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Question Paper Code: R2B05

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Second Semester

Biomedical Engineering

R21UBM205- ELECTRICAL CIRCUITS AND MEASUREMENTS

(Regulations R2021)

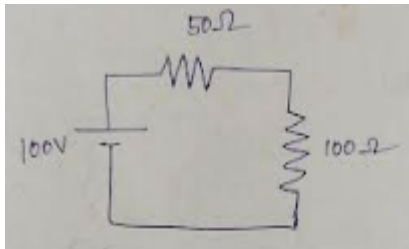
Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

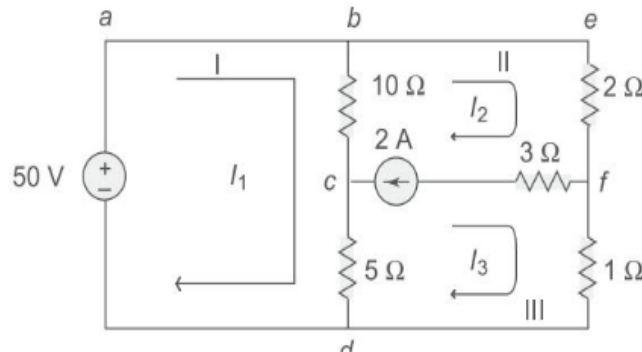
1. Calculate the voltage across 100-ohm resistor in the circuit shown below CO3-App



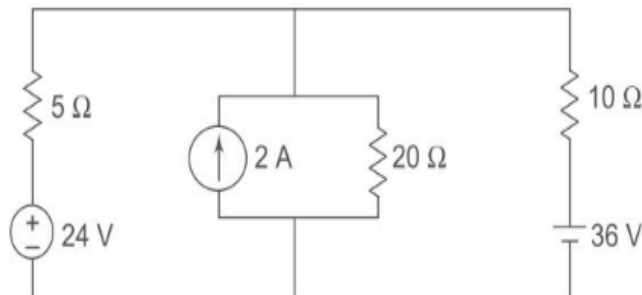
2. Distinguish between series and parallel circuit CO1-U
3. State Norton's theorem and draw its equivalent circuit. CO1-U
4. Why do you short circuit the voltage source and open the current source when you find Thevenin's voltage of a network? CO3-App
5. When do you say that a given ac circuit is at resonance? CO1-U
6. How is the mutual inductance of a pair affected when the separation between the coils is increased? CO1-U
7. What are the different reasons that cause an error in PMMC CO 2- U
8. Sketch the circuit diagram of Permanent magnet moving coil? CO 2- U
9. Justify why we need earthing? CO 2- U
10. Which is better concealed wiring or open wiring? Justify? CO 2- U

PART – B (5 x 16= 80 Marks)

11. (a) (i) Determine the current in the 5 V resistor in the network given CO3- App (10)
in Fig.

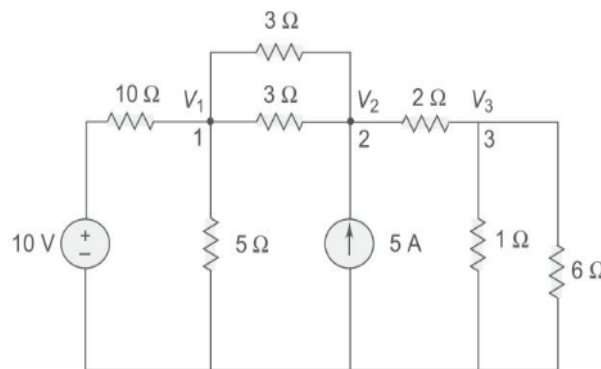


- (ii) For the circuit shown in Fig. use nodal analysis to find the CO3- App (6)
current delivered by the 24 V source.



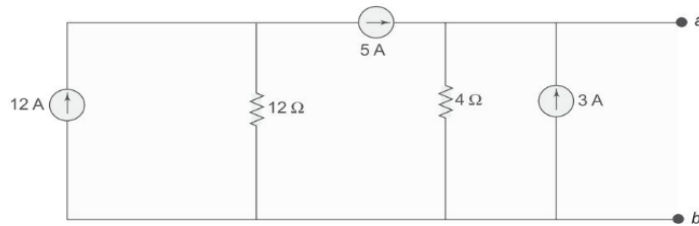
Or

- (b) (i) Determine the voltages at each node for the circuit shown in CO3- App (10)
Fig



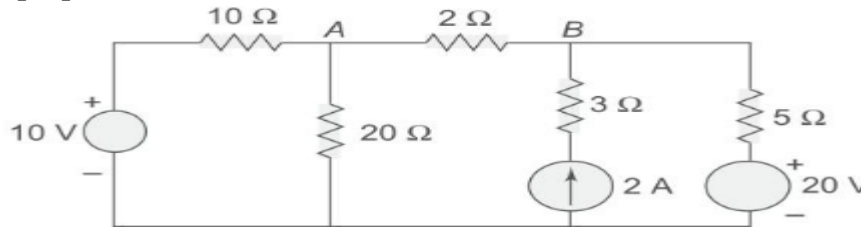
- (ii) An electric circuit has three terminals A, B, C. Between A and B is connected a 2 V resistor, between B and C are connected a 7 V resistor and a 5 V resistor in parallel, and between A and C is connected a 1 V resistor. A battery of 10 V is then connected between terminals A and C calculate (a) total current drawn from the battery, (b) voltage across the 2 V resistor, and (c) current passing through the 5 V resistor. CO3- App (6)

12. (a) Determine the Thevenin's and Norton's equivalent circuits with respect to terminals ab for the circuit shown in Fig. CO3- App (16)

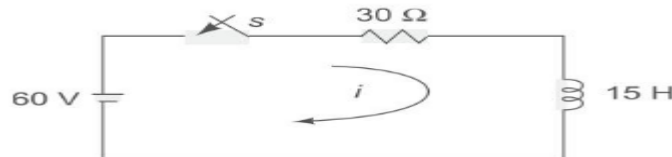


Or

- (b) Find the voltage across the 2 V resistor in Fig. by using the superposition theorem. CO3- App (16)



13. (a) (i) A series circuit with $R = 10\text{-ohm}$, $L = 0.1\text{ H}$ and $C = 50\text{ mF}$ has an applied voltage $V = 50\angle 0^\circ$ with variable frequency. Find the resonant frequency, the value of frequency at which maximum voltage occurs across the inductor and the value of frequency at which maximum voltage occurs across the capacitor. CO4- App (8)
- (ii) A series RL circuit with $R = 30\text{ ohm}$ and $L = 15\text{ H}$ has a constant voltage $V = 60\text{ V}$ applied at $t = 0$ as shown in Fig. Determine the current i , the voltage across resistor and the voltage across the inductor. CO4- App (8)



Or

- (b) (i) Consider an RL circuit with $R = 100\text{ ohms}$ and $L = 10\text{ mH}$. The circuit is connected to a DC voltage source of 10V. Initially, the switch was open, and there was no current flowing through the circuit. At $t = 0$, the switch is closed. Calculate the time constant of the circuit, the maximum current that flows through the circuit, and the time it takes for the current to reach 63.2% of its maximum value. Also, sketch the current waveform and voltage waveform of the circuit for the first 5 milliseconds after the switch is closed. CO4- App (8)

- (ii) In ECG Resonance circuit have the following specifications: CO4- App (8)
 coil inductance 5 mH, resistance 10 Ω , capacitance 250Nf,
 variable-frequency supply 50V.Determine (a) Parameters under
 series resonance circuit(b)Parameters under parallel resonance
 circuit.From the above observation which resonance circuit is best
 for ECG application?
14. (a) A current transformer (CT) is designed to measure the primary CO2- App (16)
 current of a power line, which has a rated current of 500 A. The
 CT has a turns ratio of 1:1000 and an accuracy class of 0.5.
 Determine the secondary current produced by the CT under
 normal operating conditions, as well as the maximum allowable
 burden resistance for maintaining the specified accuracy.
 Or
- (b) (i) Identify the various types of errors associated in analog CO2- App (8)
 measuring instruments and how these errors can be minimized?
 (ii) Sketch the basic construction of PMMC instrument. Develop CO2- App (8)
 the torque equation for a PMMC instrument and show that its scale
 is linear if spring control is employed?
15. (a) Explain the concept of two-way control and three-way control, CO1- U (16)
 including how the switches are interconnected and how the circuit
 operates in each case.
 Or
- (b) Evaluate the impact of technological advancements on the CO1- U (16)
 development and use of cables and wires in modern electrical
 safety in hospitals?