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Electrical Engineering

(Competitive Exams – Objective Special)

UPPSC Polytechnic Lecturer

UPSC ESE, GATE

AE Exams, PSU

Language: English

Key Features:

- **Subject-wise Premium MCQs**
- **Each MCQ With Detailed Solutions**
- ***Syllabus- UPPSC & Core Competitive 13 Subjects***

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Exam-Oriented, Suitable For:

UPPSC (Lecturer/Asst. Professor), GATE/ESE (IES), State AE & JE, PSU Recruitments (BEL, BHEL, DRDO), ISRO Scientist-C, State University & Polytechnic Lecturer/Asst. Professor Exams, and M.Tech/Ph.D. Entrance Exams (IITs, NITs & Central Universities).

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An essential book for all aspirants preparing for various technical and competitive examinations in Electrical Engineering.

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Colophon:
This book is printed on environmentally responsible paper. The layout, typesetting, and graphics have been optimized for language clarity and accessibility, suitable for technical and vocational training.

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Book Introduction

This book is designed to assist students in preparing for a wide range of competitive examinations and job-oriented assessments, including **UPPSC (Lecturer/Assistant Professor)**, **GATE / ESE (IES)**, **State AE & JE examinations**, **PSU recruitments** (such as BEL, BHEL, DRDO), **ISRO Scientist-C**, **State University and Polytechnic Lecturer/Assistant Professor examinations**, as well as **M.Tech and Ph.D. entrance examinations** conducted by **IITs, NITs, and Central Universities**.

The multiple-choice questions (MCQs) included in this book are structured across various cognitive levels—**remembering, understanding, application, and analysis**—to strengthen conceptual clarity and enhance exam readiness.

Acknowledgment

The content of this book has been developed in accordance with the **official UPPSC syllabus**, covering the **core 13 competitive subjects** prescribed for the examination.

Some diagrams, tables, and reference materials presented in this book have been adapted or reproduced from standard textbooks and authoritative sources related to the subject. The author sincerely acknowledges these sources and expresses heartfelt gratitude to the scholars and authors whose works have contributed to the enrichment, accuracy, and clarity of this book.

Syllabus

Subject Name	Part-1
Electrical Circuits and Networks	Circuit elements, KCL, KVL, Nodal and Mesh analysis, Thevenins's, Norton's, Superposition and Maximum power transfer theorems, Steady state and Transient Response of DC and AC networks, Two-part networks, magnetically coupled circuits.
Electromagnetic Field Theory	Electrostatic fields; Gausses Law, Maxwell's equations, Energy density in electrostatic fields, Properties of materials Magnetostatic Fields: Biot- Savart's Law, Ampere's circuit law, Maxwell's equations, Application of Ampere's law, Waves and applications.
Basic Electronics Engineering	Basics of Semiconductor diodes BJT, FET, MOSFETS characteristics, Different types amplifiers, equivalent circuit and frequency response, Oscillator and other circuits, feedback amplifiers.
Electrical and Electronics Measurements	Principles of measurement, Accuracy, Precision, Errors, Moving-coil, Moving iron, Dynamometer and induction types of instruments, Measurement of voltage, Current, Power, Energy and Power factor, Instrument transformer, Bridges and Potentiometers, Electronic instruments, Digital voltmeters, Phase Frequency measurement, Q-meters, Basics of sensors and transducers.
Electrical Machines	Electro Magnetic Energy conversion (EMEC), DC Machines-types, Generator and motor characteristics, Starting and control of motors; Synchronous machines-Principle and performance, Regulation, Parallel operation of generators, Motor starting, Characteristics and application, Single phase, three phase transformers-Principle, Equivalent circuit efficiency, Regulation, Connections.
Power Systems	Basic power generation concepts- Steam, gas and water turbines, Line parameters and calculations, Performance of transmission lines, Mechanical design of overhead lines and insulators, Corona and radio interference, Power factor correction, Symmetrical components, Fault analysis, Load flow equations and methos of solutions, Power system stability- Power system transients and travelling waves, EHV transmission, HVDC transmission, Concepts of FACTs, Voltage control and Economic operation, Concepts of distributed generations, Solar and wind power, Smart grid Concept.
Control System	Mathematical modelling of physical systems, Principles of feedback, Transfer function, Block Diagram and signal flow graphs, Time response specification, Routh-Hurwitz criterion, Bode plots, root loci, Nyquist technique, Lag, Lead and lead-lag compensation, stability analysis, transient and frequency response analysis, State space model, State transition matrix, Controllability and observability, PID and industrial controllers.
	Part-2
Analog and Digital Electronics	Operational amplifies- Characteristics and applications, combinational and sequential circuits, Multiplexers, Multivibrators, Sample and hold circuits, A/D and D/A converters, Basics of filter circuits and applications, Active filters, Microprocessor basics- Interfaces and applications, Basics of integrated circuits, Analog communication basics, Modulation and Demodulation, Noise and bandwidth Signal to noise ratio, Transmitters and receivers, Digital communication basics-sampling, quantizing, coding , frequency and time domain multiplexing, Power line carrier communication systems.
Systems and Signal Processing	Representation of continuous and discrete-time signals, Shifting and sealing operations, Linear, time-invariant and causal systems, Fourier series representation of continuous periodic signals, Sampling theorem, Fourier and Laplace transform, Z-transforms, Discrete Fourier transform, FFT Linear convolution, FIR and IIR filters, bilinear transformation.
Induction and Special Machines	Three-Phase induction motors- rotating magnetic field theory, Equivalent circuit and determination of its parameters, Torque-slip characteristics, Starters, Speed control, induction generators, Single-phase induction motors- theory, Characteristics, Starting and applications, Servomotors, Stepper motors, brushless DC (BLDC) motors.

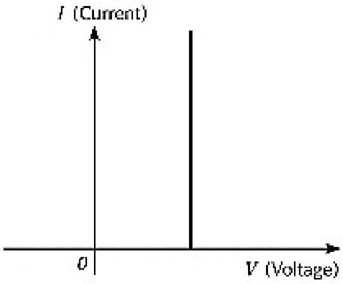
Power System Protection	Principles and need for protection schemes, Types of faults, Relay application and Characteristics- over current relays, Directional relays, Distance relay, Differential relays, Methods of Arc extinction, Restriking voltages and recovery voltage, testing of circuit breakers, Protective schemes for power system equipment, Surge in transmission line and protection.
Power Electronic and Drivers	Semiconductor power diodes, Transistors, Thyristors, Trias, GTOs, MOSFETs, IGBTs- principles of operation and their static characteristics, Triggering circuits, Phase control rectifiers, Bridge convertors- fully controlled and half controlled, Principle of choppers and inverters, Basic concepts of adjustable speed DC and AC drives, DC-DC switched mode converters, DC-AC switched mode converters, Resonant convertors, Basics of electric drives- types, quadrant operation, Reversing and breaking of electric motors, Estimation of power ratings, Traction motors.
Electrical Material	Electrical engineering materials, Crystal structures and defects, Ceramic materials, Insulating materials, Magnetic materials- basics, Properties and applications; Ferrites, Ferro-magnetic materials and components, Basics of solid-state Physics, Conductors, Photo-conductivities, Basics of Nano materials and superconductors.

Table of Contents

Part-1

1. Electrical Circuits and Networks

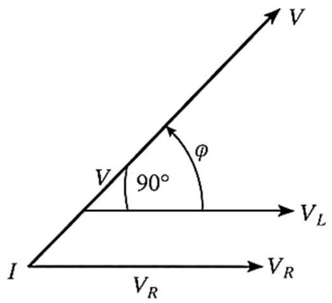
Q1. In an ideal resistor of 10 Ω carrying a current of 2 A, the power dissipated is
(a) 10 W
(b) 20 W
(c) 40 W
(d) 80 W
Ans. c | Sol. : Power $P = I^2R = (2)^2 \times 10 = 40$ W.
Q2. Which circuit element stores energy in a magnetic field?
(a) Resistor
(b) Capacitor
(c) Inductor
(d) Voltage source
Ans. c | Sol. : An inductor stores energy in its magnetic field.
Q3. Kirchhoff's Current Law is mathematically expressed as
(a) $\Sigma V = 0$
(b) ΣI = constant
(c) ΣI entering = ΣI leaving
(d) $\Sigma IR = 0$
Ans. c | Sol. : KCL states total current entering a node equals total current leaving it.
Q4. At a node, 6 A and 4 A enter the node while one branch current leaves. The outgoing current is
(a) 2 A
(b) 6 A
(c) 10 A
(d) 12 A
Ans. c | Sol. : By KCL, outgoing current = 6 + 4 = 10 A.
Q5. Kirchhoff's Voltage Law is based on the law of
(a) Conservation of charge
(b) Conservation of energy
(c) Conservation of mass
(d) Ohm's law
Ans. b | Sol. : KVL follows from conservation of energy in a closed loop.
Q6. In a loop containing a 10 V source and voltage drops of 4 V and 6 V, the KVL equation verifies that
(a) $\Sigma V = 10$ V
(b) $\Sigma V = 0$
(c) $\Sigma V = 20$ V
(d) $\Sigma V = -10$ V
Ans. b | Sol. : KVL states algebraic sum of voltages around a closed loop is zero.
Q7. Which analysis method uses node voltages as primary variables?
(a) Mesh analysis
(b) Nodal analysis
(c) Superposition theorem
(d) Maximum power transfer theorem
Ans. b | Sol. : Nodal analysis determines node voltages using KCL.
Q8. The given I–V characteristic corresponds to which circuit element?



(a) Ideal current source
(b) Ideal voltage source
(c) Linear resistor
(d) Practical diode
Ans. b | Sol. : The diagram shows constant voltage for all values of current, represented by a vertical line on the V-axis, which is the defining I–V characteristic of an ideal voltage source.
Q9. Mesh analysis is applicable only to
(a) Linear circuits
(b) Non-planar circuits
(c) Planar circuits
(d) AC circuits only
Ans. c | Sol. : Mesh analysis requires planar circuits.
Q10. In a circuit having 3 meshes, the number of mesh equations is
(a) 1
(b) 2
(c) 3
(d) 6
Ans. c | Sol. : Each mesh produces one independent KVL equation.
Q11. Which theorem allows analysis of a circuit by considering one independent source at a time?
(a) Thevenin's theorem
(b) Norton's theorem
(c) Superposition theorem
(d) Reciprocity theorem
Ans. c | Sol. : Superposition considers one source active at a time.
Q12. While applying superposition theorem, dependent sources are
(a) Removed
(b) Short-circuited
(c) Open-circuited
(d) Kept active
Ans. d | Sol. : Dependent sources remain active during superposition.
Q13. In superposition, an ideal voltage source is replaced by
(a) Open circuit
(b) Short circuit
(c) Resistor
(d) Current source
Ans. b | Sol. : An ideal voltage source has zero internal resistance, so it is shorted.

Q14. In superposition, an ideal current source is replaced by
(a) Short circuit
(b) Voltage source
(c) Open circuit
(d) Resistor
Ans. c | Sol. : Ideal current source has infinite internal resistance, so it is opened.

Q15. The phasor diagram indicates that the circuit current I is:



(a) Leading the applied voltage V
(b) In phase with voltage V
(c) Lagging the applied voltage V
(d) Leading only the resistive voltage
Ans. c | Sol. : From the diagram, voltage phasor V leads the current phasor I, indicating that current lags voltage, characteristic of an inductive circuit.

Q16. The Thevenin resistance of a circuit is obtained by
(a) Removing load only
(b) Shorting all sources
(c) Deactivating all independent sources
(d) Removing dependent sources
Ans. c | Sol. : Independent voltage sources are shorted and current sources opened.

Q17. If Thevenin voltage is 20 V and Thevenin resistance is 5 Ω, the Norton current is
(a) 2 A
(b) 4 A
(c) 5 A
(d) 10 A
Ans. b | Sol. : Norton current IN = VTH / RTH = 20 / 5 = 4 A.

Q18. Norton's theorem represents a network as
(a) Voltage source in series with resistance
(b) Current source in parallel with resistance
(c) Only a current source
(d) Only a resistance
Ans. b | Sol. : Norton equivalent is a current source in parallel with resistance.

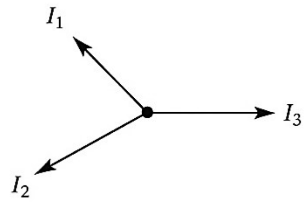
Q19. Relationship between Thevenin and Norton resistance is
(a) RTH = 2RN
(b) RTH = RN
(c) RTH = RN / 2
(d) RTH ≠ RN
Ans. b | Sol. : Thevenin and Norton resistances are equal.

Q20. Maximum power transfer occurs when
(a) RL = 0
(b) RL > RS
(c) RL < RS
(d) RL = RS
Ans. d | Sol. : Maximum power transfer occurs when load resistance equals source resistance.

Q21. If source resistance is 10 Ω, the load resistance for maximum power transfer is
(a) 5 Ω
(b) 10 Ω
(c) 20 Ω
(d) 0 Ω
Ans. b | Sol. : RL must equal source resistance.

Q22. The efficiency at maximum power transfer is
(a) 25%
(b) 50%
(c) 75%
(d) 100%
Ans. b | Sol. : At maximum power transfer, efficiency is 50%.

Q23. From the diagram, which currents are directed away from the node?



(a) I_1 only
(b) I_2 only
(c) I_3 only
(d) I_1 and I_2
Ans. c | Sol. : The arrow of $\mathbf{I_3}$ is drawn pointing outward from the node, while $\mathbf{I_1}$ and $\mathbf{I_2}$ point toward the node.

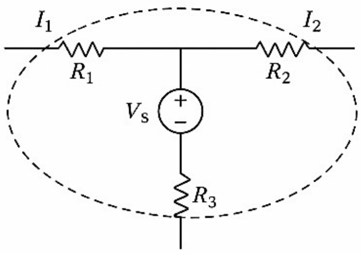
Q24. Which theorem is NOT applicable to non-linear circuits?
(a) Superposition
(b) Thevenin
(c) Norton
(d) Maximum power transfer
Ans. a | Sol. : Superposition is valid only for linear circuits.

Q25. In nodal analysis, current directions are generally assumed
(a) Toward reference node
(b) Away from reference node
(c) Arbitrarily
(d) Based on polarity
Ans. c | Sol. : Current directions can be assumed arbitrarily.

Q26. In mesh analysis, mesh currents are usually assumed
(a) Clockwise
(b) Anticlockwise
(c) Randomly
(d) Alternating

Ans. a | Sol. : Clockwise direction is conventionally assumed.

Q27. Considering the indicated directions of $I_1$and I_2, which currents are **leaving the top node**?



(a) I_1only
(b) I_2only
(c) Both $I_1$and I_2
(d) Neither I_1nor I_2
Ans. c | Sol. :- The arrows on both $I_1$and $I_2$are directed **away from the top node** through $R_1$and R_2.

Q28. If two resistors 4 Ω and 6 Ω are in series, the equivalent resistance is
(a) 2.4 Ω
(b) 10 Ω
(c) 24 Ω
(d) 1.5 Ω
Ans. b | Sol. : Series resistance adds directly: 4 + 6 = 10 Ω.

Q29. If two resistors 4 Ω and 6 Ω are in parallel, the equivalent resistance is
(a) 2.4 Ω
(b) 10 Ω
(c) 1.5 Ω
(d) 24 Ω
Ans. a | Sol. : Req = (4×6)/(4+6) = 24/10 = 2.4 Ω.

Q30. In an electrical circuit, why is an ideal current source considered to have infinite internal resistance?
(a) To maximize power dissipation
(b) To maintain constant current independent of load
(c) To minimize voltage variation
(d) To satisfy KVL
Ans. b | Sol. : Infinite internal resistance ensures that the current remains constant regardless of the load connected.

Q31. Why does KCL remain valid even in AC circuits?
(a) Because voltages are sinusoidal
(b) Because resistance is frequency independent
(c) Because charge conservation holds at all times
(d) Because power factor is unity
Ans. c | Sol. : KCL is based on conservation of charge, which is valid for both DC and AC circuits.

Q32. If KVL is applied to a loop containing a time-varying magnetic field, why does it fail?
(a) Due to resistive losses
(b) Due to induced electromotive force
(c) Due to current division
(d) Due to node voltage instability
Ans. b | Sol. : A time-varying magnetic field induces emf, violating the energy conservation assumption of KVL.

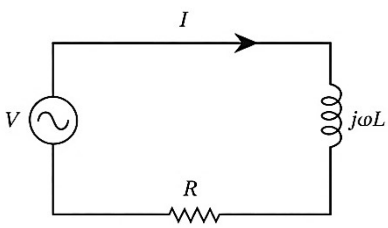
Q33. Why is nodal analysis preferred when current sources are present in a circuit?
(a) It avoids voltage calculations
(b) It directly applies KCL at nodes
(c) It eliminates dependent sources
(d) It reduces circuit resistance
Ans. b | Sol. : Nodal analysis uses KCL, which naturally accommodates current sources.

Q34. What is the conceptual reason for choosing a reference node in nodal analysis?
(a) To eliminate mesh currents
(b) To simplify current calculations
(c) To define all other node voltages uniquely
(d) To reduce power loss
Ans. c | Sol. : All node voltages are measured relative to a reference node, giving a unique voltage solution.

Q35. Why is mesh analysis restricted to planar circuits?
(a) Non-planar circuits violate Ohm's law
(b) KVL cannot be applied to non-planar circuits
(c) Mesh currents cannot be uniquely defined
(d) Superposition fails in non-planar circuits
Ans. c | Sol. : In non-planar circuits, independent meshes cannot be clearly identified.

Q36. In mesh analysis, why are mesh currents usually assumed in the same direction?
(a) To satisfy KCL
(b) To simplify sign conventions
(c) To reduce power loss
(d) To eliminate voltage sources
Ans. b | Sol. : Assuming a common direction simplifies equation formulation and sign consistency.

Q37. When traversing the loop in the direction of current *I*, the correct KVL equation in phasor form is:



(a) $V + IR + I(j\omega L) = 0$
(b) $V = IR + I(j\omega L)$
(c) $IR = V + I(j\omega L)$
(d) $I(R - j\omega L) = V$
Ans. b | Sol. := Following the indicated current direction, the source rise equals the **sum of voltage drops across** R**and** $j\omega L$.

Q38. Why are dependent sources not deactivated during superposition analysis?
(a) They have infinite resistance
(b) They depend on circuit variables
(c) They violate KCL if removed

(d) They always deliver power
Ans. b | Sol. : Dependent sources are controlled by circuit variables and must remain active.

Q39. What is the conceptual advantage of Thevenin's theorem?
(a) It increases circuit complexity
(b) It converts AC circuits to DC
(c) It simplifies load analysis
(d) It eliminates power loss
Ans. c | Sol. : Thevenin's theorem reduces a complex network to a simple equivalent for load analysis.

Q40. Why is Thevenin resistance found by deactivating independent sources?
(a) To remove power dissipation
(b) To observe internal resistance of the network
(c) To eliminate load current
(d) To simplify voltage calculation
Ans. b | Sol. : Deactivating sources reveals the inherent resistance seen from the load terminals.

Q41. How is Norton's theorem conceptually related to Thevenin's theorem?
(a) Both use different resistances
(b) Norton is valid only for AC circuits
(c) Both represent the same network behavior
(d) Norton ignores dependent sources
Ans. c | Sol. : Norton and Thevenin equivalents describe identical terminal behavior using different forms.

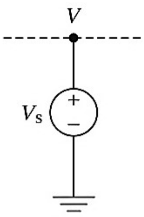
Q42. Why are Thevenin and Norton resistances always equal?
(a) Due to power conservation
(b) Due to network linearity
(c) Due to equivalent terminal characteristics
(d) Due to Ohm's law
Ans. c | Sol. : Both models represent the same network seen from the load terminals.

Q43. Why does maximum power transfer occur when load resistance equals source resistance?
(a) Because voltage becomes maximum
(b) Because current becomes zero
(c) Because impedance matching occurs
(d) Because efficiency becomes 100%
Ans. c | Sol. : Impedance matching allows maximum power flow from source to load.

Q44. Why is efficiency only 50% at maximum power transfer?
(a) Half the power is lost in the source resistance
(b) Load power is minimized
(c) Current becomes maximum
(d) Voltage becomes zero
Ans. a | Sol. : Equal power is dissipated in source and load resistances.

Q45. In nodal analysis, why are node voltages preferred over branch currents?
(a) Voltages are scalar quantities
(b) Voltages are independent variables
(c) Currents cannot be measured
(d) Voltages eliminate power calculations
Ans. b | Sol. : Node voltages are fewer and independent, reducing equation count.

Q46. From the diagram, the voltage at the indicated node V is:



(a) Zero
(b) Equal to the source voltage with opposite polarity
(c) Equal to the source voltage with the same polarity
(d) Dependent on branch currents
Ans. c | Sol. : The node is **directly connected to the positive terminal** of the voltage source whose negative terminal is grounded; hence **node voltage equals** V_s.

Q47. Why does mesh analysis become inefficient with many current sources?
(a) KVL becomes invalid
(b) Extra equations are required
(c) Current direction cannot be assumed
(d) Resistance becomes infinite
Ans. b | Sol. : Current sources require constraint equations, increasing complexity.

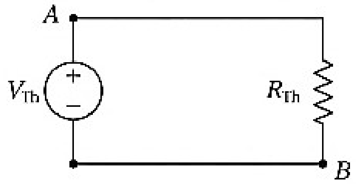
Q48. Why does an ideal voltage source have zero internal resistance?
(a) To dissipate maximum power
(b) To maintain constant voltage
(c) To satisfy KCL
(d) To increase current
Ans. b | Sol. : Zero internal resistance ensures voltage remains constant irrespective of load.

Q49. Why is superposition not applicable for power calculation directly?
(a) Power is a vector quantity
(b) Power is non-linear in voltage and current
(c) Power sources must be removed
(d) Power violates KCL
Ans. b | Sol. : Power depends on square of voltage or current, making it non-linear.

Q50. Why does KCL apply at a node but not necessarily along a branch?
(a) Branches contain voltage sources
(b) Charge accumulation can occur in branches
(c) Nodes represent charge junctions
(d) Branches violate Ohm's law
Ans. c | Sol. : Nodes are points where charge conservation directly applies.

Q51. Why does KVL ensure energy conservation in a loop?
(a) It balances currents
(b) It equates power
(c) It sums all potential changes
(d) It eliminates resistance
Ans. c | Sol. : KVL states that total energy gained equals total energy lost in a loop.

Q52. The circuit shown between terminals A and B represents:



(a) Norton equivalent network
(b) Practical voltage source
(c) Thevenin equivalent network
(d) Supernode representation
Ans. c | Sol. : The diagram shows a **voltage source** V_{Th}**in series with a resistance** R_{Th}between terminals A and B, which is the standard Theven in form.

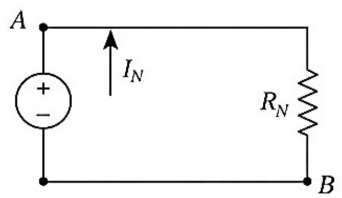
Q53. Why is maximum power transfer rarely used in power systems?
(a) Voltage instability
(b) Low efficiency
(c) High cost
(d) Non-linear loads
Ans. b | Sol. : At maximum power transfer, efficiency is only 50%, which is unacceptable for power systems.

Q54. Why does Thevenin equivalent simplify repetitive load changes?
(a) Load resistance is eliminated
(b) Source voltage changes
(c) Network need not be reanalyzed
(d) Power becomes constant
Ans. c | Sol. : Once Thevenin equivalent is found, different loads can be analyzed easily.

Q55. Why is Norton equivalent preferred in parallel load analysis?
(a) It reduces voltage equations
(b) It uses current division directly
(c) It eliminates resistance
(d) It increases accuracy
Ans. b | Sol. : Norton form aligns naturally with parallel circuits and current division.

Q56. Why does an inductor oppose sudden change in current?
(a) Due to resistive heating
(b) Due to stored electric field
(c) Due to induced back emf
(d) Due to charge accumulation
Ans. c | Sol. : A changing current induces emf opposing the change, per Lenz's law.

Q57. The circuit shown between terminals A and B represents:



(a) Thevenin equivalent network
(b) Practical voltage source
(c) Norton equivalent network
(d) Supernode representation
Ans. c | Sol. : The diagram shows a **current source** $I_N$in **parallel with resistance** $R_N$between terminals A and B, which is the standard Norton form.

Q58. A 10 Ω resistor is connected across a 20 V ideal voltage source. What is the current through the resistor?
(a) 1 A
(b) 2 A
(c) 10 A
(d) 20 A
Ans. b | Sol. : Using Ohm's law, I = V/R = 20/10 = 2 A.

Q59. At a node, currents of 3 A and 5 A enter, and one branch current leaves. What is the magnitude of the outgoing current?
(a) 2 A
(b) 5 A
(c) 8 A
(d) 15 A
Ans. c | Sol. : By KCL, outgoing current equals sum of incoming currents = 3 + 5 = 8 A.

Q60. In a closed loop, voltage rises of 24 V and drops of 10 V and 14 V are present. Which law is verified?
(a) KCL
(b) Ohm's law
(c) KVL
(d) Superposition
Ans. c | Sol. : Algebraic sum of voltages is zero, satisfying Kirchhoff's Voltage Law.

Q61. A circuit has 4 nodes. How many nodal equations are required to solve it?
(a) 1
(b) 2
(c) 3
(d) 4
Ans. c | Sol. : Number of nodal equations = N − 1 = 4 − 1 = 3.

Q62. In nodal analysis, a voltage source connects two non-reference nodes. What technique is applied?
(a) Source transformation
(b) Mesh current method
(c) Supernode formation
(d) Norton conversion
Ans. c | Sol. : A voltage source between two nodes forms a supernode.

Q63. A planar circuit has 3 independent meshes. How many mesh equations are required?
(a) 1
(b) 2
(c) 3
(d) 6
Ans. c | Sol. : Each independent mesh yields one KVL equation.

Q64. A 12 V source is in series with 6 Ω and 3 Ω resistors. What is the loop current?
(a) 1 A

(b) 1.33 A
(c) 2 A
(d) 4 A
Ans. b | Sol. : Loop current I = V/R = 12/9 = 1.33 A.

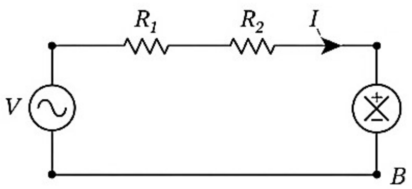
Q65. Using superposition, which sources are deactivated while finding partial response?
(a) All sources
(b) Only dependent sources
(c) Independent sources other than the active one
(d) No source
Ans. c | Sol. : Only one independent source is kept active; others are replaced by their internal resistances.

Q66. While applying superposition, an ideal current source is replaced by
(a) Short circuit
(b) Open circuit
(c) Resistor
(d) Voltage source
Ans. b | Sol. : Ideal current source has infinite internal resistance, so it is open-circuited.

Q67. A Thevenin equivalent has VTH = 30 V and RTH = 10 Ω. What is the current when a 10 Ω load is connected?
(a) 1 A
(b) 1.5 A
(c) 2 A
(d) 3 A
Ans. b | Sol. : Total resistance = 10 + 10 = 20 Ω, current = 30/20 = 1.5 A.

Q68. What is the Norton current corresponding to the above Thevenin equivalent?
(a) 1.5 A
(b) 2 A
(c) 3 A
(d) 5 A
Ans. c | Sol. : Norton current IN = VTH / RTH = 30/10 = 3 A.

Q69. The circuit shown is most suitable for application of which theorem(s)?



(a) Only KVL
(b) Only Superposition
(c) Only Maximum Power Transfer
(d) Both Superposition and Maximum Power Transfer
Ans. d | Sol. : The diagram contains an independent source, linear resistors, and a load terminal, making it suitable for both superposition (source contribution) and maximum power transfer (load analysis).

Q70. For maximum power transfer, the load resistance should be
(a) Zero
(b) Infinity
(c) Equal to source resistance
(d) Double the source resistance
Ans. c | Sol. : Maximum power transfer occurs when RL = RS.

Q71. A source has RTH = 8 Ω and VTH = 16 V. What is the maximum power delivered to the load?
(a) 4 W
(b) 6 W
(c) 8 W
(d) 16 W
Ans. c | Sol. : Pmax = VTH^2 / (4RTH) = 256 / 32 = 8 W.

Q72. What is the efficiency at maximum power transfer condition?
(a) 25%
(b) 50%
(c) 75%
(d) 100%
Ans. b | Sol. : Half of the power is dissipated in source resistance.

Q73. A current source of 4 A is in parallel with 8 Ω. What is the Thevenin voltage?
(a) 0 V
(b) 16 V
(c) 32 V
(d) 4 V
Ans. c | Sol. : Thevenin voltage equals current times parallel resistance = 32 V.

Q74. Two resistors 6 Ω and 3 Ω are in parallel. What is the equivalent resistance?
(a) 1 Ω
(b) 2 Ω
(c) 4.5 Ω
(d) 9 Ω
Ans. b | Sol. : Req = (6×3)/(6+3) = 18/9 = 2 Ω.

Q75. A 5 A current source supplies two parallel branches of 2 Ω and 3 Ω. Current through 2 Ω branch is
(a) 2 A
(b) 3 A
(c) 4 A
(d) 5 A
Ans. b | Sol. : Current division: I_2 = 5 × (3/(2+3)) = 3 A.

Q76. In mesh analysis, a current source between two meshes requires
(a) Ignoring the source
(b) Writing KVL directly
(c) Supermesh formation
(d) Node conversion
Ans. c | Sol. : A current source common to two meshes forms a supermesh.

Q77. A circuit contains only dependent sources and resistors. Can Thevenin equivalent be found?
(a) No
(b) Only Norton equivalent
(c) Yes, using test source
(d) Only for AC circuits

Ans. c | Sol. : A test source is applied to find equivalent resistance.

Q78. A 10 V source supplies a 5 Ω load directly. Power delivered to load is

(a) 5 W
(b) 10 W
(c) 20 W
(d) 40 W

Ans. c | Sol. : Power delivered = 20 W.

Q79. In nodal analysis, currents leaving a node are generally taken as

(a) Negative
(b) Zero
(c) Positive
(d) Undefined

Ans. c | Sol. : Conventionally, currents leaving the node are taken as positive.

Q80. A loop contains two opposing voltage sources of 20 V and 5 V. Net voltage is

(a) 25 V
(b) 15 V
(c) 10 V
(d) 0 V

Ans. b | Sol. : Opposing sources subtract: 20 − 5 = 15 V.

Q81. Which theorem simplifies repeated calculation of load current for different loads?

(a) Superposition
(b) Maximum power transfer
(c) Thevenin
(d) KVL

Ans. c | Sol. : Once Thevenin equivalent is known, different loads are easily analyzed.

Q82. If load resistance is less than source resistance, delivered power is

(a) Maximum
(b) Zero
(c) Less than maximum
(d) Infinite

Ans. c | Sol. : Maximum power occurs only when RL = RS.

Q83. A voltage source of 24 V is connected to a series combination of 4 Ω and RL. For maximum power, RL equals

(a) 2 Ω
(b) 4 Ω
(c) 6 Ω
(d) 8 Ω

Ans. b | Sol. : Load resistance must equal source resistance.

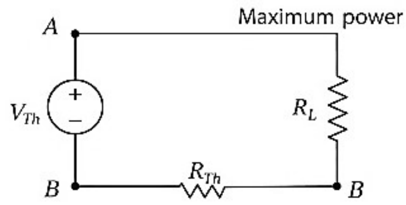
Q84. Which method directly uses KCL as the governing equation?

(a) Mesh analysis
(b) Nodal analysis
(c) Loop analysis
(d) Superposition

Ans. b | Sol. :Nodal analysis directly uses Kirchhoff's Current Law (KCL). Is method me har node par entering aur leaving currents ka algebraic sum zero maana jata hai.

Mesh aur loop analysis mainly KVL (Kirchhoff's Voltage Law) par based hote hain, jabki superposition ek network theorem hai, koi direct KCL-based method nahi.

Q85. From the diagram, maximum power is delivered to the load R_L when:



(a) $R_L = 0$
(b) $R_L \to \infty$
(c) $R_L = R_{Th}$
(d) $R_L = \frac{V_{Th}}{R_{Th}}$

Ans. c | Sol. : The diagram explicitly shows a **Thevenin source V_{Th} with series resistance** R_{Th} supplying R_L; maximum power transfer occurs when $R_L = R_{Th}$.

Q86. A circuit consists of two resistors 4 Ω and 6 Ω connected in series to a 20 V source. If the polarity of the source is reversed, what happens to the power dissipated in the resistors?

(a) It becomes zero
(b) It doubles
(c) It remains unchanged
(d) It becomes negative

Ans. c | Sol. : Power depends on the square of current; reversing source polarity does not change current magnitude.

Q87. At a node, three currents of 2 A, 3 A, and 5 A are entering. If two branch currents leave the node, what constraint must they satisfy?

(a) Their difference must be zero
(b) Their product must be zero
(c) Their sum must be 10 A
(d) Their ratio must be unity

Ans. c | Sol. : By KCL, sum of outgoing currents must equal sum of incoming currents.

Q88. A loop contains a resistor and a time-varying magnetic field linking the loop. Which conclusion is correct?

(a) KVL always holds
(b) KVL holds only for DC
(c) KVL fails due to induced emf
(d) KCL becomes invalid

Ans. c | Sol. : Time-varying magnetic flux induces emf, violating the basic assumption of KVL.

Q89. In nodal analysis, why is a supernode treated as a single entity?

(a) It removes dependent sources
(b) It simplifies KVL equations
(c) Voltage source constrains node voltages
(d) It reduces branch currents

Ans. c | Sol. : A voltage source fixes the voltage difference between nodes, requiring combined treatment.

Q90. A circuit has 5 nodes and 2 independent voltage sources. How many independent nodal equations are required?

(a) 2
(b) 3
(c) 4
(d) 5

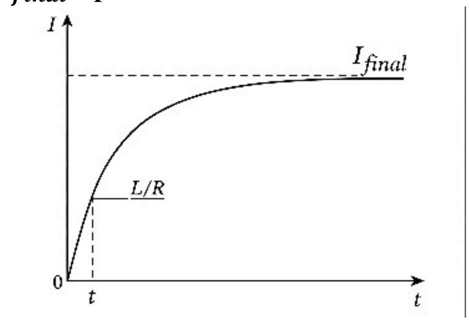
Ans. b | Sol. : Nodal equations = N − 1 − (number of voltage sources not connected to reference).

Q91. In mesh analysis, a current source common to two meshes leads to

(a) Elimination of one mesh
(b) Formation of supermesh
(c) Conversion to nodal analysis
(d) Violation of KVL

Ans. b | Sol. : A supermesh is formed to apply KVL around the outer loop.

Q92. The dashed horizontal line labeled I_{final}represents:



(a) Peak transient current
(b) Current at one time constant
(c) Steady-state current
(d) Average current

Ans. c | Sol. :The curve asymptotically approaches the dashed line, indicating the steady-state (final) current.

Q93. In superposition, why is power not directly superimposed?

(a) Power is scalar
(b) Power is frequency dependent
(c) Power is nonlinear in voltage/current
(d) Power violates energy conservation

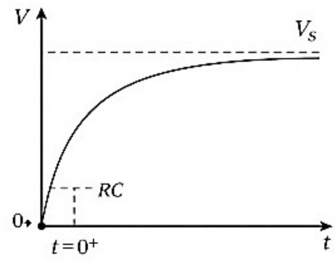
Ans. c | Sol. : Power depends on square of voltage or current, making it nonlinear.

Q94. A network contains one dependent source and several independent sources. During superposition, which sources are deactivated?

(a) All sources
(b) Only dependent source
(c) All independent sources except one
(d) Only voltage sources

Ans. c | Sol. : Dependent sources remain active; independent sources are deactivated one at a time.

Q95. The given voltage–time curve most accurately represents the transient response of a:



(a) RL circuit during switch-ON
(b) RC circuit during charging
(c) RLC circuit at resonance
(d) Pure resistive circuit

Ans. b | Sol. : The voltage rises exponentially from zero toward a constant value $V_S$with time constant **RC**, which is characteristic of **capacitor charging in an RC circuit**.

Q96. If a Thevenin equivalent has RTH = 6 Ω and the load is increased from 6 Ω to 12 Ω, what happens to the load power?

(a) It increases
(b) It decreases
(c) It becomes maximum
(d) It remains same

Ans. b | Sol. : Maximum power occurs only at RL = RTH; deviation reduces power.

Q97. Why are Thevenin and Norton equivalents interchangeable?

(a) They have identical sources
(b) They deliver same current only
(c) They exhibit identical terminal behavior
(d) They have equal voltages

Ans. c | Sol. : Both represent the same I-V characteristics at the load terminals.

Q98. A Norton equivalent has IN = 4 A and RN = 5 Ω. What is the open-circuit voltage?

(a) 0 V
(b) 5 V
(c) 20 V
(d) 25 V

Ans. c | Sol. : VTH = IN × RN = 4 × 5 = 20 V.

Q99. A source with internal resistance supplies maximum power to a load. Which statement is correct?

(a) Efficiency is maximum
(b) Load power equals source power
(c) Half the power is dissipated internally
(d) Load current is minimum

Ans. c | Sol. : At maximum power transfer, source and load dissipate equal power.

Q100. In nodal analysis, increasing the number of nodes primarily affects

(a) Circuit power
(b) Equation complexity
(c) Source voltage
(d) Load current

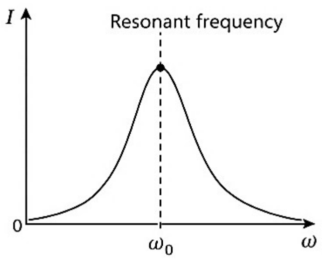
Ans. b | Sol. : More nodes increase the number of simultaneous equations.

Q101. Why is mesh analysis generally avoided for circuits with many current sources?
(a) KVL becomes invalid
(b) Current directions are undefined
(c) Additional constraint equations are required
(d) Resistance becomes infinite
Ans. c | Sol. : Current sources complicate mesh equations, increasing analytical effort.

Q102. A resistive network is linear. What implication does this have for superposition?
(a) Superposition is invalid
(b) Superposition is valid
(c) Only DC sources can be used
(d) Power superposition is valid
Ans. b | Sol. : Linearity ensures proportionality, allowing superposition.

Q103. Two resistors in parallel draw currents I1 and I2. If one resistor value decreases, what happens?
(a) Total current decreases
(b) Voltage across branches changes
(c) Current redistributes
(d) Power becomes zero
Ans. c | Sol. : Parallel branch currents redistribute based on resistance values.

Q104. The curve shown indicates that the circuit current is maximum at:



(a) $\omega = 0$
(b) $\omega \to \infty$
(c) $\omega = \omega_0$
(d) At two frequencies symmetric about ω_0
Ans. c | Sol. : The plotted current peaks at the dashed vertical line labeled **resonant frequency** ω_0.

Q105. Why is maximum power transfer undesirable in power systems?
(a) Voltage instability
(b) Nonlinear loads
(c) Low efficiency
(d) High current
Ans. c | Sol. : Only 50% efficiency occurs at maximum power transfer.

Q106. In Thevenin equivalent, changing the load affects
(a) Source voltage
(b) Thevenin resistance
(c) Load current and power
(d) Internal network
Ans. c | Sol. : The equivalent remains fixed; only load response changes.

Q107. A circuit has more meshes than nodes. Which method is preferable?
(a) Mesh analysis
(b) Nodal analysis
(c) Superposition
(d) Norton
Ans. b | Sol. : Fewer node equations make nodal analysis more efficient.

Q108. A voltage source in series with resistance is converted to a current source in parallel with the same resistance. What remains invariant?
(a) Power
(b) Terminal behavior
(c) Internal losses
(d) Source polarity
Ans. b | Sol. : Source transformation preserves external I-V characteristics.

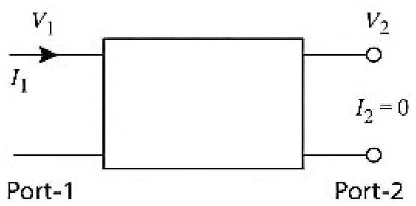
Q109. Why does an ideal capacitor block DC in steady state?
(a) Voltage becomes zero
(b) Charge accumulation stops current
(c) Resistance becomes infinite
(d) Electric field vanishes
Ans. b | Sol. : Once fully charged, no further current flows.

Q110. Why does an ideal inductor act as a short circuit in DC steady state?
(a) Magnetic field vanishes
(b) Resistance becomes zero
(c) Induced emf becomes zero
(d) Current becomes infinite
Ans. c | Sol. : With constant current, no changing flux exists to induce emf.

Q111. A circuit obeys KCL but violates KVL. What is the most likely cause?
(a) Node instability
(b) Time-varying magnetic field
(c) Dependent source
(d) Nonlinear resistor
Ans. b | Sol. : Induced emf breaks KVL but not charge conservation.

Q112. Why does Norton equivalent simplify parallel load analysis?
(a) Voltage is eliminated
(b) Current division applies directly
(c) Power equations simplify
(d) Resistance is removed
Ans. b | Sol. : Parallel loads naturally use current division with Norton form.

Q113. From the diagram, the condition $I_2 = 0$at Port-2 indicates that:



(a) Port-2 is short-circuited
(b) Port-2 is open-circuited
(c) Port-2 is matched
(d) Port-2 is grounded
Ans. b | Sol. : The diagram explicitly shows $I_2 = 0$, which corresponds to an **open-circuit condition** at Port-2.

Q114. A circuit solution satisfies KCL at all nodes but gives incorrect voltages. Which step is most likely wrong?
(a) Current direction assumption
(b) Reference node selection
(c) KVL equation formulation
(d) Power calculation
Ans. c | Sol. : Incorrect KVL equations lead to wrong voltage results.

Q115. The steady-state response of a DC circuit occurs when
(a) Current is maximum
(b) All transient components vanish
(c) Inductors behave as open circuits
(d) Capacitors behave as short circuits
Ans. b | Sol. : Steady state is reached when all transient effects die out and circuit variables become constant.

Q116. In DC steady state, an ideal inductor behaves as
(a) Open circuit
(b) Short circuit
(c) Voltage source
(d) Current source
Ans. b | Sol. : In steady-state DC, current is constant, so induced emf is zero and the inductor acts as a short circuit.

Q117. In DC steady state, an ideal capacitor behaves as
(a) Short circuit
(b) Open circuit
(c) Resistor
(d) Inductor
Ans. b | Sol. : Once fully charged, a capacitor blocks DC current and behaves as an open circuit.

Q118. The transient response of a circuit is primarily due to
(a) Resistors
(b) Independent sources
(c) Energy storage elements
(d) Load resistance
Ans. c | Sol. : Transients occur because inductors and capacitors store and release energy.

Q119. The time constant of an RC circuit is given by
(a) R/C
(b) C/R
(c) RC
(d) 1/RC
Ans. c | Sol. : Time constant τ = RC seconds for an RC circuit.

Q120. The time constant of an RL circuit is
(a) L/R
(b) R/L
(c) RL
(d) 1/RL
Ans. a | Sol. : For an RL circuit, time constant τ = L/R seconds.

Q121. The unit of time constant is
(a) Ohm
(b) Henry
(c) Second
(d) Farad
Ans. c | Sol. : Time constant represents time and is measured in seconds.

Q122. In an RC charging circuit, capacitor voltage reaches about 63.2% of final value in
(a) Half time constant
(b) One time constant
(c) Two time constants
(d) Five time constants
Ans. b | Sol. : After one time constant, capacitor voltage reaches 63.2% of its final value.

Q123. In an RL circuit, current reaches approximately steady state after
(a) One time constant
(b) Two time constants
(c) Three time constants
(d) Five time constants
Ans. d | Sol. : Practically, steady state is assumed after five time constants.

Q124. In AC steady-state analysis, circuit variables vary
(a) Linearly with time
(b) Exponentially with time
(c) Sinusoidally with time
(d) Randomly with time
Ans. c | Sol. : In AC steady state, voltages and currents vary sinusoidally.

Q125. The opposition offered by an inductor to AC is called
(a) Resistance
(b) Capacitive reactance
(c) Inductive reactance
(d) Impedance
Ans. c | Sol. : Inductive reactance XL = ωL opposes AC current.

Q126. The opposition offered by a capacitor to AC is known as
(a) Resistance
(b) Capacitive reactance
(c) Inductive reactance

(d) Admittance
Ans. b | Sol. : Capacitive reactance XC = 1/ωC opposes AC current.

Q127. Impedance is defined as
(a) Ratio of current to voltage
(b) Opposition to DC only
(c) Combined effect of resistance and reactance
(d) Reciprocal of resistance
Ans. c | Sol. : Impedance combines resistance and reactance in AC circuits.

Q128. The unit of impedance is
(a) Siemens
(b) Henry
(c) Ohm
(d) Farad
Ans. c | Sol. : Impedance is measured in ohms.

Q129. In a pure resistive AC circuit, voltage and current are
(a) 90° out of phase
(b) In phase
(c) 180° out of phase
(d) Leading by 45°
Ans. b | Sol. : In a pure resistor, voltage and current are in phase.

Q130. In a pure inductive circuit, current
(a) Leads voltage by 90°
(b) Lags voltage by 90°
(c) Is in phase with voltage
(d) Is independent of voltage
Ans. b | Sol. : Current lags voltage by 90° in an inductive circuit.

Q131. In a pure capacitive circuit, current
(a) Lags voltage by 90°
(b) Is in phase with voltage
(c) Leads voltage by 90°
(d) Is zero
Ans. c | Sol. : Current leads voltage by 90° in a capacitive circuit.

Q132. A two-port network has
(a) One input and one output terminal
(b) Two input and two output terminals
(c) Four terminals grouped as two ports
(d) Only two terminals
Ans. c | Sol. : A two-port network consists of four terminals grouped into two ports.

Q133. The Z-parameters of a two-port network are called
(a) Admittance parameters
(b) Hybrid parameters
(c) Impedance parameters
(d) Transmission parameters
Ans. c | Sol. : Z-parameters relate port voltages to port currents.

Q134. The Y-parameters of a two-port network are known as
(a) Impedance parameters
(b) Admittance parameters
(c) Hybrid parameters
(d) Inverse parameters
Ans. b | Sol. : Y-parameters relate port currents to port voltages.

Q135. Transmission (ABCD) parameters are useful for
(a) Parallel networks
(b) Series networks
(c) Cascaded networks
(d) Nonlinear networks
Ans. c | Sol. : ABCD parameters are convenient for cascaded two-port networks.

Q136. The coupling coefficient between two coils lies between
(a) −1 and 0
(b) 0 and 1
(c) 1 and 2
(d) −1 and 1
Ans. b | Sol. : Coupling coefficient k ranges from 0 (no coupling) to 1 (perfect coupling).

Q137. The unit of mutual inductance is
(a) Ohm
(b) Henry
(c) Weber
(d) Tesla
Ans. b | Sol. : Mutual inductance is measured in henry.

Q138. Mutual inductance exists due to
(a) Electric field coupling
(b) Resistive coupling
(c) Magnetic field coupling
(d) Capacitive coupling
Ans. c | Sol. : Mutual inductance arises due to magnetic flux linkage between coils.

Q139. In magnetically coupled circuits, dot convention indicates
(a) Polarity of resistance
(b) Direction of induced voltage
(c) Value of inductance
(d) Magnitude of current
Ans. b | Sol. : Dot convention shows relative polarity of induced emf in coupled coils.

Q140. If currents enter the dotted ends of both coupled coils, the mutual flux
(a) Opposes self flux
(b) Is zero
(c) Aids self flux
(d) Becomes negative
Ans. c | Sol. : Currents entering dotted terminals produce aiding mutual flux.

Q141. If current enters the dotted end of one coil and leaves the dotted end of the other, the mutual flux
(a) Aids self flux
(b) Is maximum
(c) Opposes self flux
(d) Becomes independent
Ans. c | Sol. : Opposite dot currents result in opposing mutual flux.

Q142. The steady-state response of an AC circuit depends on
(a) Initial conditions
(b) Energy storage elements
(c) Input frequency
(d) Switching instant
Ans. c | Sol. : AC steady-state behavior depends on the frequency of the applied source.

Q143. Transient response of a circuit is independent of
(a) Initial conditions
(b) Circuit parameters
(c) Energy storage elements
(d) Final steady state
Ans. d | Sol. : Transient response depends on initial conditions and parameters, not final steady state.

Q144. In AC circuits, power factor is defined as
(a) Ratio of real power to reactive power
(b) Cosine of phase angle
(c) Ratio of apparent power to real power
(d) Sine of phase angle
Ans. b | Sol. : Power factor is $\cos\varphi$, where φ is the phase difference between voltage and current.

Q145. The steady-state response of a DC circuit signifies that
(a) Circuit variables are increasing linearly
(b) Transient components have completely died out
(c) Energy storage elements are inactive
(d) The supply is disconnected
Ans. b | Sol. : Steady state is reached when transient effects vanish and currents/voltages become constant.

Q146. Why does an inductor behave as a short circuit in DC steady state?
(a) Its resistance becomes zero
(b) Magnetic field disappears
(c) Induced emf becomes zero for constant current
(d) Voltage across it becomes infinite
Ans. c | Sol. : In DC steady state, current is constant, so no changing flux exists to induce emf.

Q147. Why does a capacitor act as an open circuit in DC steady state?
(a) Its resistance increases
(b) Voltage becomes zero
(c) Charge accumulation stops current flow
(d) Electric field vanishes
Ans. c | Sol. : Once fully charged, the capacitor blocks further DC current.

Q148. The transient response of a circuit exists because of
(a) Resistors
(b) Independent sources
(c) Energy storage elements
(d) Load variation
Ans. c | Sol. : Inductors and capacitors store energy, causing transient behavior.

Q149. In an RC circuit, what physical meaning does the time constant represent?
(a) Time for current to become zero
(b) Time for voltage to reach final value
(c) Time to reach 63.2% of final response
(d) Time for maximum power transfer
Ans. c | Sol. : Time constant indicates how fast the circuit responds to a change.

Q150. Why is the transient response independent of the final steady-state value?
(a) Because resistance dominates
(b) Because transient depends on initial conditions
(c) Because sources are removed
(d) Because inductance becomes zero
Ans. b | Sol. : Transient response depends on initial energy stored, not the final value.

Q151. In an AC steady-state circuit, why are phasors used?
(a) To eliminate resistance
(b) To convert AC to DC
(c) To simplify sinusoidal calculations
(d) To remove frequency dependence
Ans. c | Sol. : Phasors transform differential equations into algebraic ones.

Q152. Why does inductive reactance increase with frequency?
(a) Resistance increases
(b) Magnetic field weakens
(c) Rate of change of current increases
(d) Capacitance decreases
Ans. c | Sol. : $X_L = \omega L$ increases as frequency increases.

Q153. Why does capacitive reactance decrease with increasing frequency?
(a) Charge reduces
(b) Electric field weakens
(c) Capacitor blocks DC only
(d) $X_C = 1/\omega C$ decreases as frequency increases
Ans. d | Sol. : Higher frequency allows easier current flow through the capacitor.

Q154. In a pure inductive AC circuit, why does current lag voltage?
(a) Due to resistance
(b) Due to stored electric field
(c) Due to induced back emf
(d) Due to power loss
Ans. c | Sol. : Changing current induces emf opposing the change.

Q155. In a pure capacitive AC circuit, why does current lead voltage?
(a) Charge accumulation precedes voltage rise
(b) Resistance is zero
(c) Magnetic field dominates
(d) Power factor is unity
Ans. a | Sol. : Current flows to charge the capacitor before voltage builds up.

Q156. Why is impedance used instead of resistance in AC circuits?
(a) Resistance becomes zero
(b) AC has no losses

(c) Both magnitude and phase matter
(d) Voltage becomes constant
Ans. c | Sol. : Impedance accounts for both resistance and reactance.

Q157. What does the power factor indicate in an AC circuit?
(a) Energy stored
(b) Phase relationship between voltage and current
(c) Frequency of supply
(d) Power loss only
Ans. b | Sol. : Power factor equals $\cos\varphi$, indicating phase difference.

Q158. Why is power factor unity in a purely resistive circuit?
(a) No reactance is present
(b) Voltage is maximum
(c) Current is zero
(d) Resistance is infinite
Ans. a | Sol. : Absence of reactance keeps voltage and current in phase.

Q159. Why does transient analysis become important during switching operations?
(a) Steady state fails
(b) Energy redistribution occurs
(c) Resistance changes
(d) Sources are nonlinear
Ans. b | Sol. : Switching changes energy stored in inductors and capacitors.

Q160. A two-port network is defined to
(a) Reduce power loss
(b) Simplify circuit modeling
(c) Eliminate transient response
(d) Convert AC to DC
Ans. b | Sol. : Two-port representation simplifies analysis of complex networks.

Q161. Why are Z-parameters called open-circuit parameters?
(a) They ignore current
(b) They are measured with open output ports
(c) They eliminate resistance
(d) They apply only to DC
Ans. b | Sol. : Z-parameters are defined under open-circuit conditions.

Q162. Why are Y-parameters known as short-circuit parameters?
(a) They reduce equations
(b) They are measured with shorted ports
(c) They remove voltage sources
(d) They apply to AC only
Ans. b | Sol. : Y-parameters are obtained under short-circuit conditions.

Q163. Why are ABCD parameters preferred for cascaded networks?
(a) They reduce losses
(b) They eliminate sources
(c) They can be multiplied directly
(d) They ignore phase shift
Ans. c | Sol. : Cascaded networks are easily analyzed using matrix multiplication.

Q164. Magnetic coupling between coils occurs due to
(a) Electric field interaction
(b) Resistive sharing
(c) Mutual flux linkage
(d) Capacitance between turns
Ans. c | Sol. : Magnetic flux of one coil links with another.

Q165. Why does mutual inductance depend on coupling coefficient?
(a) Resistance varies
(b) Flux linkage varies
(c) Current becomes zero
(d) Voltage becomes infinite
Ans. b | Sol. : Coupling coefficient indicates how much flux links both coils.

Q166. What does dot convention signify in magnetically coupled circuits?
(a) Coil resistance
(b) Polarity of induced voltage
(c) Direction of current flow
(d) Value of inductance
Ans. b | Sol. : Dots indicate relative polarity of induced emf.

Q167. Why does mutual flux aid when currents enter dotted terminals?
(a) Fields oppose
(b) Magnetic polarities reinforce
(c) Resistance decreases
(d) Voltage becomes zero
Ans. b | Sol. : Same dot current direction causes reinforcing magnetic fields.

Q168. Why does mutual flux oppose when currents enter opposite dotted terminals?
(a) Fields cancel
(b) Resistance increases
(c) Voltage reverses
(d) Capacitance dominates
Ans. a | Sol. : Opposite directions produce opposing magnetic fields.

Q169. In magnetically coupled circuits, leakage flux causes
(a) Perfect coupling
(b) Energy loss
(c) Zero mutual inductance
(d) Increased resistance
Ans. b | Sol. : Leakage flux does not link coils and represents energy loss.

Q170. Why is coupling coefficient always less than unity in practice?
(a) Due to resistance
(b) Due to leakage flux
(c) Due to capacitance
(d) Due to core saturation
Ans. b | Sol. : Not all flux produced links the other coil.

Q171. Why does AC steady-state response depend on frequency?
(a) Resistance changes
(b) Reactance varies with frequency
(c) Voltage becomes constant
(d) Current becomes zero
Ans. b | Sol. : Inductive and capacitive reactance depend on frequency.

Q172. Why is transient response absent in purely resistive circuits?
(a) No energy storage exists
(b) Voltage is constant
(c) Power factor is unity
(d) Frequency is zero
Ans. a | Sol. : Without energy storage, no transient behavior occurs.

Q173. Why is initial current through an inductor continuous?
(a) Resistance is zero
(b) Magnetic energy cannot change instantaneously
(c) Voltage is infinite
(d) Flux is zero
Ans. b | Sol. : Sudden change would require infinite induced emf.

Q174. Why is initial voltage across a capacitor continuous?
(a) Current is zero
(b) Electric field cannot change instantaneously
(c) Resistance is infinite
(d) Inductance dominates
Ans. b | Sol. : Instantaneous voltage change would require infinite current.

Q175. A 20 V DC source is applied to an RC series circuit with R = 10 Ω and C = 0.1 F at t = 0. What is the initial current?
(a) 0 A
(b) 1 A
(c) 2 A
(d) Infinite
Ans. c | Sol. : At t = 0, the capacitor behaves as a short circuit, so initial current I = V/R = 20/10 = 2 A.

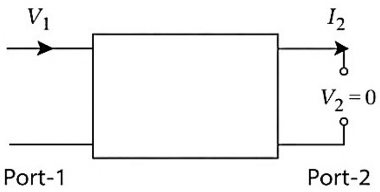
Q176. For the RC circuit above, what is the time constant?
(a) 0.01 s
(b) 0.1 s
(c) 1 s
(d) 10 s
Ans. c | Sol. : Time constant τ = RC = 10 × 0.1 = 1 s.

Q177. An RL circuit has R = 5 Ω and L = 10 H. A DC source is suddenly applied. What is the time constant?
(a) 0.5 s
(b) 2 s
(c) 5 s
(d) 10 s
Ans. b | Sol. : Time constant τ = L/R = 10/5 = 2 s.

Q178. In the RL circuit above, what is the initial current just after switching?
(a) Maximum value
(b) Half of final value
(c) Zero
(d) Infinite
Ans. c | Sol. : Inductor current cannot change instantaneously, so initial current is zero.

Q179. A capacitor of 100 μF is connected to a 50 Hz AC source. If frequency is doubled, capacitive reactance will
(a) Double
(b) Become half
(c) Remain same
(d) Become four times
Ans. b | Sol. : XC = 1/(ωC); doubling frequency halves reactance.

Q180. From the diagram, the condition $V_2 = 0$at Port-2 indicates that:



(a) Port-2 is open-circuited
(b) Port-2 is short-circuited
(c) Port-2 is matched
(d) Port-2 is floating
Ans. b | Sol. : The diagram explicitly labels $V_2 = 0$, which corresponds to a **short-circuit condition** at Port-2.

Q181. A purely inductive AC circuit draws current I. If frequency increases, the current will
(a) Increase
(b) Decrease
(c) Remain same
(d) Become zero
Ans. b | Sol. : Higher frequency increases inductive reactance, reducing current.

Q182. A purely capacitive circuit draws 5 A at 50 Hz. At 100 Hz, the current will be approximately
(a) 2.5 A
(b) 5 A
(c) 10 A
(d) 20 A
Ans. c | Sol. : Capacitive current is proportional to frequency; doubling frequency doubles current.

Q183. In an AC series RLC circuit at resonance, the impedance is
(a) Maximum
(b) Minimum
(c) Infinite
(d) Purely reactive
Ans. b | Sol. : At resonance, inductive and capacitive reactances cancel, leaving only resistance.

Q184. At resonance in a series RLC circuit, the power factor is
(a) Zero
(b) Leading

(c) Lagging
(d) Unity
Ans. d | Sol. : Voltage and current are in phase at resonance.
Q185. A two-port network is terminated with a matched load. What is the reflection at the output port?
(a) Maximum
(b) Minimum
(c) Unity
(d) Infinite
Ans. b | Sol. : Matched load eliminates reflections.
Q186. In a two-port network, Z-parameters are determined by
(a) Short-circuiting both ports
(b) Open-circuiting both ports
(c) Open-circuiting output port
(d) Short-circuiting input port
Ans. c | Sol. : Z-parameters are measured with output port open.
Q187. If Y-parameters of a two-port network are known, they are most useful for
(a) Series connections
(b) Parallel connections
(c) Cascaded connections
(d) Nonlinear analysis
Ans. b | Sol. : Y-parameters suit parallel interconnections.
Q188. ABCD parameters are preferred when networks are
(a) In parallel
(b) In series
(c) Cascaded
(d) Short-circuited
Ans. c | Sol. : ABCD parameters multiply directly for cascaded networks.
Q189. Two identical coils have self-inductance of 4 H each and mutual inductance of 2 H. What is the coefficient of coupling?
(a) 0.25
(b) 0.5
(c) 0.75
(d) 1
Ans. b | Sol. : k = M/√(L1L2) = 2/√(4×4) = 0.5.
Q190. Two coils are perfectly coupled. If self-inductances are 9 H and 4 H, mutual inductance is
(a) 6 H
(b) 3 H
(c) 12 H
(d) 1 H
Ans. a | Sol. : For perfectly coupled coils (k = 1), $M = \sqrt{L_1 L_2} = \sqrt{9 \times 4} = 6\text{H}$.
Q191. In magnetically coupled coils, currents entering dotted terminals will produce
(a) Opposing flux
(b) No mutual flux
(c) Aiding flux
(d) Zero induced emf
Ans. c | Sol. : Same dot current direction produces aiding mutual flux.
Q192. If currents enter dotted end of one coil and undotted end of the other, mutual inductance effect is
(a) Reinforced
(b) Cancelled
(c) Opposing
(d) Independent
Ans. c | Sol. : Opposite dot currents cause opposing flux.
Q193. A leakage coefficient close to zero indicates
(a) Poor coupling
(b) Perfect coupling
(c) High resistance
(d) Core saturation
Ans. b | Sol. : Low leakage means most flux links both coils.
Q194. A transient response in an RLC circuit will decay faster if
(a) Resistance is low
(b) Resistance is high
(c) Inductance is high
(d) Capacitance is high
Ans. b | Sol. : Higher resistance increases damping, causing faster decay.
Q195. In an under-damped RLC circuit, the transient response is
(a) Non-oscillatory
(b) Critically damped
(c) Oscillatory with decay
(d) Constant
Ans. c | Sol. : Underdamping results in oscillations with exponential decay.
Q196. A critically damped circuit reaches steady state
(a) With oscillations
(b) In minimum time without oscillation
(c) Slowly
(d) Never
Ans. b | Sol. : Critical damping gives fastest non-oscillatory response.
Q197. An AC circuit draws 10 A at 0.8 power factor lagging from 200 V supply. What is the real power?
(a) 800 W
(b) 1600 W
(c) 2000 W
(d) 2500 W
Ans. b | Sol. : P = VI cosφ = 200 × 10 × 0.8 = 1600 W.
Q198. If power factor improves from 0.6 to 0.9 for the same real power, line current will
(a) Increase
(b) Decrease
(c) Remain same
(d) Become zero
Ans. b | Sol. : Higher power factor reduces current for same power.
Q199. In steady-state AC analysis, initial conditions are

(a) Always required
(b) Sometimes required
(c) Ignored
(d) Dominant
Ans. c | Sol. : Steady-state AC response is independent of initial conditions.

Q200. A capacitor initially charged to 10 V is suddenly connected across a resistor. The initial voltage across the capacitor will be
(a) 0 V
(b) 5 V
(c) 10 V
(d) Infinite
Ans. c | Sol. : Capacitor voltage cannot change instantaneously.

Q201. An inductor carrying 5 A current is suddenly disconnected. Immediately after disconnection, current will be
(a) Zero
(b) Reduced
(c) Same
(d) Infinite
Ans. c | Sol. : Inductor current is continuous and cannot change instantly.

Q202. If frequency of AC source tends to zero, a capacitor behaves as
(a) Short circuit
(b) Open circuit
(c) Inductor
(d) Resistor
Ans. b | Sol. : At DC (zero frequency), capacitive reactance becomes infinite.

Q203. If frequency of AC source tends to infinity, an inductor behaves as
(a) Open circuit
(b) Short circuit
(c) Capacitor
(d) Voltage source
Ans. a | Sol. : Inductive reactance increases with frequency and becomes very large.

Q204. A DC source is suddenly applied to an RL circuit. Which parameter primarily determines how fast the current reaches steady state?
(a) Source voltage
(b) Inductance–resistance ratio
(c) Load power
(d) Circuit topology
Ans. b | Sol. : The rate of rise of current depends on the time constant $\tau = L/R$.

Q205. In an RC circuit, if resistance is doubled while capacitance remains constant, the transient response will
(a) Become twice as fast
(b) Become twice as slow
(c) Remain unchanged
(d) Become oscillatory
Ans. b | Sol. : Time constant $\tau = RC$ doubles, slowing the transient response.

Q206. An inductor and capacitor are both present in a circuit. Which condition guarantees absence of transient oscillations?
(a) Zero resistance
(b) High inductance
(c) Critical damping
(d) Low capacitance
Ans. c | Sol. : Critical damping produces fastest non-oscillatory transient response.

Q207. A capacitor initially charged is connected across a resistor. Which quantity determines the initial discharge current?
(a) Capacitor voltage and resistance
(b) Capacitance only
(c) Time constant
(d) Power rating
Ans. a | Sol. : Initial current equals V/R, where V is initial capacitor voltage.

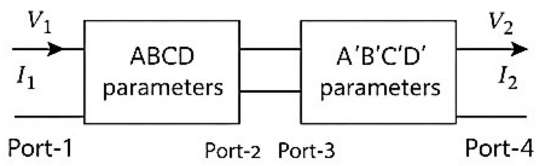
Q208. In AC steady-state analysis, why are differential equations avoided?
(a) They give inaccurate results
(b) Phasor method converts them to algebraic equations
(c) Resistance dominates reactance
(d) Initial conditions are unknown
Ans. b | Sol. : Phasors simplify sinusoidal steady-state analysis by avoiding differential equations.

Q209. An RLC series circuit operates below resonance. Which behavior is correct?
(a) Circuit is inductive
(b) Circuit is capacitive
(c) Impedance is minimum
(d) Power factor is unity
Ans. b | Sol. : Below resonance, capacitive reactance dominates.

Q210. At resonance in a series RLC circuit, which quantity becomes maximum?
(a) Impedance
(b) Power factor
(c) Current
(d) Reactance
Ans. c | Sol. : Minimum impedance at resonance causes maximum current.

Q211. If frequency is increased above resonance in a series RLC circuit, the circuit becomes
(a) Capacitive
(b) Resistive
(c) Inductive
(d) Open-circuited
Ans. c | Sol. : Above resonance, inductive reactance dominates.

Q212. From the diagram, the overall network between Port-1 and Port-4 is best analyzed using:



(a) z-parameters
(b) y-parameters
(c) h-parameters
(d) Transmission (ABCD) parameters
Ans. d | Sol. :- The diagram explicitly shows two cascaded blocks labeled with ABCD parameters, which are directly suited for cascade analysis.

Q213. A two-port network simplifies analysis primarily because it
(a) Removes nonlinearities
(b) Separates input and output behavior
(c) Eliminates frequency effects
(d) Avoids transient response
Ans. b | Sol. : Two-port models relate input and output variables systematically.

Q214. Why are Z-parameters unsuitable for parallel-connected two-port networks?
(a) They ignore voltage
(b) They assume open-circuit conditions
(c) They are frequency dependent
(d) They require matched loads
Ans. b | Sol. : Open-circuit conditions make Z-parameters inconvenient for parallel connections.

Q215. Which two-port parameter set is most convenient for cascade connections?
(a) Z-parameters
(b) Y-parameters
(c) h-parameters
(d) ABCD parameters
Ans. d | Sol. : ABCD matrices multiply directly for cascaded networks.

Q216. If the output port of a two-port network is open, which parameter is most easily determined?
(a) Y-parameter
(b) Z-parameter
(c) h-parameter
(d) g-parameter
Ans. b | Sol. : Z-parameters are defined with output port open.

Q217. Why does perfect magnetic coupling rarely occur in practice?
(a) Due to resistance
(b) Due to leakage flux
(c) Due to saturation
(d) Due to capacitive effects
Ans. b | Sol. : Not all flux produced by one coil links the other.

Q218. Two coils have strong magnetic coupling. What effect does this have on mutual inductance?
(a) It becomes zero
(b) It decreases
(c) It increases
(d) It becomes negative
Ans. c | Sol. : Strong coupling means more flux linkage, increasing mutual inductance.

Q219. If currents enter dotted terminals of two coupled coils, the induced voltage will
(a) Oppose self-induced voltage
(b) Be zero
(c) Aid self-induced voltage
(d) Become independent
Ans. c | Sol. : Dot convention indicates aiding polarity for same-dot current direction.

Q220. In a magnetically coupled circuit, reversing current direction in one coil will
(a) Not affect mutual inductance
(b) Reverse polarity of induced voltage
(c) Increase resistance
(d) Eliminate coupling
Ans. b | Sol. : Induced voltage polarity depends on current direction.

Q221. An under-damped RLC circuit is preferred in applications requiring
(a) Fast settling without overshoot
(b) Oscillatory response
(c) Maximum resistance
(d) Zero inductance
Ans. b | Sol. : Underdamping produces oscillations with decaying amplitude.

Q222. Why does increasing resistance in an RLC circuit increase damping?
(a) Energy dissipation increases
(b) Capacitance decreases
(c) Inductance increases
(d) Frequency decreases
Ans. a | Sol. : Resistance dissipates energy, reducing oscillations faster.

Q223. In AC circuits, why does reactive power not contribute to useful work?
(a) It is imaginary
(b) It alternates between source and reactive elements
(c) It reduces voltage
(d) It increases frequency
Ans. b | Sol. : Reactive power stores and releases energy without net consumption.

Q224. If an AC circuit draws the same current but power factor improves, what happens to real power?
(a) Decreases
(b) Increases
(c) Remains same
(d) Becomes zero
Ans. b | Sol. : Real power $P = VI\cos\varphi$ increases with improved power factor.

Q225. Why is transient analysis crucial in switching circuits?
(a) Steady state cannot be reached
(b) Initial energy redistribution affects system response
(c) Frequency changes abruptly
(d) Load resistance becomes zero

Ans. b | Sol. : Switching alters stored energy, affecting transient behavior.

Q226. A capacitor voltage cannot change instantaneously because

(a) Resistance is infinite
(b) It would require infinite current
(c) Electric field disappears
(d) Charge becomes zero

Ans. b | Sol. : Instantaneous voltage change demands infinite current.

Q227. An inductor current cannot change instantaneously because

(a) Voltage becomes zero
(b) Magnetic energy cannot change abruptly
(c) Resistance dominates
(d) Flux linkage is constant

Ans. b | Sol. : Sudden current change requires infinite induced emf.

Q228. At very high frequency, a capacitor effectively behaves as

(a) Open circuit
(b) Short circuit
(c) Inductor
(d) Resistor

Ans. b | Sol. : Capacitive reactance approaches zero at high frequency.

Q229. At very low frequency, an inductor behaves approximately as

(a) Short circuit
(b) Open circuit
(c) Capacitor
(d) Voltage source

Ans. a | Sol. : Inductive reactance approaches zero as frequency approaches zero.

Q230. Why is steady-state AC response independent of initial conditions?

(a) Resistance dominates
(b) Energy storage effects vanish
(c) Sources are ideal
(d) Frequency is constant

Ans. b | Sol. : After transients decay, initial conditions no longer influence response.

Q231. In two-port network analysis, reciprocity implies

(a) Equal input and output currents
(b) Symmetry of transfer parameters
(c) Zero power loss
(d) Perfect matching

Ans. b | Sol. : Reciprocal networks have symmetric transmission properties.

Q232. If a coupled-coil system shows negligible mutual inductance, the coupling is

(a) Perfect
(b) Tight
(c) Loose
(d) Negative

Ans. c | Sol. : Small mutual inductance indicates weak or loose coupling.

Q233. Why does leakage inductance degrade transformer performance?

(a) It increases efficiency
(b) It reduces mutual flux
(c) It eliminates losses
(d) It improves regulation

Ans. b | Sol. : Leakage inductance represents flux not linking both coils, reducing effective energy transfer.

Q234. Thevenin's theorem reduces a network to

(a) Current source in parallel with resistance
(b) Voltage source in series with resistance
(c) Voltage source only
(d) Resistance only

Ans. b | Sol. : Thevenin equivalent is a voltage source in series with resistance.

Q235. If a circuit has N nodes, the number of nodal equations required is

(a) N
(b) N − 2
(c) N − 1
(d) 2N

Ans. c | Sol. : One node is taken as reference, so equations = N − 1.

Q236. A circuit element that does not dissipate energy is

(a) Resistor
(b) Inductor
(c) Practical source
(d) Lamp

Ans. b | Sol. : Ideal inductors store but do not dissipate energy.

Q237. Why does superposition theorem require linear circuit elements?

(a) Because non-linear elements store energy
(b) Because linearity ensures proportional response
(c) Because linear circuits have no losses
(d) Because dependent sources are removed

Ans. b | Sol. : Superposition relies on proportionality between cause and effect, valid only in linear circuits.

Q238. Why does a supernode occur in nodal analysis?

(a) Due to current sources
(b) Due to short circuits
(c) Due to voltage sources between nodes
(d) Due to dependent resistors

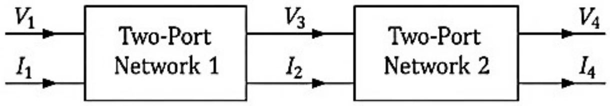
Ans. c | Sol. : A voltage source connecting two non-reference nodes forms a supernode.

Q239. Why does a capacitor oppose sudden change in voltage?

(a) Due to inductive reactance
(b) Due to stored charge
(c) Due to magnetic field
(d) Due to resistance

Ans. b | Sol. : Stored charge prevents instantaneous voltage change across a capacitor.

Q240. From the diagram, the interconnection between Two-Port Network-1 and Two-Port Network-2 is:



(a) Parallel–parallel connection
(b) Series–parallel connection
(c) Cascade (series) connection
(d) Feedback connection
Ans. c | Sol. :The output of Network-1 directly feeds the input of Network-2, indicating a cascade (series) interconnection.

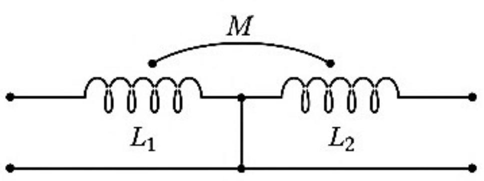
Q241. Two meshes share a resistor of value R. How does this resistor appear in mesh equations?
(a) Only in one mesh equation
(b) With same sign in both equations
(c) With opposite signs in equations
(d) It is eliminated
Ans. c | Sol. : The shared resistor current depends on the difference of mesh currents.

Q242. Why does a purely resistive AC circuit have no transient response?
(a) Voltage is constant
(b) No energy storage exists
(c) Power factor is unity
(d) Impedance is minimum
Ans. b | Sol. : Transients arise only from energy-storage elements.

Q243. In maximum power transfer, doubling the load resistance causes load power to
(a) Double
(b) Become zero
(c) Reduce below maximum
(d) Remain unchanged
Ans. c | Sol. : Any deviation from RL = RTH reduces power.

Q244. The Thevenin resistance of a circuit containing only dependent sources is found by
(a) Open-circuiting the output
(b) Short-circuiting all elements
(c) Applying a test source
(d) Using superposition
Ans. c | Sol. : A test source is required since independent sources are absent.

Q245. The diagram indicates that inductors $L_1$and $L_2$are:



(a) Electrically isolated
(b) Magnetically uncoupled
(c) Magnetically coupled
(d) Connected in parallel without coupling
Ans. c | Sol. : The curved arc labeled Mbetween $L_1$and L_2explicitly indicates **magnetic coupling (mutual inductance)**.

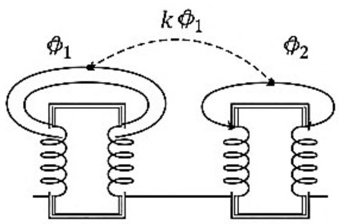
Q246. Why is mesh analysis based on KVL rather than KCL?
(a) Meshes represent current paths
(b) KCL fails in loops
(c) Voltage is easier to compute
(d) Power loss is minimized
Ans. a | Sol. : Meshes are closed loops where KVL is directly applicable.

Q247. A loop has two opposing sources 30 V and 10 V. Why does KVL still hold?
(a) Currents cancel
(b) Net voltage is algebraic sum
(c) Power is conserved
(d) Resistance is zero
Ans. b | Sol. : KVL accounts for algebraic sum of voltage rises and drops.

Q248. The Thevenin and Norton resistances of a network are
(a) Always zero
(b) Always different
(c) Always equal
(d) Related by square law
Ans. c | Sol. : Both represent the same network seen from load terminals.

Q249. If a Thevenin equivalent has VTH = 12 V and RTH = 6 Ω, the maximum power delivered is
(a) 3 W
(b) 6 W
(c) 12 W
(d) 24 W
Ans. b | Sol. : Pmax = VTH^2 / (4RTH) = 144 / 24 = 6 W.

Q250. From the diagram, the dashed arc labeled $k\phi_1$represents:



(a) Leakage flux of the second coil
(b) Total flux of the first coil
(c) Portion of flux from coil-1 linking coil-2
(d) Self-induced flux in coil-2
Ans. c | Sol. : The dashed arc explicitly shows **only a fraction of** $\phi_1$linking the second core, indicated by the factor k.

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