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Question Paper Code: R2B05

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

Second Semester

Biomedical Engineering

R21UBM205- ELECTRICAL CIRCUITS AND MEASUREMENTS

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

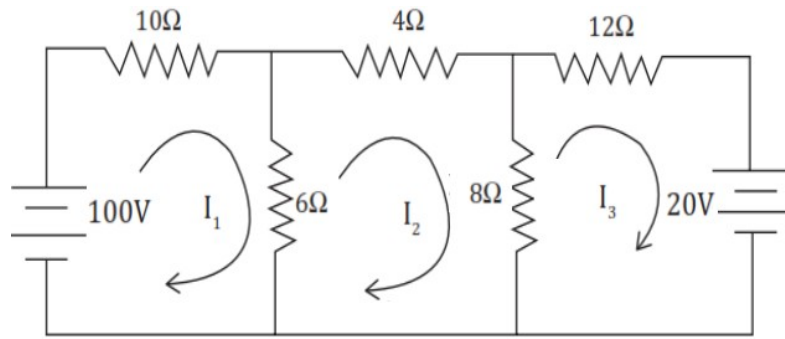
Answer All Questions

PART A - (10 x 2 = 20 Marks)

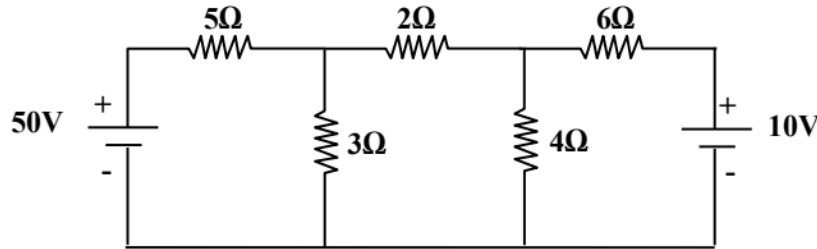
1. State Kirchhoff's Current Law and Voltage Law. CO1-U
2. Define impedance and power factor of AC circuit. CO1-U
3. What is the condition for maximum power transfer in DC circuits? CO1-U
4. Examine current division rule and voltage division rule. CO1-U
5. Define resonance. What is the condition for resonance for an RLC series circuit? CO1-U
6. Define Quality factor. CO1-U
7. Mention the advantages and disadvantages of moving iron instruments. CO1-U
8. Differentiate Current Transformers and Potential Transformers. CO1-U
9. What is the need of earthing in domestic buildings? CO1-U
10. Differentiate fuses and miniature circuit breakers. CO1-U

PART – B (5 x 16= 80 Marks)

11. (a) i) Derive the Loop currents I_1 , I_2 and I_3 by Mesh loop analysis and also Find power dissipated by 8 Ohm resistor as shown in Fig. CO1-U (8)

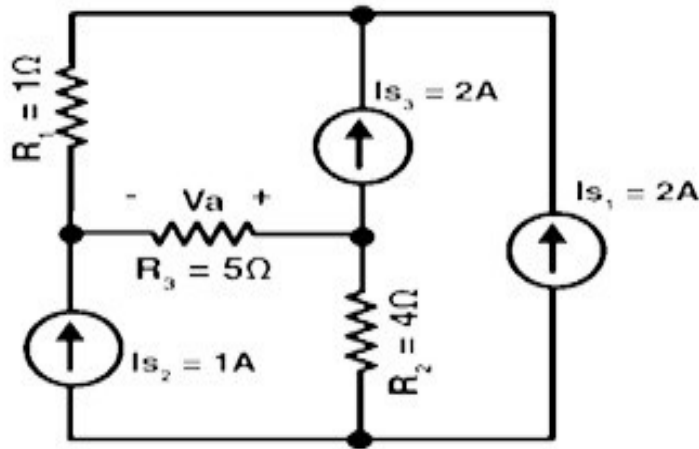


- (ii) Determine the power dissipation in the 4Ω resistor of the given circuit shown in fig. using mesh/nodal analysis. CO1-U (8)

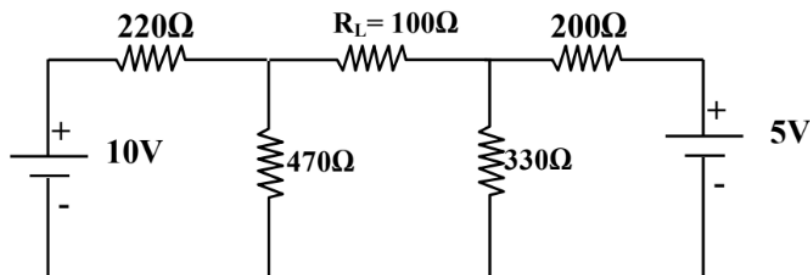


Or

- (b) Find the voltage V_a across the 5Ω resistor in the following circuit by using nodal analysis. CO1-U (16)

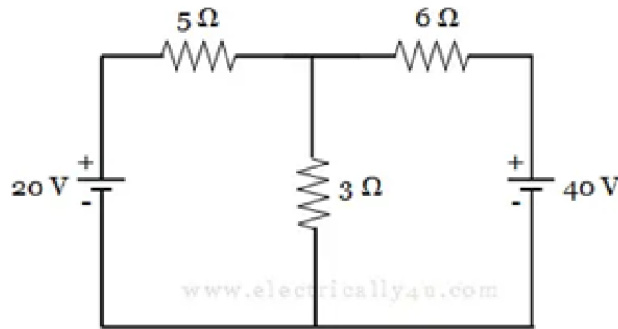


12. (a) Obtain the Norton's model and find the maximum power that can be transferred to the 100Ω load resistance in the circuit shown in figure. CO2-App (16)

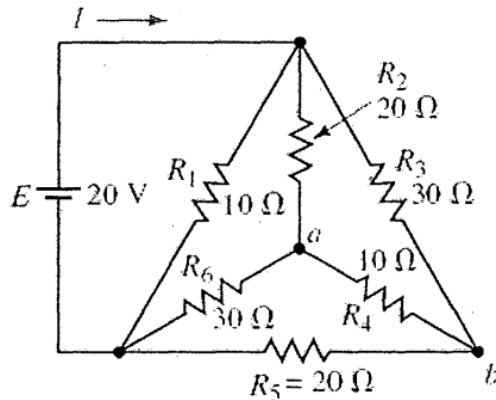


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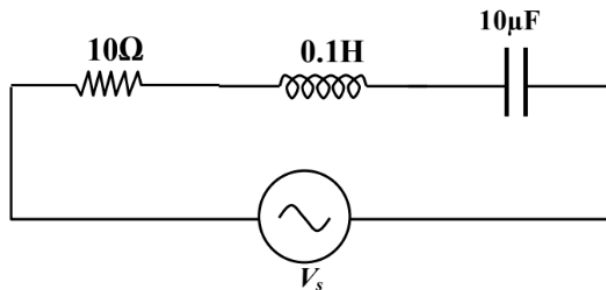
- (b) (i) Apply superposition theorem to determine current through 3Ω resistor for the given circuit in figure. CO2-App (8)



- (ii) Determine the current I using network reduction technique. CO1-U (8)



13. (a) For the circuit shown in figure, determine the impedance at resonant frequency, 10Hz above resonant frequency, and 10Hz below resonant frequency and also find quality factor of the coil. CO1-U (16)



Or

- (b) Consider an RC circuit with $R=1000$ ohms and $C=1$ microfarad. CO1-U (16)
The circuit is connected to a DC voltage source of 5V. Initially, the capacitor was uncharged. At $t=0$, the switch is closed. Calculate the transient current, the maximum voltage across the capacitor, and the time it takes for the voltage across the capacitor to reach 48.2% of its maximum value.

14. (a) i) Sketch the basic construction of PMMC instrument. Develop the torque equation for a PMMC instrument and show that its scale is linear if spring control is employed. CO1-U (10)
- ii) Discuss briefly the constructional features of an induction type energy meter. CO1-U (6)
- Or
- (b) i) Illustrate with neat diagram the construction and working principle of attractive and repulsive type moving iron instrument? CO1-U (10)
- ii) Explain the special features incorporated in an electro-dynamometer type of wattmeter so that it can be used for low power factor applications. CO1-U (6)
15. (a) Discuss in brief the causes and effects of electric shock on the human body. What are the preventive measures that can be taken to minimize the risk of electrical accidents happened in hospitals? Explain in detail. CO1-U (16)
- Or
- (b) Explain the principles of Two-way and Three-way control switching systems in complex electrical installations. CO1-U (16)