'समानो मन्त्रः समितिः समानी'

UNIVERSITY OF NORTH BENGAL

B.Sc. Sec 1st Semester Examination, 2023

UPHYSEC11001-PHYSICS

BASIC ELECTRICAL CIRCUITS AND MEASUREMENTS

Time Allotted: 2 Hours | Full Marks: 40

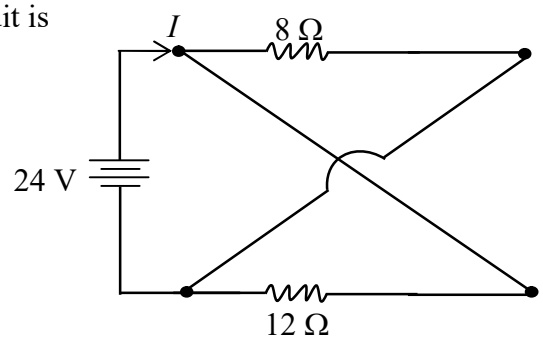
The figures in the margin indicate full marks.

GROUP-A

(Compulsory)

1. Choose the correct alternative: 1×5 = 5

(a) The current I in the given circuit is



(A) 2 A

(B) 3 A

(C) 4 A

(D) 5 A

(b) An ammeter with full scale deflection current of 100 μA and internal resistance of 100 Ω is required to measure a maximum current of 10 mA. The shunt resistance needed is

(A) 1 Ω (B) 1.01 Ω (C) 10 Ω (D) 10.1 Ω

(c) Following figure represent a

(A) heater (B) fuse (C) circuit breaker (D) switch

(d) Which type of flux does transformer action need?

(A) Alternating electric flux (B) Alternating magnetic flux

(C) Increasing magnetic flux (D) Constant magnetic flux

(e) For a coil with inductance L and resistance R in series with a capacitor C has resonance impedance:

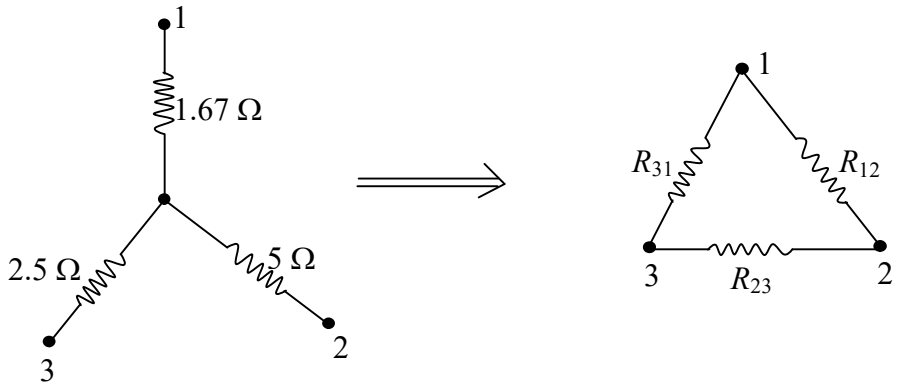
(A) zero (B) R (C) $\frac{L}{CR}$ (D) infinity

GROUP-B

Answer any *three* questions from the following 5×3 = 15

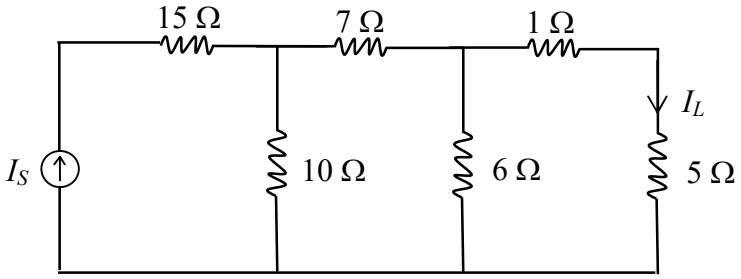
2. In the circuit shown, the voltage source follows the law $V(t) = V_0 e^{-\alpha t}$, where V_0, α are constants. The switch is closed at $t = 0$. Solve for the current, when (i) $\alpha = \frac{R}{L}$ and (ii) $\alpha \neq \frac{R}{L}$. 5

3. A star type connection of resistance as shown in figure is converted to an equivalent delta-type configuration. Determine the resistance (R_{12}, R_{23}, R_{31}) between the terminal of delta-type system. 5



4. (a) State Ohm's law. Define resistivity. 2

   (b) Find the ratio $\frac{I_L}{I_S}$ in the following circuit. 3



5. (a) Define Complex Power. 1

   (b) Complex power for a circuit is given by $S = 100 + j50$ V_A. Find the (i) apparent power and (ii) power factor. 2+2

6. (a) What do you mean by impedance of a circuit? 1

   (b) A voltage $V = (8 + 6j)$ V is applied to a circuit. The resulting current is $I = (3 - 4j)$ A. Find the (i) impedance and (ii) values of circuit element if the circuit is connected across an a.c. source of frequency 50 Hz. 2+2

7. Draw the circuit diagram of a full wave bridge rectifier and explain its operation. 2+3

GROUP-C

Answer any *two* questions from the following 10×2 = 20

8. (a) Describe in brief the construction and explain principle and operation of a permanent magnet moving coil (PMMC) instrument. 5

   (b) How will you use a PMMC instrument which gives full scale deflection at 50 mV P.d and 10 mA current as 2+2

   (i) a Voltmeter of 0-250 V range?

   (ii) an Ammeter of 0-10 A range?

   (c) Can you measure power in an a.c. circuit by using an ammeter and a voltmeter? Justify your answer. 1

9. (a) Why is the three phase voltage system preferred for supplying power? 2

   (b) Derive the relation between phase and line voltage and phase and line current for a balanced three-phase *Y* connected load (star-connected). 5

   (c) A balanced three phase *Y* connected load is fed from a 400 V, three phase, 50 Hz supply. The current per phase is 25 A and total active power absorbed by the load is 13.856 kW. Calculate the power factor. 3

10. (a) State the condition for maximum efficiency of a D.C. generator. 3

    (b) Derive an expression for the frequency of the generated emf in an AC generator. 4

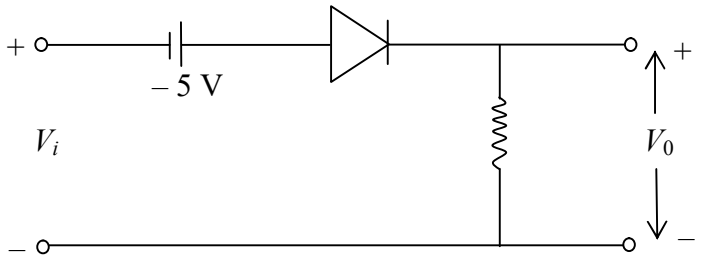
    (c) What do you mean by synchronous generator? Between DC and AC generator which one falls in this category and why? 1+2

11. (a) What is the function of insulator in transmission line? 2

    (b) Give the schematic representation of (i) photodiode and (ii) overload safety switch. 2

    (c) What is ground fault protection? 2

    (d) Determine the output wave form of the given circuit when $V_i = 20\sin\omega t$ and $R = 100\,\Omega$. 3



   (e) What is the polar representation of the voltage $(\sqrt{3} + j)$ V? 1

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