Technical Abilities (Electronics): 100 MCQs

- Target Exam: RRB Junior Engineer (RRB JE)
- Study Notes Prepared for: Entri App Users

Section 1: Basic DC & Circuit Fundamentals (Q1–Q25)

Q1. What is the SI unit of electric current?

A) Volt

B) Ampere

C) Ohm

D) Watt

Answer: B

Q2. According to Ohm's law, current is directly proportional to:

A) Resistance

B) Capacitance

C) Voltage

D) Power

Answer: C

Q3. The unit of electrical resistance is:

A) Siemens

B) Henry

C) Farad

D) Ohm

Answer: D

Q4. Conductance is the reciprocal of:

A) Resistance

B) Voltage

C) Current

D) Inductance

Answer: A

Q5. What is the unit of electrical conductance?

A) Ohm

B) Siemens (or Mho)

C) Coulomb

D) Weber

Answer: B

Q6. Kirchhoff's Current Law (KCL) is based on the conservation of:

A) Energy

B) Charge

C) Momentum

D) Mass

Answer: B

Q7. Kirchhoff's Voltage Law (KVL) is based on the conservation of:

A) Charge

B) Energy

C) Power

D) Flux

Answer: B

Q8. Two 10Ω resistors connected in series yield an equivalent resistance of:

A) 5Ω

B) 10Ω

C) 20Ω

D) 100Ω

Answer: C

Q9. Two 10Ω resistors connected in parallel yield an equivalent resistance of:

A) 5Ω

B) 10Ω

C) 20Ω

D) 2.5Ω

Answer: A

Q10. Electrical power P in a DC circuit can be calculated using:

A) $P = V \times I$

B) $P = I^2 \times R$

C) $P = \frac{V^2}{R}$

D) All of the above

Answer: D

Q11. Ideal voltage sources have:

A) Infinite internal resistance

B) Zero internal resistance

C) 100Ω internal resistance

D) Variable resistance

Answer: B

Q12. Ideal current sources have:

A) Zero internal resistance

B) Infinite internal resistance

C) 1Ω internal resistance

D) Negative resistance

Answer: B

Q13. Superposition theorem is applicable only to:

A) Non-linear circuits

B) Linear bilateral circuits

C) Digital circuits

D) Magnetic circuits

Answer: B

Q14. According to Thevenin's theorem, any linear circuit can be replaced by:

A) Current source in parallel with resistance

B) Voltage source in series with resistance

C) Voltage source in parallel with resistance

D) Ideal current source only

Answer: B

Q15. According to Norton's theorem, any linear circuit can be replaced by:

A) Current source in parallel with resistance

B) Voltage source in series with resistance

C) Voltage source in parallel with resistance

D) Ideal voltage source only

Answer: A

Q16. Maximum power transfer theorem states that max power is delivered when load resistance equals:

A) Half the source resistance

B) Thevenin source resistance

C) Double the source resistance

D) Zero

Answer: B

Q17. The power factor of a purely resistive DC circuit is:

A) 0

B) 0.5

C) 1

D) Infinity

Answer: C

Q18. The energy stored in an inductor is given by:

A) $E = \frac{1}{2}CV^2$

B) $E = \frac{1}{2}LI^2$

C) $E = LI$

D) $E = VIt$

Answer: B

Q19. The energy stored in a capacitor is given by:

A) $E = \frac{1}{2}CV^2$

B) $E = \frac{1}{2}LI^2$

C) $E = CV$

D) $E = \frac{V^2}{R}$

Answer: A

Q20. An open circuit has:

A) Zero resistance and infinite current

B) Infinite resistance and zero current

C) Zero resistance and zero current

D) Infinite resistance and infinite current

Answer: B

Q21. A short circuit has:

A) Zero resistance and maximum current

B) Infinite resistance and zero current

C) Zero current and zero voltage

D) Infinite resistance and maximum current

Answer: A

Q22. The resistivity of a conductor depends on its:

A) Length

B) Cross-sectional area

C) Material and temperature

D) Shape

Answer: C

Q23. Temperature coefficient of resistance for metals is generally:

A) Positive

B) Negative

C) Zero

D) Infinite

Answer: A

Q24. Temperature coefficient of resistance for semiconductors is generally:

A) Positive

B) Negative

C) Zero

D) Variable

Answer: B

Q25. Which device measures electrical current in a branch?

A) Voltmeter

B) Ammeter

C) Wattmeter

D) Ohmmeter

Answer: B

Section 2: AC Circuits & Phasors (Q26–Q50)

Q26. What is the frequency of standard household AC supply in North America?

A) $50\ Hz$

B) $60\ Hz$

C) $100\ Hz$

D) $120\ Hz$

Answer: B

Q27. The Form Factor of a pure sine wave is:

A) 1.00

B) 1.11

C) 1.414

D) 0.707

Answer: B

Q28. The Peak (Crest) Factor of a pure sine wave is:

A) 1.11

B) 1.414

C) 2.0

D) 0.707

Answer: B

Q29. For a sinusoidal AC wave, RMS voltage is equal to:

A) $0.707 \times V_{peak}$

B) $0.637 \times V_{peak}$

C) $1.414 \times V_{peak}$

D) $2 \times V_{peak}$

Answer: A

Q30. For a sinusoidal AC wave, Average voltage is equal to:

A) $0.707 \times V_{peak}$

B) $0.637 \times V_{peak}$

C) $1.11 \times V_{peak}$

D) V_{peak}

Answer: B

Q31. In a purely capacitive AC circuit, current:

A) Lags voltage by $90°$

B) Leads voltage by $90°$

C) Is in phase with voltage

D) Leads voltage by $180°$

Answer: B

Q32. In a purely inductive AC circuit, current:

A) Lags voltage by $90°$

B) Leads voltage by $90°$

C) Is in phase with voltage

D) Lags voltage by $45°$

Answer: A

Q33. Inductive Reactance (X_L) is calculated as:

A) $\frac{1}{2\pi fL}$

B) $2\pi fL$

C) $2\pi fC$

D) $\frac{L}{C}$

Answer: B

Q34. Capacitive Reactance (X_C) is calculated as:

A) $2\pi fC$

B) $\frac{1}{2\pi fC}$

C) $\frac{1}{2\pi fL}$

D) $2\pi fL$

Answer: B

Q35. As frequency increases, capacitive reactance:

A) Increases

B) Decreases

C) Remains unchanged

D) Becomes zero immediately

Answer: B

Q36. As frequency increases, inductive reactance:

A) Increases

B) Decreases

C) Remains unchanged

D) Oscillates

Answer: A

Q37. Impedance (Z) of a series RLC circuit is:

A) $R + X_L + X_C$

B) $\sqrt{R^2 + (X_L - X_C)^2}$

C) $\sqrt{R + X_L - X_C}$

D) $R^2 + (X_L - X_C)^2$

Answer: B

Q38. At series resonance, the total impedance of an RLC circuit is:

A) Maximum and equal to R

B) Minimum and equal to R

C) Zero

D) Infinite

Answer: B

Q39. The resonant frequency f_0 of a series RLC circuit is:

A) $\frac{1}{2\pi\sqrt{LC}}$

B) $2\pi\sqrt{LC}$

C) $\frac{1}{2\pi LC}$

D) $\sqrt{LC}$

Answer: A

Q40. Power Factor is defined as the ratio of:

A) Apparent Power to Real Power

B) Real Power to Apparent Power

C) Reactive Power to Real Power

D) Apparent Power to Reactive Power

Answer: B

Q41. Unit of Real (Active) Power is:

A) VAR

B) VA

C) Watt (or kW)

D) Joule

Answer: C

Q42. Unit of Reactive Power is:

A) Watt

B) Volt-Ampere Reactive (VAR)

C) Volt-Ampere (VA)

D) Ohm

Answer: B

Q43. Unit of Apparent Power is:

A) Watt

B) VAR

C) Volt-Ampere (VA)

D) Coulomb

Answer: C

Q44. In a 3-phase star (Y) connection:

A) Line Voltage = Phase Voltage

B) Line Voltage = $\sqrt{3} \times$ Phase Voltage

C) Line Current = $\sqrt{3} \times$ Phase Current

D) Line Voltage = $3 \times$ Phase Voltage

Answer: B

Q45. In a 3-phase delta (Δ) connection:

A) Line Voltage = Phase Voltage

B) Line Current = Phase Current

C) Line Voltage = $\sqrt{3} \times$ Phase Voltage

D) Line Voltage = 0

Answer: A

Q46. Total active power in a balanced 3-phase system is:

A) $V_L I_L \cos\theta$

B) $\sqrt{3} V_L I_L \cos\theta$

C) $3 V_L I_L \cos\theta$

D) $\sqrt{3} V_L I_L \sin\theta$

Answer: B

Q47. Capacitors are added in industrial systems to:

A) Increase inductive load

B) Improve power factor

C) Decrease system frequency

D) Convert AC to DC

Answer: B

Q48. In a 3-phase system, the phase angle difference between phases is:

A) 90°

B) 120°

C) 180°

D) 360°

Answer: B

Q49. A skin effect in AC conductors causes current to flow primarily:

A) In the core center

B) Near the outer surface

C) Uniformly throughout

D) In a zigzag path

Answer: B

Q50. Skin effect increases with:

A) Lower frequency

B) Higher frequency and larger diameter

C) Decreased conductor diameter

D) DC current

Answer: B

Section 3: Electrical Machines & Transformers (Q51–Q75)

Q51. Transformers operate on the principle of:

A) Self induction only

B) Mutual electromagnetic induction

C) Electrostatic attraction

D) Seebeck effect

Answer: B

Q52. Transformers work on:

A) AC only

B) DC only

C) Both AC and DC

D) Pulsating DC only

Answer: A

Q53. Transformer core laminations are used to reduce:

A) Copper loss

B) Hysteresis loss

C) Eddy current loss

D) Stray loss

Answer: C

Q54. The turns ratio of a transformer is given by:

A) $\frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{I_2}{I_1}$

B) $\frac{N_1}{N_2} = \frac{V_2}{V_1}$

C) $\frac{N_1}{N_2} = \frac{I_1}{I_2}$

D) $\frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{I_1}{I_2}$

Answer: A

Q55. Open-circuit test on a transformer determines:

A) Copper loss

B) Core (iron) loss

C) Friction loss

D) Total full-load loss

Answer: B

Q56. Short-circuit test on a transformer determines:

A) Core loss

B) Copper loss at full load

C) Stray losses

D) Insulation resistance

Answer: B

Q57. In an ideal transformer, efficiency is:

A) 80%

B) 90%

C) 100%

D) 50%

Answer: C

Q58. DC Generators operate on the principle of:

A) Faraday’s law of electromagnetic induction

B) Ampere’s Law

C) Lenz's Law

D) Joule's Law

Answer: A

Q59. The component in a DC generator that converts AC generated in armature to DC is:

A) Slip rings

B) Commutator

C) Brushes

D) Stator

Answer: B

Q60. Slip rings are used in:

A) DC Generators

B) AC Alternators / Induction Motors

C) DC Shunt Motors

D) Stepper Motors

Answer: B

Q61. Back EMF in a DC motor:

A) Aids applied voltage

B) Opposes applied voltage

C) Increases magnetic flux

D) Equals zero at full speed

Answer: B

Q62. The speed of a DC shunt motor can be controlled by:

A) Armature voltage control

B) Field flux control

C) Adding resistance in armature circuit

D) All of the above

Answer: D

Q63. Which DC motor provides the highest starting torque?

A) Shunt motor

B) Series motor

C) Cumulative compound motor

D) Differential compound motor

Answer: B

Q64. A DC series motor should never be started:

A) On full load

B) Without load (at no-load)

C) With field resistance added

D) At reduced voltage

Answer: B

Q65. Synchronous speed (N_s) of an AC motor is given by:

A) $\frac{120f}{P}$

B) $\frac{120P}{f}$

C) $\frac{60f}{P}$

D) $120fP$

Answer: A

Q66. The difference between synchronous speed and actual rotor speed in an induction motor is called:

A) Phase shift

B) Slip

C) Skew

D) Backlash

Answer: B

Q67. Slip (s) in an induction motor is expressed as:

A) $\frac{N_s - N}{N_s}$

B) $\frac{N - N_s}{N}$

C) $\frac{N_S}{N}$

D) $\frac{N}{N_S - N}$

Answer: A

Q68. At standstill, the slip of an induction motor is:

A) 0

B) 0.5

C) 1

D) Infinite

Answer: C

Q69. If an induction motor runs at synchronous speed, the slip becomes:

A) 1

B) 0

C) -1

D) Infinity

Answer: B

Q70. Synchronous motors run at:

A) Less than synchronous speed

B) Synchronous speed at all loads

C) Greater than synchronous speed

D) Variable speeds

Answer: B

Q71. A synchronous motor can operate at:

A) Lagging power factor only

B) Leading power factor only

C) Unity power factor only

D) Lagging, leading, or unity power factor

Answer: D

Q72. An over-excited synchronous motor running at no load acts as a:

A) Synchronous condenser (improves PF)

B) Inductor

C) Resistor

D) DC generator

Answer: A

Q73. The function of a Buchholz relay in a transformer is to protect against:

A) Overvoltage

B) Internal fault (gas-actuated)

C) Earth fault outside tank

D) Reverse current

Answer: B

Q74. Transformer oil provides:

A) Insulation only

B) Cooling only

C) Both insulation and cooling

D) Lubrication to windings

Answer: C

Q75. High-frequency transformers generally use cores made of:

A) Laminated iron

B) Ferrite

C) Cast steel

D) Copper

Answer: B

Section 4: Power Systems, Measurements & Safety (Q76–Q100)

Q76. Which plant has the highest initial setup cost?

A) Thermal power plant

B) Hydroelectric power plant / Nuclear

C) Diesel power plant

D) Gas turbine plant

Answer: B

Q77. Base load power plants operate at:

A) Low load factor

B) High plant load factor continuously

C) Peak hours only

D) Emergency times only

Answer: B

Q78. Moderating material in a nuclear reactor is used to:

A) Absorb neutrons

B) Slow down fast neutrons

C) Cool down the core

D) Generate electricity directly

Answer: B

Q79. Transmission voltages are stepped up to high levels to:

A) Increase current

B) Reduce I^2R power losses in line

C) Reduce frequency

D) Simplify insulation

Answer: B

Q80. Which cable insulation material is commonly used in modern underground lines?

A) Paper

B) XLPE (Cross-linked Polyethylene)

C) Rubber

D) PVC

Answer: B

Q81. The bundle conductors are used in EHV lines to:

A) Increase line resistance

B) Reduce corona loss and line reactance

C) Increase skin effect

D) Lower line voltage

Answer: B

Q82. Corona effect in transmission lines causes:

A) Violet glow, hissing noise, and ozone gas generation

B) Voltage drop only

C) Temperature drop

D) Current increase without loss

Answer: A

Q83. Ferranti effect refers to high-voltage transmission lines where receiving-end voltage is:

A) Less than sending-end voltage at full load

B) Greater than sending-end voltage at no-load or light load

C) Equal to sending-end voltage always

D) Zero

Answer: B

Q84. A circuit breaker automatically opens under fault conditions when triggered by a:

A) Fuse

B) Relay

C) Isolator

D) Transformer

Answer: B

Q85. What gas is widely used in high-voltage circuit breakers for arc quenching?

A) Nitrogen

B) Carbon dioxide

C) Sulfur Hexafluoride (SF_6)

D) Argon

Answer: C

Q86. A fuse is a protective device that operates on the principle of:

A) Magnetic effect of current

B) Heating effect of current (I^2R)

C) Electrostatic effect

D) Chemical effect

Answer: B

Q87. HRC fuse stands for:

A) High Rupturing Capacity fuse

B) High Resistance Current fuse

C) Heat Resistance Capacity fuse

D) Heavy Relaying Circuit fuse

Answer: A

Q88. Earth fault protection is used to guard against:

A) Overcurrent

B) Leakage current to ground

C) High frequency

D) Overfrequency

Answer: B

Q89. Megger is an instrument used to measure:

A) Low resistance

B) Medium resistance

C) High insulation resistance

D) Inductance

Answer: C

Q90. PMMC (Permanent Magnet Moving Coil) instruments measure:

A) AC only

B) DC only

C) Both AC and DC

D) Frequency

Answer: B

Q91. Moving Iron (MI) instruments can measure:

A) DC only

B) AC only

C) Both AC and DC

D) Neither AC nor DC

Answer: C

Q92. An oscilloscope is primarily used to visualize:

A) Power factor

B) Voltage waveforms over time

C) Energy consumed

D) Magnetic flux lines

Answer: B

Q93. A Current Transformer (CT) is used to step down current for:

A) High voltage generation

B) Measurement and protection instruments

C) Rectification

D) Power factor improvement

Answer: B

Q94. Never open the secondary circuit of an energized Current Transformer (CT) because it generates:

A) High dangerous voltage across secondary

B) Excessive short-circuit current

C) Reverse flux

D) Low frequency

Answer: A

Q95. Potential Transformers (PT) are connected in:

A) Series with the line

B) Parallel across the line

C) Series-parallel combination

D) Delta loop only

Answer: B

Q96. The color code for the ground/earth wire in standard international AC wiring is typically:

A) Red

B) Black

C) Green (or Green/Yellow)

D) Blue

Answer: C

Q97. The primary objective of earthing (grounding) electrical equipment is to:

A) Reduce electricity bill

B) Protect human life from electric shock

C) Increase voltage

D) Improve power factor

Answer: B

Q98. A residual current circuit breaker (RCCB / GFCI) trips when there is an imbalance between:

A) Voltage and current

B) Live (Phase) and Neutral currents

C) Frequency and power

D) Resistance and impedance

Answer: B

Q99. What range of electric current through the human body is generally considered threshold for ventricular fibrillation?

A) $1\ mA - 5\ mA$

B) $10\ mA - 20\ mA$

C) $100\ mA - 200\ mA$

D) $10\ A - 20\ A$

Answer: C

Q100. Diversity factor in power plants is defined as:

A) $\frac{Sum of individual max demands}{Simultaneous max demand of system}$

B) $\frac{Average load}{Peak load}$

C) $\frac{Max demand}{Connected load}$

D) $\frac{Energy generated}{Time}$

Answer: A