

Indian Maritime University
(A Central University, Govt of India)
End Semester Examinations – December 2024
Programme Name: B Tech (ME)
Semester: I
Subject Code: UG11T5105
Subject Name: Basic Electrical Technology

Date: 24.12.2024

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. According to KVL, the algebraic sum of all IR drops and EMFs in any closed loop of a network is always

- a) Zero
- b) Positive
- c) Negative
- d) Determined by battery e.m.f.s

2. Unit of magnetic flux is

- a) Weber
- b) Ampere-turn
- c) Tesla
- d) Coulomb

3. An a.c. current given by $i = 14.14 \sin(\omega t + \pi/6)$ has an r.m.s value of _____ amperes

- a) 10
- b) 14.14
- c) 1.14
- d) None of the above

4. The kWh meter can be classified as a/an _____ instrument

- a) Deflecting
- b) Digital
- c) Recording

d) Indicating

5. The Internal resistance of ideal current source is

- a) 0
- b) ∞
- c) Very low but finite
- d) None of the above

6. In a delta-connected system, the currents $I_R = I_B = I_Y = ?$

- a) I_{Ph}
- b) $2I_{Ph}$
- c) $3I_{Ph}$
- d) $4I_{Ph}$

7. The wattmeter method is used to measure power in a three-phase load. The wattmeter readings are 400W and -35W. What will be the power factor

- a) 0.43
- b) 0.53
- c) 0.63
- d) 0.73

8. A moving-coil permanent-magnet instrument can be used as _____ by using a low resistance shunt in:

- a) Ammeter
- b) Voltmeter
- c) Wattmeter
- d) Flux meter

9. The induced e.m.f. of a moving conductor coil can be measured using the following law:

- a) Lenz's law
- b) Faraday's law
- c) Coulomb's law
- d) Ampere's law

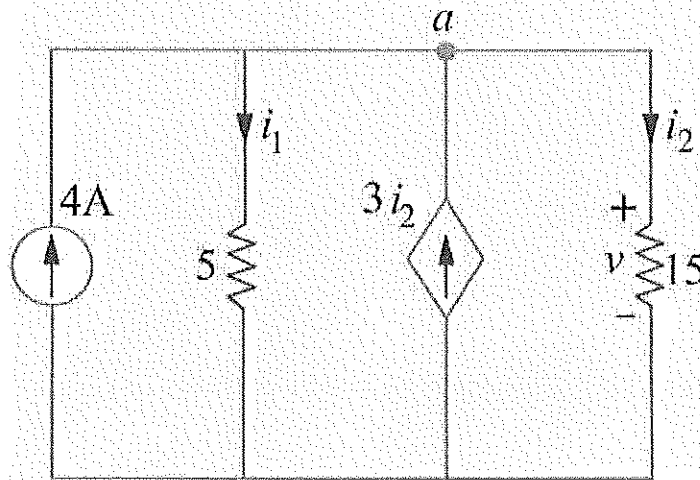
10. The symbol j represents counter clockwise rotation of a vector through—degrees

- a) 180
- b) 90
- c) 360
- d) 270

Section B

Five Questions of 02 Marks each

11. A current $i = 5 + 14.14 \sin(314t + 45^\circ)$ is passed through a center-zero PMMC and moving iron instrument. What will be the reading of both the instruments?
12. Determine the value of current i_2 and voltage drop v across 15Ω resistor in Figure below.



13. How the RLC series circuit behaves for the frequencies above and below the resonant frequencies
14. When is the force on a current-carrying conductor in a magnetic field zero?
15. What does a negative reading on one of the wattmeters in a two-wattmeter method signify?

Section C

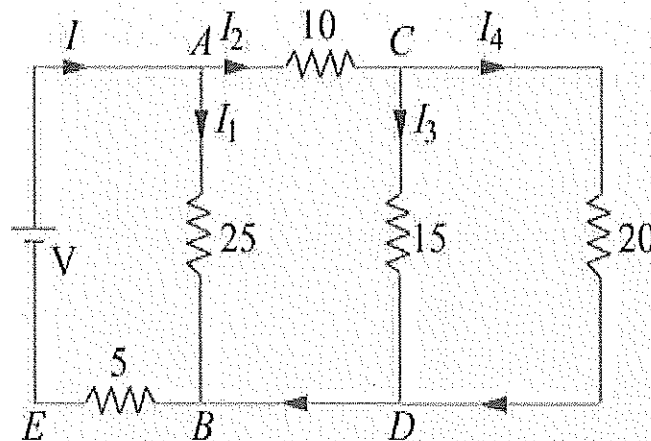
7 Questions of 10 Marks each of which any 05 questions to be answered

16. (a) Write short note on the following
- Faraday's law of Electromagnetic Induction
 - Lenz's Law

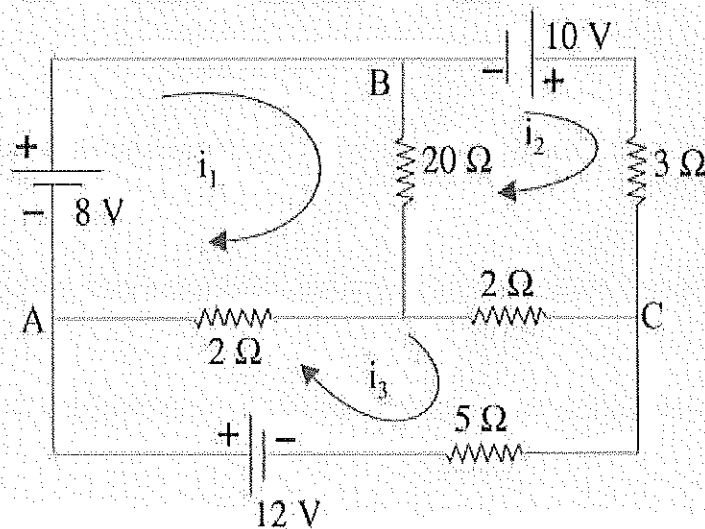
(2+2)

(b) Derive the expression for Force on current-carrying conductor lying in the magnetic field. (6)

17 a) In the circuit of Figure below, find the value of supply voltage V so that $20\text{-}\Omega$ resistor can dissipate 180 W (5)



b) Determine current in $5\text{-}\Omega$ resistor by mesh analysis (5)



18. (a) Explain the working of PMMC with neat and clean diagram. Also derive the formula for deflecting torque for PMMC. (7)

(b) The full-scale deflection current of a meter is 4 mA and its internal resistance is 400Ω . This meter is to have full deflection when 400 V is measured. What is the value of the series resistor to be used? (3)

19. a) Two magnetically-coupled coils have a mutual inductance of 32 mH. What is the average e.m.f. induced in one, if the current through the other changes from 3 to 15 mA in 0.004 second? Given that one coil has twice the number of turns in the other, calculate the inductance of each coil. Neglect leakage. (5)

b) Two identical 750 turn coils A and B lie in parallel planes. A current changing at the rate of 1500 A/s in A induces an e.m.f. of 11.25 V in B. Calculate the mutual inductance of the arrangement. If the self-inductance of each coil is 15 mH, calculate the flux produced in coil A per ampere and the percentage of this flux which links the turns of B. (5)

20. a) Three 100 Ω non-inductive resistances are connected in (a) star (b) delta across a 400-V, 50-Hz, 3-phase mains. Calculate the power taken from the supply system in each case. In the event of one of the three resistances getting open-circuited, what would be the value of total power taken from the mains in each of the two cases? (5)

b) A three phase 400-V, 50 Hz, a.c. supply is feeding a three phase delta connected load with each phase having a resistance of 25 ohms, an inductance of 0.15 H, and a capacitor of 120 microfarads in series. Determine the line current, volt-amp, active power and reactive volt-amp and draw the load network with proper marking of parameters (5)

21.a) A series circuit consists of a resistance of 6 Ω and an inductive reactance of 8 Ω . A potential difference of 141.4 V (r.m.s.) is applied to it. At a certain instant the applied voltage is + 100 V, and is increasing. Calculate at this instant, (i) the current (ii) the voltage drop across the resistance and (iii) voltage drop across inductive reactance. (5)

b) The waveform of an output current is as shown in Fig. below. It consists of a portion of the positive half cycle of a sine wave between the angle θ and 180° . Determine the effective value for $\theta = 30^\circ$. (5)

22.a) A coil of inductance 9 H and resistance 50 Ω in series with a capacitor is supplied at constant voltage from a variable frequency source. If the maximum current of 1A occurs at 75 Hz, find the frequency when the current is 0.5 A. (3)

b) A voltage of $200 \angle 53^\circ 8'$ is applied across two impedances in parallel. The values of impedances are $(12 + j 16)$ and $(10 - j 20)$. Determine the kVA, kVAR and kW in each branch and the power factor of the whole circuit (7)

