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**Question Paper Code : 81278**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Second Semester

Electrical and Electronics Engineering

EE 3251 — ELECTRIC CIRCUIT ANALYSIS

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

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Kirchhoffs Voltage Law and Kirchhoffs Current Law.
2. What do you mean by Average and RMS values in AC circuits?
3. A circuit consisting of two resistors,  $R_1$  and  $R_2$  are connected in parallel to a current source,  $I_s$ . Write the expression for the current through the Resistor,  $R_2$ .
4. State Maximum power transfer theorem.
5. Write the Laplace transform of the sine function,  $\sin \omega t$  and the Exponential function,  $e^{at}$ .
6. Write the expression for the time constant of a series RC circuit.
7. What is meant by mutual inductance?
8. Specify the condition for which a series RLC circuit is said to be in resonance.
9. Write the relationship between Phase voltage,  $V_{ph}$  and Line voltage,  $V_L$  in a star connected system.
10. Using two wattmeter method of three phase power measurements, Write the expressions for the power measured by each wattmeter.

PART B — ( $5 \times 13 = 65$  marks)

11. (a) A battery of unknown emf,  $V$  is connected across resistances as shown in Fig.1. The voltage drop across the  $8\Omega$  resistor is 20 V. Determine the current reading in the ammeter and the emf of the battery,  $V$ ?

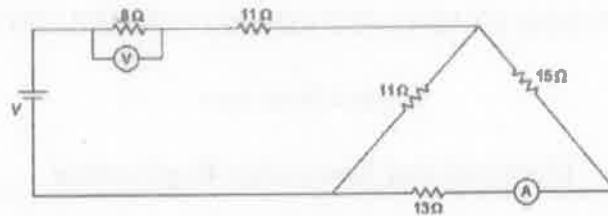


Fig. 1

Or

- (b) Write the mesh current equations for the circuit shown in Fig.2 and determine the currents,  $I_1$  and  $I_2$ .

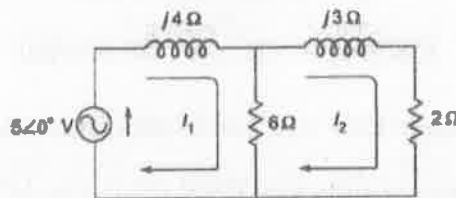


Fig. 2

12. (a) Determine the current,  $I$  in the circuit shown in Fig.3 using the superposition theorem.

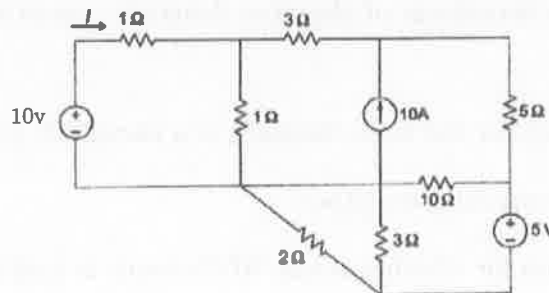


Fig. 3

Or

- (b) Determine Norton's equivalent circuit for the given circuit shown in Fig.4.

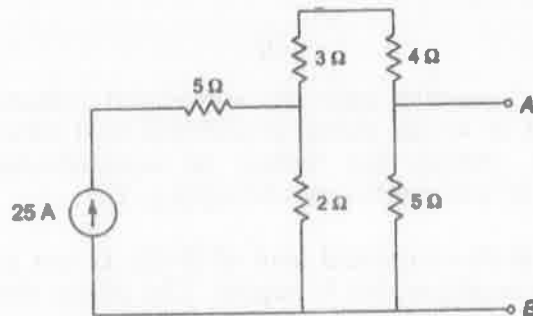


Fig. 4

13. (a) A series RL circuit shown in Fig.5 is connected to a 100 V source at  $t = 0$  seconds through switch, S. Obtain the complete expression for the current  $i(t)$ .

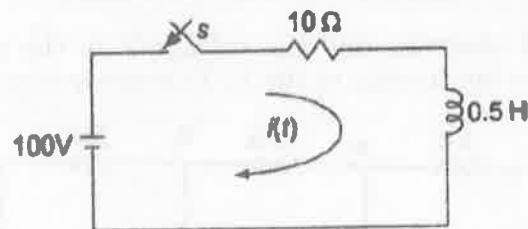


Fig. 5

Or

- (b) A Series RLC circuit shown in Fig.6, comprising of  $R = 100 \, \Omega$ ,  $L = 0.1 \, \text{H}$  and  $C = 100 \, \mu\text{F}$  is excited by a 200 V constant voltage source,  $V_s$  at  $t = 0$  seconds through a switch. Obtain the expression for the transient current,  $i$ . Assume that the circuit is relaxed initially.

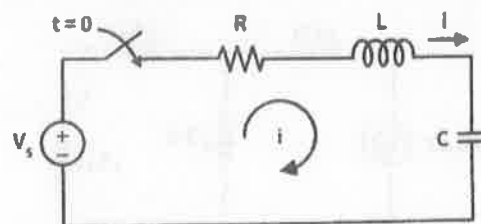


Fig. 6

14. (a) A series RLC circuit has a quality factor of 5 at 50 rad/s. The current flowing through the circuit at resonance is 10 A and the supply voltage is 100 V. The total impedance of the circuit is 20  $\Omega$ . Find the circuit constants, R, L and C.

Or

- (b) Two identical coupled coils has equivalent inductance values of 0.08 H and 0.035 H in series aiding connection and series opposing connection respectively. Obtain the values of self-inductances,  $L_1$ ,  $L_2$ , mutual inductance, M and coefficient of coupling, K.
15. (a) A balanced delta-connected load of  $(2+j3) \Omega$  per phase is connected to a balanced three-phase 440 V supply. The phase current is 10 A. Find the total active power, reactive power and apparent power in the circuit.

Or

- (b) A three phase, star connected 400 V supply is given to a balanced star connected load of  $(8+j6) \Omega$  in each phase. Find the line current, power factor and total active power in the circuit. Given supply voltage is line voltage.

PART C — (1 × 15 = 15 marks)

16. (a) Using nodal analysis, find the voltage V in the circuit shown in Fig. 7 which makes the current in the 10  $\Omega$  resistor zero.

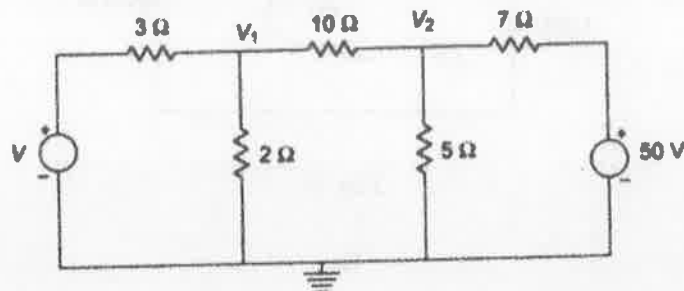


Fig. 7

Or

- (b) Using Thevenin's theorem, determine the load current,  $I_L$  in the circuit shown in Fig. 8.

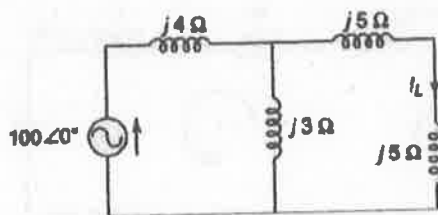


Fig. 8