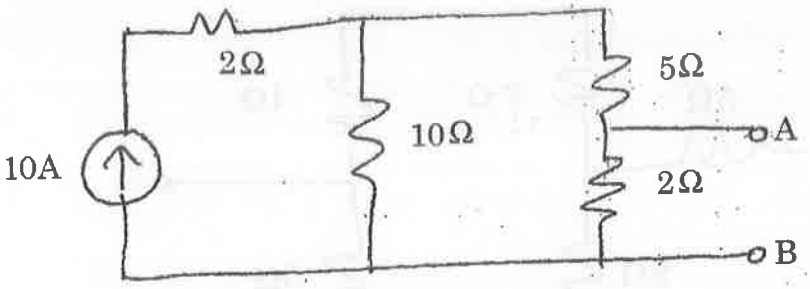


Fig. 11 (b) (i)

ii) Find the voltage between A and B of the circuit shown below in Fig. 11 (b) (ii) by mesh analysis. **(6)**

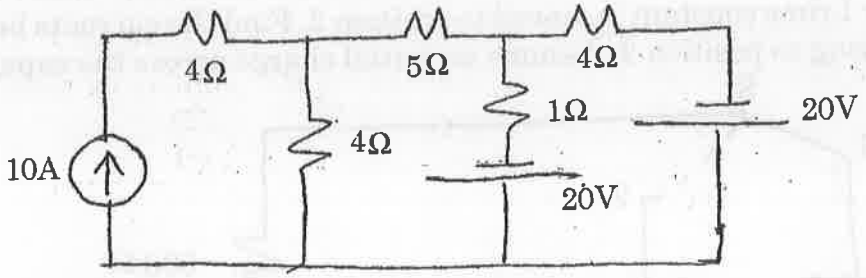


Fig. 11 (b) (ii)

12. a) Determine the Thevenin equivalent circuit across terminal AB shown in Fig. 12 (a) **(13)**

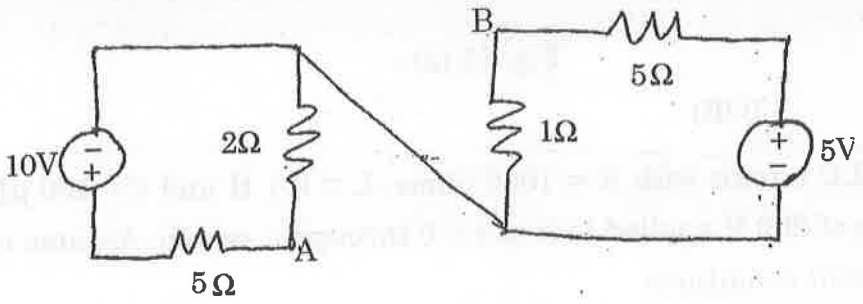


Fig. 12 (a)

(OR)

b) Determine the Norton equivalent circuit across terminals A and B as shown in Fig. 12 (b). **(13)**

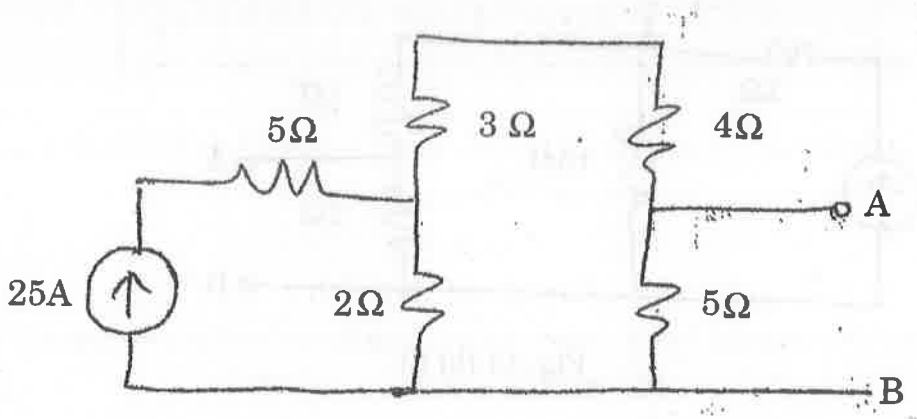


Fig. 12 (b)

13. a) In a circuit shown in figure 13 (a), the switch is closed on position 1 at t = 0 and after 1 time constant is moved to position 2. Find the currents before and after moving to position 2. Assume no initial charge across the capacitor. **(13)**

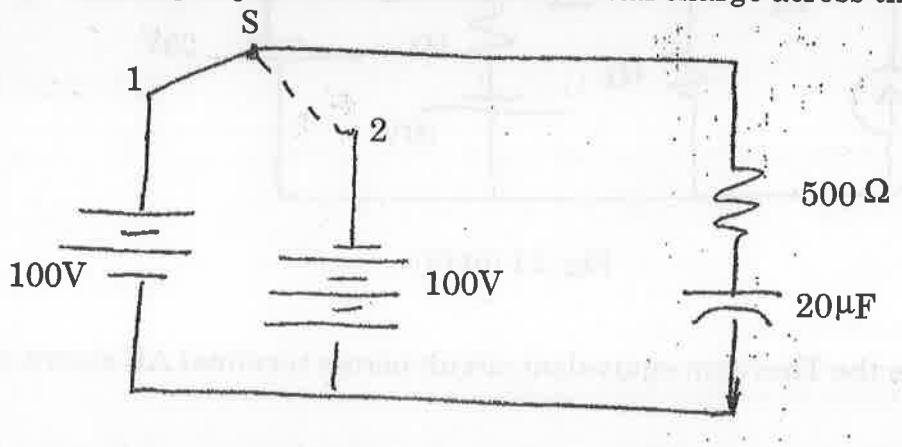


Fig. 13 (a)

(OR)

b) A series RLC circuit with R = 1000 ohms, L = 0.1 H and C= 100 μF has a DC voltage of 200 V applied to it at t = 0 through a switch. Assume initially relaxed circuit conditions

i) Find the expression for the transient current. **(7)**

ii) For what value of capacitance the circuit will be critically damped. **(6)**

14. a) i) A symmetrical 3 phase 440 V system supplies balanced delta connected load. The branch current is $10\angle 30°$ lagging. Find

1) Line current
2) Total active power
3) Total reactive power and draw phasor diagram. **(7)**

ii) Calculate the total power input and readings of two wattmeters connected to measure power in three phase balanced load. Reactive power input is 15 kVAR and load power factor is 0.8. **(6)**

(OR)

b) A three phase delta connected load has $Z_{ab} = 100 + j0$, $Z_{ab} = -j100$, $Z_{ab} = 70.7 + j70.7$. Compute the line and phase currents if it is connected in

i) abc sequence **(7)**

ii) acb sequence. **(6)**

15. a) i) A coil having an inductance of 100 mH is magnetically coupled to another coil having an inductance of 900 mH. The coefficient of coupling between the coils is 0.45. Calculate the equivalent inductance of the two coils connected by

- Series aiding,
- Parallel aiding,
- Series opposing, and
- Parallel opposing **(7)**

ii) A series circuit consisting of an 12Ω resistor 84.4 μF capacitor and a variable inductor connected to a 100 V 50 Hz supply. For the resonance condition determine the current through the inductor and voltage drop across it. Find Q and Bandwidth. **(6)**

(OR)

b) Calculate the currents $I_1$ and $I_2$ in the circuit shown in Fig. 15 (b). **(13)**

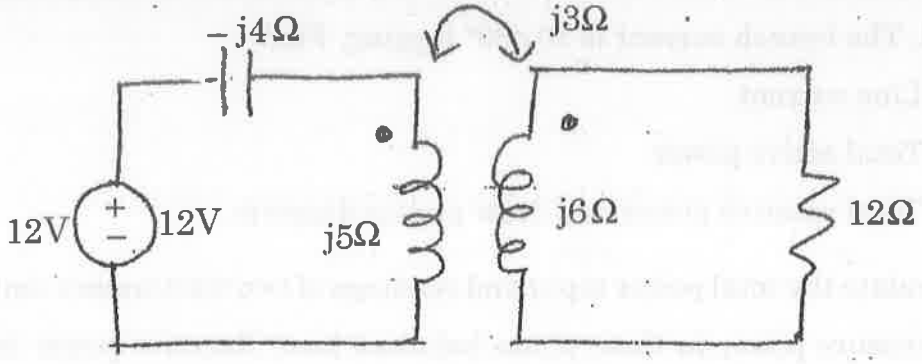


Fig. 15 (b)

PART – C **(1×15=15 Marks)**

16. a) i) A three-phase three-wire 220 V ABC system feeds an delta connected load whose phase impedance is $15\angle 60°\Omega$. Find the phase and line currents in this system and draw the phasor diagram. **(8)**

ii) Find the current through various branches of the circuit shown in Fig. 16 (a) (ii) by employing superposition theorem. **(7)**

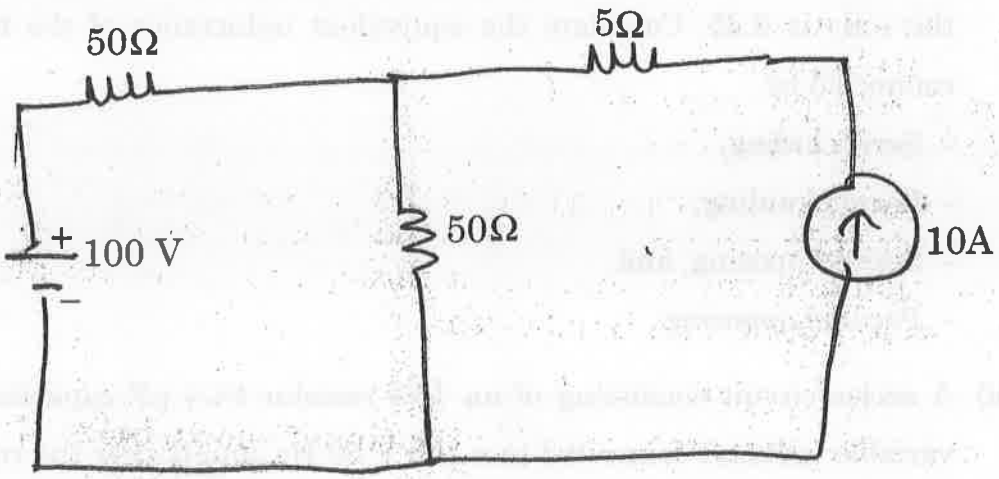


Fig. 16 (a) (ii)

(OR)

b) i) A three-phase four-wire 415 V ABC system feeds an unbalanced Y-connected load with $Z_A = 15\angle 0°\Omega$, $Z_B = 10\angle 30°\Omega$ and $Z_C = 40\angle 60°\Omega$. Obtain the four line currents. **(8)**

ii) Three impedances $Z_1 = (10.5 + j20)$, $Z_2 = (20 + j33.5)$ and $Z_3 = (10 - j15)$ ohms are delta connected to a 415 V, three phase system. Determine the phase currents, line currents and total power consumed by the load. **(7)**