

Indian Maritime University
(A Central University, Govt of India)
Supplementary Examinations – March/April 2024
Programme Name: B Tech (ME)
Semester: II
Subject Code: UG11T4202
Subject Name: Basic Electrical Engineering

Date: 09.03.2024

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

General Instructions

- (i) All Sections (A, B & C) are to be attempted.
- (ii) Options, if any, are specified in respective section.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. The commercial unit of electrical energy is _____.
a. kWh b. Watts c. Joules d. Calories
2. Kirchhoff's first law i.e., $\sum i=0$ at a junction, is based on the law of conservation of _____.
a. Energy b. Momentum c. Speed d. Charge
3. The electric energy required to raise the temperature of a given amount of water is 1000kWh. If heat losses are 20%, the total heating energy required is ____ kWh.
a. 1500 b. 1250 c. 1200 d. 1000
4. When a resistor dissipates 100 watts of electricity and there is a 10 V potential difference across it, the current flowing through it is _____.
a. 1000 A b. 10 A c. 1 A d. 100 A
5. The magnetic flux density is measured in _____.
a. Weber b. Ampere-turn c. Weber/m² d. Ampere-turn/m
6. An emf of 10 V is produced by self-inductance, when the current changes at a steady rate of 2A to 1A in 2 ms. The value of self-inductance is _____.
a. 5 mH b. 10 mH c. 20 mH d. 50 mH

7. An inductive coil has an impedance of 5 ohms with an inductive reactance of 4 ohms. The resistance of the coil is _____.

- a. 1 ohm b. 3 ohms c. 6.4 ohms d. 9 ohms

8. The clamp meter is mostly used for measuring _____.

- a. high current b. high voltage c. earth resistance d. ground capacitance

9. Power-factor is nothing but the ratio of

- a. active power to apparent power b. active power to reactive power
c. reactive power to apparent power d. reactive power to active power

10. Example of an insulator is

- a. Copper b. Aluminum c. Silicon d. Rubber

Section B

(5X2=10 Marks)

Five Questions of 02 Marks each

11. What is meant by impedance of a coil? How will you express it in rectangular form?

12. Three resistors $2\ \Omega$, $3\ \Omega$, and $4\ \Omega$ are connected in series. If the applied voltage across this combination is 24 V, find the voltage drop across each resistor.

13. Draw the B-H curve of a coil.

14. State Faraday's law of electromagnetic induction.

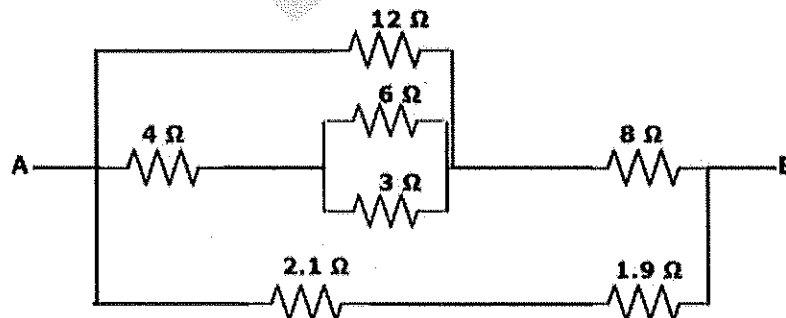
15. Find the maximum and RMS values of an AC sinusoidal voltage, whose instantaneous value in Volts is $10 \sin \omega t$.

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

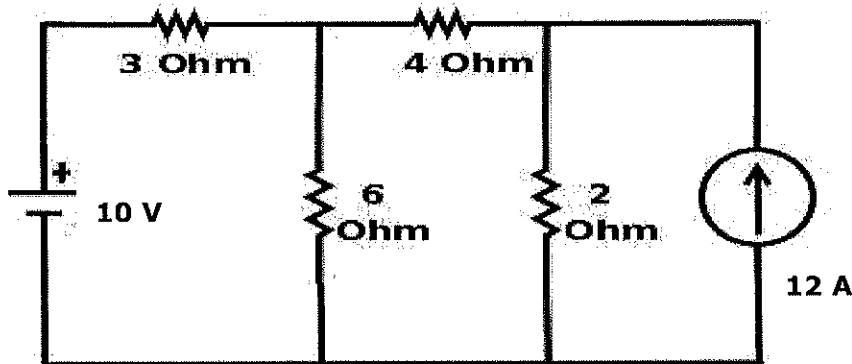
(5X10=50 Marks)

16. (a) Calculate the total resistance of the network between points A and B of the circuit shown below. (6 Marks)

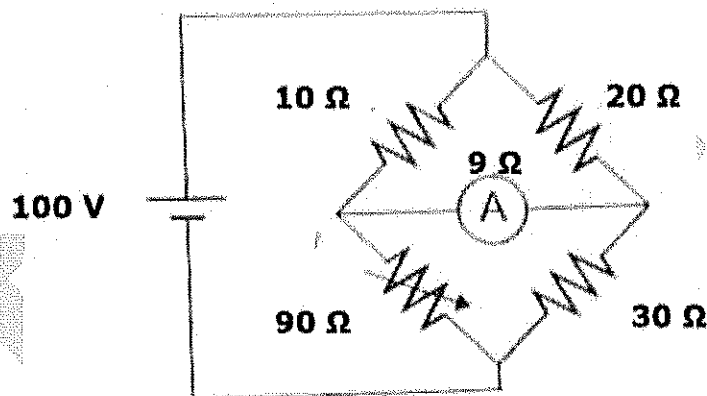


(b) Two coils in series have a resistance of $12\ \Omega$ and when connected in parallel have a resistance of $3\ \Omega$. Find the value of resistances. (4 Marks)

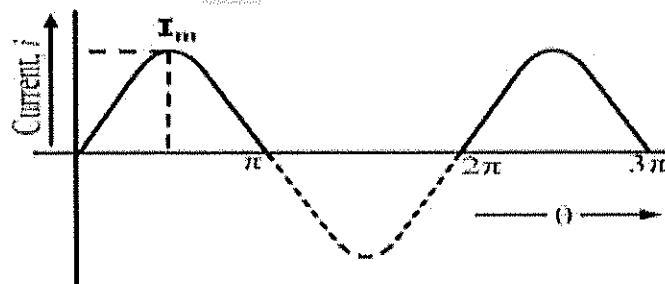
17. Apply loop current method to find the mesh currents I_1 , I_2 , and I_3 in the given circuit. (10 Marks)



18. For the network shown in the figure below, determine the current through the ammeter A having a resistance of 9Ω . (10 Marks)



19. (a) Prove that the RMS value of half-wave rectified AC sinusoidal current is $I_m/2$. (6 marks)



Current flows from the source to the load only when $\theta = 0$ to π & 2π to 3π

(b) Deduce the expression $e = Blv$, (where B is the magnetic flux density in Wb/m^2 , l is the effective length of the conductor in m , and v is the linear velocity in m/sec) when the conductor is moving at right angles to the stationary magnetic field, from basic principles of electromagnetic induction. (4 Marks)

20. A series circuit with $R = 10 \Omega$, $L = 50 \text{ mH}$ and $C = 100 \mu\text{F}$ is supplied with 200 V , 50 Hz . Calculate (i) inductive reactance (ii) capacitive reactance (iii) impedance (iv) current (v) power factor (vi) active power (vii) reactive power and (viii) apparent power. (10 Marks)

21. (a) Two coils A and B lie in parallel planes. Coil A has 15000 turns and coil B has 12000 turns. 55% of flux produced by coil A links coil B. A current of 6 A in coil A produces 0.05 mWb, while the same current in coil B produces 0.08 mWb. Calculate the mutual inductance and the coupling coefficient. (6 Marks)

(b) A wire having a length of 1 m moves at right angles to its length at 50 m/sec in a uniform magnetic field of 1 Wb/m^2 . Determine the emf induced in the conductor when the direction of motion is (i) at right angles to the field (ii) inclined at 30° to the direction of the field. (4 Marks)

22. Why is it necessary to regularly check insulation resistance? Discuss with neat sketch working of insulation tester. Also mention precautions to be taken while using insulation tester. (10 Marks)