Total No. of Printed Pages : 13

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B

SET-X

Ph.D-EE-December, 2024
Electrical Engineering

Sr. No. 10022

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name _____

Date of Examination _____

(Signature of the Candidate) (Signature of the Invigilator)

SEAL

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1. In a commutation circuit, satisfactory turn off of an SCR is obtained when :
   (1) Circuit turn-off time < Device turn-off time
   (2) Circuit time constant < Device turn-off time
   (3) Circuit turn-off time > Device turn-off time
   (4) Circuit time constant > Device turn-off time

2. Which of the following is not a current triggered device ?
   (1) Thyristor (2) GTO (3) Triac (4) MOSFET

3. A switched mode power supply operating at 20 kHz to 100 kHz range uses as main switching element :
   (1) Thyristor (2) MOSFET (3) Triac (4) UJT

4. The Triac can be used as :
   (1) AC voltage regulator (2) Inverter
   (3) Rectifier (4) Multi-quadrant Chopper

5. Which of the following does not cause permanent damage to the SCR ?
   (1) High rate of rise of current (2) High current
   (3) High rate of rise of voltage (4) High temperature rise

6. Which of the following Flip-flop circuits holds or toggles its output according to the input state ?
   (1) T (2) D (3) JK (4) SR

7. Two's complement of 0111 is :
   (1) 1000 (2) 1100 (3) 1001 (4) 1010

8. Toggeling all the values of any binary number gives its :
   (1) Two's complement (2) One's complement
   (3) Bit shifted number (4) None of the above

9. If the inductance L is removed from the load of any circuit, the power drawn as compared to previous case shall be :
   (1) less (2) more (3) same (4) can't be said

10. The RMS value of alternating current is representation of equivalent DC value in terms of :
    (1) charge transfer (2) heat generation (3) mass transfer (4) voltage generation

11. In India, which organisation performs the role of Independent System Operator :
(1) CEA (2) PGCIL (3) CERC (4) POSOCO

12. Snubber circuit is used to limit the :
(1) Rise of current
(2) Rise of voltage across device
(3) Conduction period
(4) Commutation period

13. The dimension of outer conductor are b and c and that of inner conductor is a, the ratio of inner and outer current densities is :
(1) $(c^2 - b^2)/a^2$ (2) $a^2/(c^2 - b^2)$ (3) $(c-b)/a$ (4) $(cb)/a^2$

14. The following statement is correct for uniform plane waves :
(1) The wavelength λ is longer and velocity v is higher in all real media than they are in free space
(2) The wavelength λ is longer and velocity v is lower in all real media than they are in free space
(3) The wavelength λ is shorter and velocity v is higher in all real media than they are in free space
(4) The wavelength λ is shorter and velocity v is lower in all real media than they are in free space

15. A lossless dielectric slab has $\varepsilon_R = 9$. Its intrinsic impedance is :
(1) 360 $\pi\Omega$ (2) 120 $\pi\Omega$ (3) 40 $\pi\Omega$ (4) 30 $\pi\Omega$

16. If $D = 10\ y^2\ a_x + 10\ x^2 y\ a_y + 15\ a_z$, the total charge enclosed within the region $0 < x, y, z < 1$m is :
(1) 40/3 C (2) 20/3 C (3) 10/3 C (4) 5/3 C

17. A perfect dielectric medium has a uniform plane wave. Which of the following statements for the wave are correct ?
(1) The electric and magnetic fields are in the same direction
(2) The electric and magnetic fields are perpendicular to each other
(3) The electric and magnetic fields are opposite to each other
(4) The electric and magnetic fields do not occur in the medium

18. The magnetic flux density in the air gap between two iron surfaces is B_g. The force between the iron surfaces at this flux density is F. If the flux density is reduced to (3/4) B_g, the decrease in the force would be :
(1) (3/4) F (2) (7/16) F (3) (1/4) F (4) None of the above

19. In a full-wave controlled rectifier (center tap transformer connection), if ac supply is 230 V, 50 Hz, the PIV required for SCRs shall be :
(1) 230 V (2) 325 V (3) 460 V (4) 650 V

20. In a half-wave rectifier with a shunt capacitance filter, what is the frequency of ac ripple at output, if the frequency of ac supply is 50 Hz.
(1) 25 Hz (2) 50 Hz (3) 100 Hz (4) Zero Hz

21. An alternator is said to be over excited when it is operating at :
(1) Leading power factor (2) Lagging power factor
(3) Unity power factor (4) None of these

22. In a transformer hysteresis and eddy current losses depend upon :
(1) Load current (2) Supply frequency
(3) Maximum flux density (4) (2) and (3) both

23. Role of power system stabilizer in excitation system is to :
(1) Provide de power to the synchronous machine field winding
(2) Processes and amplifies input current signal
(3) Provide an additional input signal to regulator to damp power system oscillation
(4) Provide an additional input signal to regulator to boost system frequency

24. Resistance switching is normally employed in :
(1) Bulk oil breakers (2) Minimum oil breakers
(3) SF6 circuit breakers (4) Air blast circuit breakers

25. The arc voltage in a circuit breaker is :
(1) In the phase with arc current (2) Lagging the arc current by 90°
(3) Leading the arc current by 90° (4) Lagging the arc current by 45°

26. A negative sequence relay is commonly used to protect :
(1) Transformers (2) Transmission lines
(3) Alternators (4) Bus bar

27. If the fault current is 3000 amps, the relay setting 50% and the C.T. ratio is 400/5, then the plug setting multiplier will be :
(1) 25 amps (2) 15 amps (3) 50 amps (4) 30 amps

28. In a HRC fuse the time between the cut off and the final current zero is called ?
(1) Pre- arcing time (2) Arcing time
(3) Total operating time (4) Dead time

29. Bimetallic thermometer measures temperature in the following range :
(1) 0 to 400°C (2) –40 to 1000 °C (3) 700 to 1500 °C (4) 45 to 500°C

30. Thermistor is a transducer. Its temperature coefficient is :
(1) Negative (2) Positive (3) Zero (4) Infinite

31. If supply to one terminal of three phase core type transformer connected in star-delta fails, assuming magnetic circuit symmetry, voltage on secondary side at no load will be :
(1) 345, 115, 115 (2) 230, 115, 115 (3) 230, 230, 115 (4) 345, 0, 345

32. The windings of a Q kVA, V_1/V_2 volts, three phase delta connected core type transformer are connected to operate as single-phase transformer. The maximum voltage and power rating of new configuration shall be :
(1) V_1/V_2, 3Q (2) $\sqrt{3}\ V_1/V_2$, 2Q (3) V_1/V_2, Q/3 (4) $2\ V_1/V_2$, 2Q/3

33. An effectively grounded system has :
(1) $0 \leq X_0/X_1 \leq 3, R_0/X_1 > 1$ (2) $0 \leq R_0/X_1 \leq 1, X_0/X_1 > 3$
(3) $0 \leq X_0/X_1 \leq 3, 0 \leq R_0/X_1 \leq 1$ (4) $0 \leq X_0/X_1 \leq 1, 0 \leq R_0/X_1 \leq 3$

34. A 50 Hz 220/400, 50 kVA, single-phase transformer operates on 220 V, 40 Hz supply with secondary winding. Then :
(1) The eddy current loss and hysteresis loss of the transformer increases
(2) The eddy current loss and hysteresis loss of the transformer decreases
(3) Hysteresis loss of the transformer increases while eddy current loss remains same
(4) The eddy current loss decreases while hysteresis loss remains same.

35. Which of the following should be the operating value for a relay in radial system according to Indian Standard specifications ?
(1) $\leq 1.2\ I_{setting}$ (2) $\geq 1.3\ I_{setting}$ (3) $\geq 1.5\ I_{setting}$ (4) $\geq 1.73\ I_{setting}$

36. A fuse wire of circular cross-section with 0.8 mm radius blows off at a current of 8 A. What should be the radius of the wire to blow at a current of 1 A ?
(1) 1.6 mm (2) 0.4 mm (3) 0.2 mm (4) 0.1 mm

37. In a biased differential relay the bias is defined as the ratio of :
(1) Fault current and operating current
(2) Operating coil current and restraining coil current
(3) Number of turns of restraining and operating coil
(4) Fault current and restraining coil current

38. Why is it difficult to interrupt a capacitive circuit ?
(1) Current magnitude is very small
(2) The restriking voltage is very high
(3) The current has a leading power factor
(4) None of the above

39. A differential relay measures the vector difference between :
(1) Two currents
(2) Two voltages
(3) Two or more similar electrical quantities
(4) None of the above

40. In an impedance relay, fault current is maximum if fault occurs near the :
(1) Realy
(2) Center of the line
(3) Transformer
(4) None of the above

41. A wound rotor induction motor is preferred over squirrel cage induction motor when the major consideration involved is :
(1) High Starting Torque
(2) Low Starting Torque
(3) Limited range speed control
(4) All of these

42. The shunt resistance component in the equivalent circuit obtained by no-load test of an induction motor, is representative of :
(1) all losses
(2) Windage and friction losses
(3) Core losses
(4) Copper losses

43. a. The rotor of squirrel cage induction motor has short circuited distributed windings on it.

b. The stator of squirrel cage induction motor has concentrated windings on it.
(1) Statement a is true
(2) Statement b is true
(3) Both are true
(4) None is true

44. a. The starting torque of the three phase induction motor is zero and increases linearly.

b. The starting torque of a three phase induction motor can be increased with additional rotor resistance.

(1) Statement a is true
(2) Statement b is true
(3) Both are true
(4) None is true

45. a. The DOL starter is used only for wound rotor type of three phase induction motor.

b. The DOL starter uses only "ON & OFF" switches and does not have any control of starting current.

(1) Statement a is true
(2) Statement b is true
(3) Both are true
(4) None is true

46. a. The three phase induction motor is always operated in the negative Torque-slip characteristic zone.

b. The negative Torque-slip characteristic zone is beyond maximum torque point towards zero slip.

(1) Statement a is true
(2) Statement b is true
(3) Both are true
(4) None is true

47. a. The slip is the difference of synchronous speed and actual speed of the three phase induction motor.

b. The slip is always proportional to torque of the three phase induction motor.

(1) Statement a is true
(2) Statement b is true
(3) Both are true
(4) None is true

48. a. The rotor of a three phase induction motor generates rotating magnetic field at 3000 rpm.

b. The stator of a three phase,. induction motor controls the slip of the rotor.

(1) Statement a is true
(2) Statement b is true
(3) Both are true
(4) None is true

49. a. The efficiency of a three phase induction motor shall be less if the air gap is large.

b. The large air gap shall lead to poor power factor in a three phase induction motor.

(1) Statement a is true
(2) Statement b is true
(3) Both are true
(4) None is true

B

50. a. The synchronous speed of an induction motor is dependent of frequency of voltage supply.
b. The actual speed of the induction motor is dependent on the number of poles of the motor.
(1) Statement a is true
(2) Statement b is true
(3) Both are true
(4) None is true

51. A single diode operates as a :
(1) Capacitor
(2) Bridge Rectifier
(3) Full Wave Rectifier
(4) Half Wave Rectifier

52. The ratio of latching current / holding current in a 20 thyristor shall be :
(1) Less than 1 (2) More than 1 (3) Equal to 1 (4) Any of these

53. If an AC voltage wave is corrupted with an arbitrary number of harmonics, then the overall voltage waveform differs from its fundamental frequency component in terms of :
(1) Only the peak values
(2) Only the RMS values
(3) Only the Average values
(4) All of these

54. The anode current through a conducting SCR is 10A. If its gate current is doubled, then the anode current shall be :
(1) Zero (2) Doubled (3) Halved (4) Same

55. The RMS value of resultant current in a wire which carries a dc current of 10 A and a sinusoidal alternating current of peak value 20 A, is :
(1) 14.1 A (2) 17.3 A (3) 22.4 A (4) 30 A

56. The thyristor circuit that directly converts polyphase AC voltages from one frequency to another frequency is known as :
(1) Cycloconverter
(2) Inverter
(3) Converter
(4) Chopper

57. If a single diode, fed from an AC source, is supplying to a pure inductor, it will conduct for :
(1) 90° (2) 180° (3) 270° (4) 360°

58. A single-phase diode bridge rectifier supplying a highly inductive load with almost ripple free current to the load. The AC side current waveform shall be :
(1) sinusoidal (2) constant DC (3) triangular (4) square

59. Snubber circuit is used to limit the Rate of :
(1) Conduction period (2) Commutation Period
(3) Rise of voltage across device (4) Rise of Current

60. An SCR is considered to be a semi-controlled device because :
(1) It can be turned OFF but not ON by gate pulse
(2) It can be turned ON but not OFF gate pulse
(3) It conducts during only half cycle of AC wave
(4) It can be turned ON during only half cycle of AC wave

61. The Average value of alternating current is representation of equivalent DC value in terms of :
(1) charge transfer (2) heat generation (3) mass transfer (4) voltage generation

62. The power density of a three phase system as compared to a single phase system is :
(1) higher (2) lower (3) equal (4) fluctuating

63. In the blocked rotor test of a three-phase induction motor, the obtained parameters are representative of :
(1) All losses (2) Windage and friction losses
(3) Core losses (4) Copper losses

64. The blocked rotor test of a three-phase induction motor is equivalent to :
(1) Heat run Test (2) No load Test
(3) Open Circuit Test (4) Short Circuit Test

65. The direct on line (DOL) starting in a three phase induction motor is provided for ratings :
(1) above 5 hp (2) above 10 hp (3) up to 5 hp (4) Not at all

66. The star-delta starter is used in a three phase induction motor to provide starting torque at :
(1) increased current (2) reduced current
(3) increased voltage (4) None

67. For high starting torque in a squirrel cage induction motor the rotor is made with provisions of :

(1) Double cage
(2) External resistance
(3) External supply
(4) All of these

68. An induction motor will run at synchronous speed :

(1) At no load
(2) At light load
(3) At rated load
(4) Never

69. An 6 pole three-phase induction motor is running at 900 rpm. What is the speed of rotting magnetic field and rotor slip, respectively :

(1) 3000 rpm, 10%
(2) 1500 rpm, 10%
(3) 1000 rpm, 10%
(4) 1000 rpm, 5%

70. The developed starting torque of an induction motor by an auto-transformer starter with a tapping of 30% is 80 Nm. If the tapping of auto-transformer starter is changed to 60%, then the starting torque shall be :

(1) 40 Nm (2) 160 Nm (3) 240 Nm (4) 320 Nm

71. Which of the following is a desirable characteristic of an instrument ?

(1) High drift
(2) High measuring lag
(3) High fidelity
(4) Poor reproducibility

72. Which of the following in the flue gases going out of the furnace is measured by Zirconia probe ?

(1) Oxygen
(2) Carbon dioxide
(3) Carbon monoxide
(4) Temperature

73. Working principle of mercury in glass thermometer is based on following :

(1) Volumetric expansion
(2) Pressure rise with temperature
(3) Linear expansion
(4) Temperature rise with pressure

74. Gamma rays is used for the measurement of one of the following :

(1) Pressure (2) Temperature (3) Flow (4) Liquid level

75. Which of the following is not a differential pressure flow meter ?

(1) Rota meter (2) Flow nuzzle (3) Venturi meter (4) Orifice meter

76. Which of the following is not a variable area flow meter ?

(1) Rota meter
(2) Piston type meter
(3) Venturi meter
(4) Magnetic flow meter

77. Which one of the following uses the principle of hall effect in its construction ?

(1) Ammeter (2) Voltmeter (3) Galvanometer (4) Gauss meter

78. In automatic generation control the voltage and frequency is controlled by :

(1) Controlling the excitation
(2) Controlling the turbine action
(3) Excitation control for voltage and turbine speed control for frequency
(4) Turbine speed control for voltage and excitation control for frequency

79. Unit up- time in unit commitment problem is :

(1) A unit minimum operating time
(2) A unit minimum repair time
(3) A unit total life time
(4) A unit minimum designing time

80. ACSR conductor having seven steel standard surrounded by 25 aluminium conductor will be specified as :

(1) 7/25 (2) 7/32 (3) 25/7 (4) 25/32

81. Actual tripping of a static relay is obtained by :

(1) IGBTs
(2) Thyristors
(3) UJTs
(4) None of the above

82. By increasing the transmission voltage to double of its original value, the same power can be dispatched keeping the line loss :

(1) Equal to original value
(2) Half the original value
(3) Double the original value
(4) One-fourth of original value

83. For the synchronous generator connected to an infinite bus through a transmission line, how are the change of voltage (ΔV) and change of frequency (Δf) related to the active power (P) and the reactive power (Q) ?

(1) ΔV is proportional to P and Δf to Q
(2) ΔV is proportional to Q and Δf to P
(3) Both ΔV and Δf are proportional to P
(4) Both ΔV and Δf are proportional to Q

84. A lossless coaxial transmission line has a length of 10 cm. Find the lowest resonant frequency if the line is air filled :
(1) 374.5 MHz (2) 474 MHz (3) 581 MHz (4) 749 MHz

85. Which one of the following is valid for short transmission lines in terms of ABCD parameters ?
(1) $B = D = 0$ (2) $C = 0$ (3) $A = B = 1$ (4) $A = C = 1$

86. Two capacitors with capacitances C and 2C are connected in serices. The terminal voltage and energy stored of the series combination are V and Wse respectively. Next the capacitors are connected in parallel. The terminal voltage and energy stored of the parallel combination are V/2 and Wpa respectively. The ratio of Wse/Wpa is :
(1) 16/9 (2) 8/9 (3) 4/9 (4) 2/9

87. The complex electric and magnetic field intensities in an electromagnetic field in terms of real and imaginary parts are $E = (E_a + jE_i)a_x$ and $H = (H_a + jH_i)a_y$ where the quantities are amplitudes. Which of the following expressions gives the real part of the complex pointing vector :
(1) $(E_x(t)H_y(t) - E_Y(t)H_x(t))a_z$ (2) $(E_x(t)H_y(t) + E_y(t)H_x(t))a_z$
(3) $(E_x(t)H_x(t) - E_y(t)H_y(t))a_z$ (4) $(E_x(t)H_x(t) + E_y(t)H_y(t))a_z$

88. Which material is used for indoor bus bar ?
(1) Copper (2) Aluminium (3) Silver (4) Galvanized steel

89. The load sharing between two steam driven alternators operating in parallel may be adjusted by varying the :
(1) Power factor (2) Speed of the alternator
(3) Steam supply to the prime mover (4) None of these

90. Overspeed protection of generator is done by :
(1) Differential relay (2) Over current relay
(3) Alarm (4) Governor

91. The Newton Raphson method is also called as :
(1) Tangent method (2) Secant method
(3) Chord method (4) Diameter method

92. For a given x–y plot, the value of y/x in terms of the angle θ is given by :
(1) Sec θ (2) Tan θ (3) Cot θ (4) Cosec θ

93. Laplace transform of $f(t) = e^{at}$ is :

(1) $s/(s + a)$ (2) $s/(s - a)$ (3) $1/(s + a)$ (4) $1/(s - a)$

94. Laplace transform of the unit step function u(t) :

(1) $1/s^3$ (2) $1/s^2$ (3) $1/s$ (4) 1

95. The Fourier series for $f\{x\} = \sin^2 x$ defined over range of $-\pi \leq x \leq \pi$ is :

(1) $\{\frac{1}{2} - (\text{Sin } 2x)/2\}$ (2) $\{\frac{1}{2} + (\text{Sin } 2x)/2\}$

(3) $\{\frac{1}{2} - (\text{Cos } 2x)/2\}$ (4) $\{\frac{1}{2} + (\text{Cos } 2x)/2\}$

96. The Fourier series expansion of X^3 in the range of $-1 < X < 1$ with periodic continuation has :

(1) Only Cosine Terms (2) Only Sine Terms

(3) Both Sine and Cosine Terms (4) Can't be said

97. Find the wrong one from the following statements :

(1) If A is diagonalizable and invertible, then A^{-1} is diagonalizable.

(2) If A is diagonalizable, then A^T is diagonalizable.

(3) If every eigenvalue of a matrix A has algebraic multiplicity 1, then A is diagonalizable.

(4) An n x n matrix with fewer than n distinct eigenvalues is not diagonalizable.

98. If A and B are square matrices of the same order, then tr(AB) =

(1) tr (BA) (2) tr (A + B) (3) tr (A) + tr (B) (4) tr (A) tr (B)

99. A linear system is called consistent if it has :

(1) At least one solution (2) infinitely solutions

(3) no solutions (4) None of these

100. Following method is used for finding the minima or maxima for a unimodal function :

(1) Exhaustive search (2) Interval halving

(3) Region elimination (4) All of these

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   (3) no solutions (4) None of these

10. Following method is used for finding the minima or maxima for a unimodal function :
(1) Exhaustive search
(2) Interval halving
(3) Region elimination
(4) All of these

11. If supply to one terminal of three phase core type transformer connected in star-delta fails, assuming magnetic circuit symmetry, voltage on secondary side at no load will be :
(1) 345, 115, 115 (2) 230, 115, 115 (3) 230, 230, 115 (4) 345, 0, 345

12. The windings of a Q kVA, V_1/V_2 volts, three phase delta connected core type transformer are connected to operate as single-phase transformer. The maximum voltage and power rating of new configuration shall be :
(1) V_1/V_2, 3Q (2) $\sqrt{3}\ V_1/V_2$, 2Q (3) V_1/V_2, Q/3 (4) $2\ V_1/V_2$, 2Q/3

13. An effectively grounded system has :
(1) $0 \leq X_0/X_1 \leq 3, R_0/X_1 > 1$
(2) $0 \leq R_0/X_1 \leq 1, X_0/X_1 > 3$
(3) $0 \leq X_0/X_1 \leq 3, 0 \leq R_0/X_1 \leq 1$
(4) $0 \leq X_0/X_1 \leq 1, 0 \leq R_0/X_1 \leq 3$

14. A 50 Hz 220/400, 50 kVA, single-phase transformer operates on 220 V, 40 Hz supply with secondary winding. Then :
(1) The eddy current loss and hysteresis loss of the transformer increases
(2) The eddy current loss and hysteresis loss of the transformer decreases
(3) Hysteresis loss of the transformer increases while eddy current loss remains same
(4) The eddy current loss decreases while hysteresis loss remains same.

15. Which of the following should be the operating value for a relay in radial system according to Indian Standard specifications ?
(1) $\leq 1.2\ I_{setting}$ (2) $\geq 1.3\ I_{setting}$ (3) $\geq 1.5\ I_{setting}$ (4) $\geq 1.73\ I_{setting}$

16. A fuse wire of circular cross-section with 0.8 mm radius blows off at a current of 8 A. What should be the radius of the wire to blow at a current of 1 A ?
(1) 1.6 mm (2) 0.4 mm (3) 0.2 mm (4) 0.1 mm

17. In a biased differential relay the bias is defined as the ratio of :
(1) Fault current and operating current
(2) Operating coil current and restraining coil current
(3) Number of turns of restraining and operating coil
(4) Fault current and restraining coil current

18. Why is it difficult to interrupt a capacitive circuit ?
(1) Current magnitude is very small
(2) The restriking voltage is very high
(3) The current has a leading power factor
(4) None of the above

19. A differential relay measures the vector difference between :
(1) Two currents
(2) Two voltages
(3) Two or more similar electrical quantities
(4) None of the above

20. In an impedance relay, fault current is maximum if fault occurs near the :
(1) Realy
(2) Center of the line
(3) Transformer
(4) None of the above

21. Actual tripping of a static relay is obtained by :
(1) IGBTs
(2) Thyristors
(3) UJTs
(4) None of the above

22. By increasing the transmission voltage to double of its original value, the same power can be dispatched keeping the line loss :
(1) Equal to original value
(2) Half the original value
(3) Double the original value
(4) One-fourth of original value

23. For the synchronous generator connected to an infinite bus through a transmission line, how are the change of voltage (ΔV) and change of frequency (Δf) related to the active power (P) and the reactive power (Q) ?
(1) ΔV is proportional to P and Δf to Q
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24. A lossless coaxial transmission line has a length of 10 cm. Find the lowest resonant frequency if the line is air filled :
(1) 374.5 MHz (2) 474 MHz (3) 581 MHz (4) 749 MHz

25. Which one of the following is valid for short transmission lines in terms of ABCD parameters ?
(1) $B = D = 0$ (2) $C = 0$ (3) $A = B = 1$ (4) $A = C = 1$

26. Two capacitors with capacitances C and 2C are connected in serices. The terminal voltage and energy stored of the series combination are V and Wse respectively. Next the capacitors are connected in parallel. The terminal voltage and energy stored of the parallel combination are V/2 and Wpa respectively. The ratio of Wse/Wpa is :

(1) 16/9 (2) 8/9 (3) 4/9 (4) 2/9

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(1) $(E_x(t)H_y(t) - E_Y(t)H_x(t))a_z$ (2) $(E_x(t)H_y(t) + E_y(t)H_x(t))a_z$

(3) $(E_x(t)H_x(t) - E_y(t)H_y(t))a_z$ (4) $(E_x(t)H_x(t) + E_y(t)H_y(t))a_z$

28. Which material is used for indoor bus bar ?

(1) Copper (2) Aluminium (3) Silver (4) Galvanized steel

29. The load sharing between two steam driven alternators operating in parallel may be adjusted by varying the :

(1) Power factor (2) Speed of the alternator

(3) Steam supply to the prime mover (4) None of these

30. Overspeed protection of generator is done by :

(1) Differential relay (2) Over current relay

(3) Alarm (4) Governor

31. An alternator is said to be over excited when it is operating at :

(1) Leading power factor (2) Lagging power factor

(3) Unity power factor (4) None of these

32. In a transformer hysteresis and eddy current losses depend upon :

(1) Load current (2) Supply frequency

(3) Maximum flux density (4) (2) and (3) both

33. Role of power system stabilizer in excitation system is to :

(1) Provide de power to the synchronous machine field winding

(2) Processes and amplifies input current signal

(3) Provide an additional input signal to regulator to damp power system oscillation

(4) Provide an additional input signal to regulator to boost system frequency

34. Resistance switching is normally employed in :
(1) Bulk oil breakers
(2) Minimum oil breakers
(3) SF6 circuit breakers
(4) Air blast circuit breakers

35. The arc voltage in a circuit breaker is :
(1) In the phase with arc current
(2) Lagging the arc current by 90°
(3) Leading the arc current by 90°
(4) Lagging the arc current by 45°

36. A negative sequence relay is commonly used to protect :
(1) Transformers
(2) Transmission lines
(3) Alternators
(4) Bus bar

37. If the fault current is 3000 amps, the relay setting 50% and the C.T. ratio is 400/5, then the plug setting multiplier will be :
(1) 25 amps (2) 15 amps (3) 50 amps (4) 30 amps

38. In a HRC fuse the time between the cut off and the final current zero is called ?
(1) Pre- arcing time
(2) Arcing time
(3) Total operating time
(4) Dead time

39. Bimetallic thermometer measures temperature in the following range :
(1) 0 to 400°C (2) –40 to 1000 °C (3) 700 to 1500 °C (4) 45 to 500°C

40. Thermistor is a transducer. Its temperature coefficient is :
(1) Negative (2) Positive (3) Zero (4) Infinite

41. Which of the following is a desirable characteristic of an instrument ?
(1) High drift
(2) High measuring lag
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(3) Excitation control for voltage and turbine speed control for frequency

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(1) A unit minimum operating time (2) A unit minimum repair time

(3) A unit total life time (4) A unit minimum designing time

50. ACSR conductor having seven steel standard surrounded by 25 aluminium conductor will be specified as :

(1) 7/25 (2) 7/32 (3) 25/7 (4) 25/32

51. In India, which organisation performs the role of Independent System Operator :

(1) CEA (2) PGCIL (3) CERC (4) POSOCO

52. Snubber circuit is used to limit the :

(1) Rise of current (2) Rise of voltage across device

(3) Conduction period (4) Commutation period

53. The dimension of outer conductor are b and c and that of inner conductor is a, the ratio of inner and outer current densities is :

(1) $(c^2 - b^2)/a^2$ (2) $a^2/(c^2 - b^2)$ (3) $(c-b)/a$ (4) $(cb)/a^2$

54. The following statement is correct for uniform plane waves :

(1) The wavelength λ is longer and velocity v is higher in all real media than they are in free space

(2) The wavelength λ is longer and velocity v is lower in all real media than they are in free space

(3) The wavelength λ is shorter and velocity v is higher in all real media than they are in free space

(4) The wavelength λ is shorter and velocity v is lower in all real media than they are in free space

55. A lossless dielectric slab has $\varepsilon_R = 9$. Its intrinsic impedance is :

(1) $360\ \pi\Omega$ (2) $120\ \pi\Omega$ (3) $40\ \pi\Omega$ (4) $30\ \pi\Omega$

56. If $D = 10\ y^2\ a_x + 10\ x^2y\ a_y + 15\ a_z$, the total charge enclosed within the region $0 < x, y, z < 1$m is :

(1) 40/3 C (2) 20/3 C (3) 10/3 C (4) 5/3 C

57. A perfect dielectric medium has a uniform plane wave. Which of the following statements for the wave are correct ?

(1) The electric and magnetic fields are in the same direction

(2) The electric and magnetic fields are perpendicular to each other

(3) The electric and magnetic fields are opposite to each other

(4) The electric and magnetic fields do not occur in the medium

58. The magnetic flux density in the air gap between two iron surfaces is B_g. The force between the iron surfaces at this flux density is F. If the flux density is reduced to (3/4) B_g, the decrease in the force would be :

(1) (3/4) F (2) (7/16) F (3) (1/4) F (4) None of the above

59. In a full-wave controlled rectifier (center tap transformer connection), if ac supply is 230 V, 50 Hz, the PIV required for SCRs shall be :

(1) 230 V (2) 325 V (3) 460 V (4) 650 V

60. In a half-wave rectifier with a shunt capacitance filter, what is the frequency of ac ripple at output, if the frequency of ac supply is 50 Hz.

(1) 25 Hz (2) 50 Hz (3) 100 Hz (4) Zero Hz

61. A single diode operates as a :

(1) Capacitor (2) Bridge Rectifier

(3) Full Wave Rectifier (4) Half Wave Rectifier

62. The ratio of latching current / holding current in a 20 thyristor shall be :

(1) Less than 1 (2) More than 1 (3) Equal to 1 (4) Any of these

63. If an AC voltage wave is corrupted with an arbitrary number of harmonics, then the overall voltage waveform differs from its fundamental frequency component in terms of :

(1) Only the peak values (2) Only the RMS values

(3) Only the Average values (4) All of these

64. The anode current through a conducting SCR is 10A. If its gate current is doubled, then the anode current shall be :

(1) Zero (2) Doubled (3) Halved (4) Same

65. The RMS value of resultant current in a wire which carries a dc current of 10 A and a sinusoidal alternating current of peak value 20 A, is :

(1) 14.1 A (2) 17.3 A (3) 22.4 A (4) 30 A

66. The thyristor circuit that directly converts polyphase AC voltages from one frequency to another frequency is known as :

(1) Cycloconverter (2) Inverter

(3) Converter (4) Chopper

67. If a single diode, fed from an AC source, is supplying to a pure inductor, it will conduct for :

(1) 90° (2) 180° (3) 270° (4) 360°

68. A single-phase diode bridge rectifier supplying a highly inductive load with almost ripple free current to the load. The AC side current waveform shall be :

(1) sinusoidal (2) constant DC (3) triangular (4) square

69. Snubber circuit is used to limit the Rate of :

(1) Conduction period (2) Commutation Period

(3) Rise of voltage across device (4) Rise of Current

70. An SCR is considered to be a semi-controlled device because :
(1) It can be turned OFF but not ON by gate pulse
(2) It can be turned ON but not OFF gate pulse
(3) It conducts during only half cycle of AC wave
(4) It can be turned ON during only half cycle of AC wave

71. In a commutation circuit, satisfactory turn off of an SCR is obtained when :
(1) Circuit turn-off time < Device turn-off time
(2) Circuit time constant < Device turn-off time
(3) Circuit turn-off time > Device turn-off time
(4) Circuit time constant > Device turn-off time

72. Which of the following is not a current triggered device ?
(1) Thyristor (2) GTO (3) Triac (4) MOSFET

73. A switched mode power supply operating at 20 kHz to 100 kHz range uses as main switching element :
(1) Thyristor (2) MOSFET (3) Triac (4) UJT

74. The Triac can be used as :
(1) AC voltage regulator (2) Inverter
(3) Rectifier (4) Multi-quadrant Chopper

75. Which of the following does not cause permanent damage to the SCR ?
(1) High rate of rise of current (2) High current
(3) High rate of rise of voltage (4) High temperature rise

76. Which of the following Flip-flop circuits holds or toggles its output according to the input state ?
(1) T (2) D (3) JK (4) SR

77. Two's complement of 0111 is :
(1) 1000 (2) 1100 (3) 1001 (4) 1010

78. Toggeling all the values of any binary number gives its :
(1) Two's complement (2) One's complement
(3) Bit shifted number (4) None of the above

79. If the inductance L is removed from the load of any circuit, the power drawn as compared to previous case shall be :
(1) less (2) more (3) same (4) can't be said

80. The RMS value of alternating current is representation of equivalent DC value in terms of :
(1) charge transfer (2) heat generation (3) mass transfer (4) voltage generation

81. The Average value of alternating current is representation of equivalent DC value in terms of :
(1) charge transfer (2) heat generation (3) mass transfer (4) voltage generation

82. The power density of a three phase system as compared to a single phase system is :
(1) higher (2) lower (3) equal (4) fluctuating

83. In the blocked rotor test of a three-phase induction motor, the obtained parameters are representative of :
(1) All losses
(2) Windage and friction losses
(3) Core losses
(4) Copper losses

84. The blocked rotor test of a three-phase induction motor is equivalent to :
(1) Heat run Test
(2) No load Test
(3) Open Circuit Test
(4) Short Circuit Test

85. The direct on line (DOL) starting in a three phase induction motor is provided for ratings :
(1) above 5 hp (2) above 10 hp (3) up to 5 hp (4) Not at all

86. The star-delta starter is used in a three phase induction motor to provide starting torque at :
(1) increased current
(2) reduced current
(3) increased voltage
(4) None

87. For high starting torque in a squirrel cage induction motor the rotor is made with provisions of :
(1) Double cage
(2) External resistance
(3) External supply
(4) All of these

88. An induction motor will run at synchronous speed :

(1) At no load (2) At light load (3) At rated load (4) Never

89. An 6 pole three-phase induction motor is running at 900 rpm. What is the speed of rotting magnetic field and rotor slip, respectively :

(1) 3000 rpm, 10% (2) 1500 rpm, 10% (3) 1000 rpm, 10% (4) 1000 rpm, 5%

90. The developed starting torque of an induction motor by an auto-transformer starter with a tapping of 30% is 80 Nm. If the tapping of auto-transformer starter is changed to 60%, then the starting torque shall be :

(1) 40 Nm (2) 160 Nm (3) 240 Nm (4) 320 Nm

91. A wound rotor induction motor is preferred over squirrel cage induction motor when the major consideration involved is :

(1) High Starting Torque (2) Low Starting Torque

(3) Limited range speed control (4) All of these

92. The shunt resistance component in the equivalent circuit obtained by no-load test of an induction motor, is representative of :

(1) all losses (2) Windage and friction losses

(3) Core losses (4) Copper losses

93. a. The rotor of squirrel cage induction motor has short circuited distributed windings on it.

b. The stator of squirrel cage induction motor has concentrated windings on it.

(1) Statement a is true (2) Statement b is true

(3) Both are true (4) None is true

94. a. The starting torque of the three phase induction motor is zero and increases linearly.

b. The starting torque of a three phase induction motor can be increased with additional rotor resistance.

(1) Statement a is true (2) Statement b is true

(3) Both are true (4) None is true

95. a. The DOL starter is used only for wound rotor type of three phase induction motor.
b. The DOL starter uses only "ON & OFF" switches and does not have any control of starting current.
(1) Statement a is true (2) Statement b is true
(3) Both are true (4) None is true

96. a. The three phase induction motor is always operated in the negative Torque-slip characteristic zone.
b. The negative Torque-slip characteristic zone is beyond maximum torque point towards zero slip.
(1) Statement a is true (2) Statement b is true
(3) Both are true (4) None is true

97. a. The slip is the difference of synchronous speed and actual speed of the three phase induction motor.
b. The slip is always proportional to torque of the three phase induction motor.
(1) Statement a is true (2) Statement b is true
(3) Both are true (4) None is true

98. a. The rotor of a three phase induction motor generates rotating magnetic field at 3000 rpm.
b. The stator of a three phase,. induction motor controls the slip of the rotor.
(1) Statement a is true (2) Statement b is true
(3) Both are true (4) None is true

99. a. The efficiency of a three phase induction motor shall be less if the air gap is large.
b. The large air gap shall lead to poor power factor in a three phase induction motor.
(1) Statement a is true (2) Statement b is true
(3) Both are true (4) None is true

100. a. The synchronous speed of an induction motor is dependent of frequency of voltage supply.
b. The actual speed of the induction motor is dependent on the number of poles of the motor.
(1) Statement a is true (2) Statement b is true
(3) Both are true (4) None is true

Total No. of Printed Pages : 13

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C

SET-X

Ph.D-EE-December, 2024
Electrical Engineering

Sr. No. 10023

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name _____

Date of Examination _____

(Signature of the Candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

SEAL

1. ***All questions are compulsory.***
2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There shall be negative marking. A deduction of 0.25 marks shall be there for each wrong answer. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
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(2) 8/9
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21. The Newton Raphson method is also called as :
(1) Tangent method (2) Secant method
(3) Chord method (4) Diameter method

22. For a given x–y plot, the value of y/x in terms of the angle θ is given by :
(1) Sec θ (2) Tan θ (3) Cot θ (4) Cosec θ

23. Laplace transform of $f(t) = e^{at}$ is :
(1) $s/(s+a)$ (2) $s/(s-a)$ (3) $1/(s+a)$ (4) $1/(s-a)$

24. Laplace transform of the unit step function u(t) :
(1) $1/s^3$ (2) $1/s^2$ (3) $1/s$ (4) 1

25. The Fourier series for $f(x) = \sin^2 x$ defined over range of $-\pi \le x \le \pi$ is :
(1) $\{\frac{1}{2} - (\text{Sin } 2x)/2\}$ (2) $\{\frac{1}{2} + (\text{Sin } 2x)/2\}$
(3) $\{\frac{1}{2} - (\text{Cos } 2x)/2\}$ (4) $\{\frac{1}{2} + (\text{Cos } 2x)/2\}$

26. The Fourier series expansion of X^3 in the range of $-1 < X < 1$ with periodic continuation has :
(1) Only Cosine Terms (2) Only Sine Terms
(3) Both Sine and Cosine Terms (4) Can't be said

27. Find the wrong one from the following statements :
(1) If A is diagonalizable and invertible, then A^{-1} is diagonalizable.
(2) If A is diagonalizable, then A^T is diagonalizable.
(3) If every eigenvalue of a matrix A has algebraic multiplicity 1, then A is diagonalizable.
(4) An n x n matrix with fewer than n distinct eigenvalues is not diagonalizable.

28. If A and B are square matrices of the same order, then tr(AB) =
(1) tr (BA) (2) tr (A + B) (3) tr (A) + tr (B) (4) tr (A) tr (B)

29. A linear system is called consistent if it has :
(1) At least one solution (2) infinitely solutions
(3) no solutions (4) None of these

30. Following method is used for finding the minima or maxima for a unimodal function :
(1) Exhaustive search (2) Interval halving
(3) Region elimination (4) All of these

31. A wound rotor induction motor is preferred over squirrel cage induction motor when the major consideration involved is :
(1) High Starting Torque (2) Low Starting Torque
(3) Limited range speed control (4) All of these

32. The shunt resistance component in the equivalent circuit obtained by no-load test of an induction motor, is representative of :
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b. The negative Torque-slip characteristic zone is beyond maximum torque point towards zero slip.

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37. a. The slip is the difference of synchronous speed and actual speed of the three phase induction motor.

b. The slip is always proportional to torque of the three phase induction motor.

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38. a. The rotor of a three phase induction motor generates rotating magnetic field at 3000 rpm.

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b. The large air gap shall lead to poor power factor in a three phase induction motor.

(1) Statement a is true
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(3) Both are true
(4) None is true

40. a. The synchronous speed of an induction motor is dependent of frequency of voltage supply.

b. The actual speed of the induction motor is dependent on the number of poles of the motor.

(1) Statement a is true
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(3) Both are true
(4) None is true

41. A single diode operates as a :

(1) Capacitor
(2) Bridge Rectifier
(3) Full Wave Rectifier
(4) Half Wave Rectifier

42. The ratio of latching current / holding current in a 20 thyristor shall be :

(1) Less than 1 (2) More than 1 (3) Equal to 1 (4) Any of these

43. If an AC voltage wave is corrupted with an arbitrary number of harmonics, then t overall voltage waveform differs from its fundamental frequency component in tern of :
(1) Only the peak values
(2) Only the RMS values
(3) Only the Average values
(4) All of these

44. The anode current through a conducting SCR is 10A. If its gate current is doubled, the the anode current shall be :
(1) Zero
(2) Doubled
(3) Halved
(4) Same

45. The RMS value of resultant current in a wire which carries a dc current of 10 A and a sinusoidal alternating current of peak value 20 A, is :
(1) 14.1 A
(2) 17.3 A
(3) 22.4 A
(4) 30 A

46. The thyristor circuit that directly converts polyphase AC voltages from one frequency to another frequency is known as :
(1) Cycloconverter
(2) Inverter
(3) Converter
(4) Chopper

47. If a single diode, fed from an AC source, is supplying to a pure inductor, it will conduct for :
(1) 90°
(2) 180°
(3) 270°
(4) 360°

48. A single-phase diode bridge rectifier supplying a highly inductive load with almost ripple free current to the load. The AC side current waveform shall be :
(1) sinusoidal
(2) constant DC
(3) triangular
(4) square

49. Snubber circuit is used to limit the Rate of :
(1) Conduction period
(2) Commutation Period
(3) Rise of voltage across device
(4) Rise of Current

50. An SCR is considered to be a semi-controlled device because :
(1) It can be turned OFF but not ON by gate pulse
(2) It can be turned ON but not OFF gate pulse
(3) It conducts during only half cycle of AC wave
(4) It can be turned ON during only half cycle of AC wave

51. An alternator is said to be over excited when it is operating at :
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54. Resistance switching is normally employed in :
(1) Bulk oil breakers (2) Minimum oil breakers
(3) SF6 circuit breakers (4) Air blast circuit breakers

55. The arc voltage in a circuit breaker is :
(1) In the phase with arc current (2) Lagging the arc current by 90°
(3) Leading the arc current by 90° (4) Lagging the arc current by 45°

56. A negative sequence relay is commonly used to protect :
(1) Transformers (2) Transmission lines
(3) Alternators (4) Bus bar

57. If the fault current is 3000 amps, the relay setting 50% and the C.T. ratio is 400/5, then the plug setting multiplier will be :
(1) 25 amps (2) 15 amps
(3) 50 amps (4) 30 amps

58. In a HRC fuse the time between the cut off and the final current zero is called ?
(1) Pre- arcing time (2) Arcing time
(3) Total operating time (4) Dead time

59. Bimetallic thermometer measures temperature in the following range :
(1) 0 to 400°C (2) –40 to 1000 °C (3) 700 to 1500 °C (4) 45 to 500°C

60. Thermistor is a transducer. Its temperature coefficient is :
(1) Negative (2) Positive (3) Zero (4) Infinite

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(1) Circuit turn-off time < Device turn-off time
(2) Circuit time constant < Device turn-off time
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(1) less (2) more (3) same (4) can't be said

70. The RMS value of alternating current is representation of equivalent DC value in terms of :
(1) charge transfer (2) heat generation (3) mass transfer (4) voltage generation

71. The Average value of alternating current is representation of equivalent DC value in terms of :
(1) charge transfer (2) heat generation (3) mass transfer (4) voltage generation

72. The power density of a three phase system as compared to a single phase system is :
(1) higher (2) lower (3) equal (4) fluctuating

73. In the blocked rotor test of a three-phase induction motor, the obtained parameters are representative of :
(1) All losses
(2) Windage and friction losses
(3) Core losses
(4) Copper losses

74. The blocked rotor test of a three-phase induction motor is equivalent to :
(1) Heat run Test
(2) No load Test
(3) Open Circuit Test
(4) Short Circuit Test

75. The direct on line (DOL) starting in a three phase induction motor is provided for ratings :
(1) above 5 hp (2) above 10 hp (3) up to 5 hp (4) Not at all

76. The star-delta starter is used in a three phase induction motor to provide starting torque at :
(1) increased current
(2) reduced current
(3) increased voltage
(4) None

77. For high starting torque in a squirrel cage induction motor the rotor is made with provisions of :
(1) Double cage
(2) External resistance
(3) External supply
(4) All of these

78. An induction motor will run at synchronous speed :
(1) At no load (2) At light load (3) At rated load (4) Never

79. An 6 pole three-phase induction motor is running at 900 rpm. What is the speed of rotting magnetic field and rotor slip, respectively :
(1) 3000 rpm, 10% (2) 1500 rpm, 10% (3) 1000 rpm, 10% (4) 1000 rpm, 5%

80. The developed starting torque of an induction motor by an auto-transformer starter with a tapping of 30% is 80 Nm. If the tapping of auto-transformer starter is changed to 60%, then the starting torque shall be :
(1) 40 Nm (2) 160 Nm (3) 240 Nm (4) 320 Nm

81. If supply to one terminal of three phase core type transformer connected in star-delta fails, assuming magnetic circuit symmetry, voltage on secondary side at no load will be :
(1) 345, 115, 115 (2) 230, 115, 115 (3) 230, 230, 115 (4) 345, 0, 345

82. The windings of a Q kVA, V_1/V_2 volts, three phase delta connected core type transformer are connected to operate as single-phase transformer. The maximum voltage and power rating of new configuration shall be :
(1) V_1/V_2, 3Q (2) $\sqrt{3}\ V_1/V_2$, 2Q (3) V_1/V_2, Q/3 (4) $2\ V_1/V_2$, 2Q/3

83. An effectively grounded system has :
(1) $0 \leq X_0/X_1 \leq 3, R_0/X_1 > 1$
(2) $0 \leq R_0/X_1 \leq 1, X_0/X_1 > 3$
(3) $0 \leq X_0/X_1 \leq 3, 0 \leq R_0/X_1 \leq 1$
(4) $0 \leq X_0/X_1 \leq 1, 0 \leq R_0/X_1 \leq 3$

84. A 50 Hz 220/400, 50 kVA, single-phase transformer operates on 220 V, 40 Hz supply with secondary winding. Then :
(1) The eddy current loss and hysteresis loss of the transformer increases
(2) The eddy current loss and hysteresis loss of the transformer decreases
(3) Hysteresis loss of the transformer increases while eddy current loss remains same
(4) The eddy current loss decreases while hysteresis loss remains same.

85. Which of the following should be the operating value for a relay in radial system according to Indian Standard specifications ?
(1) $\leq 1.2\ I_{setting}$ (2) $\geq 1.3\ I_{setting}$ (3) $\geq 1.5\ I_{setting}$ (4) $\geq 1.73\ I_{setting}$

86. A fuse wire of circular cross-section with 0.8 mm radius blows off at a current of 8 A. What should be the radius of the wire to blow at a current of 1 A ?
(1) 1.6 mm (2) 0.4 mm (3) 0.2 mm (4) 0.1 mm

87. In a biased differential relay the bias is defined as the ratio of :
(1) Fault current and operating current
(2) Operating coil current and restraining coil current
(3) Number of turns of restraining and operating coil
(4) Fault current and restraining coil current

88. Why is it difficult to interrupt a capacitive circuit ?
(1) Current magnitude is very small
(2) The restriking voltage is very high
(3) The current has a leading power factor
(4) None of the above

89. A differential relay measures the vector difference between :
(1) Two currents
(2) Two voltages
(3) Two or more similar electrical quantities
(4) None of the above

90. In an impedance relay, fault current is maximum if fault occurs near the :
(1) Realy
(2) Center of the line
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(4) None of the above

91. In India, which organisation performs the role of Independent System Operator :
(1) CEA (2) PGCIL (3) CERC (4) POSOCO

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(1) Rise of current
(2) Rise of voltage across device
(3) Conduction period
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93. The dimension of outer conductor are b and c and that of inner conductor is a, the ratio of inner and outer current densities is :
(1) $(c^2 - b^2)/a^2$ (2) $a^2/(c^2 - b^2)$ (3) $(c-b)/a$ (4) $(cb)/a^2$

94. The following statement is correct for uniform plane waves :
(1) The wavelength λ is longer and velocity v is higher in all real media than they are in free space
(2) The wavelength λ is longer and velocity v is lower in all real media than they are in free space
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95. A lossless dielectric slab has $\varepsilon_R = 9$. Its intrinsic impedance is :

(1) 360 πΩ (2) 120 πΩ (3) 40 πΩ (4) 30 πΩ

96. If $D = 10\ y^2\ a_x + 10\ x^2y\ a_y + 15\ a_z$, the total charge enclosed within the region $0 < x, y, z < 1$m is :

(1) 40/3 C (2) 20/3 C (3) 10/3 C (4) 5/3 C

97. A perfect dielectric medium has a uniform plane wave. Which of the following statements for the wave are correct ?

(1) The electric and magnetic fields are in the same direction

(2) The electric and magnetic fields are perpendicular to each other

(3) The electric and magnetic fields are opposite to each other

(4) The electric and magnetic fields do not occur in the medium

98. The magnetic flux density in the air gap between two iron surfaces is B_g. The force between the iron surfaces at this flux density is F. If the flux density is reduced to (3/4) B_g, the decrease in the force would be :

(1) (3/4) F (2) (7/16) F (3) (1/4) F (4) None of the above

99. In a full-wave controlled rectifier (center tap transformer connection), if ac supply is 230 V, 50 Hz, the PIV required for SCRs shall be :

(1) 230 V (2) 325 V (3) 460 V (4) 650 V

100. In a half-wave rectifier with a shunt capacitance filter, what is the frequency of ac ripple at output, if the frequency of ac supply is 50 Hz.

(1) 25 Hz (2) 50 Hz (3) 100 Hz (4) Zero Hz

Total No. of Printed Pages : 13

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D

SET-X

Ph.D-EE-December, 2024
Electrical Engineering

Sr. No. 10024

Time : 1¼ Hours | Max. Marks : 100 | Total Questions : 100

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name _____

Date of Examination _____

(Signature of the Candidate) (Signature of the Invigilator)

SEAL

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. ***All questions are compulsory.***
2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There shall be negative marking. A deduction of 0.25 marks shall be there for each wrong answer. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

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(3) SF6 circuit breakers (4) Air blast circuit breakers

45. The arc voltage in a circuit breaker is :
(1) In the phase with arc current (2) Lagging the arc current by 90°
(3) Leading the arc current by 90° (4) Lagging the arc current by 45°

46. A negative sequence relay is commonly used to protect :
(1) Transformers (2) Transmission lines
(3) Alternators (4) Bus bar

47. If the fault current is 3000 amps, the relay setting 50% and the C.T. ratio is 400/5, then the plug setting multiplier will be :
(1) 25 amps (2) 15 amps (3) 50 amps (4) 30 amps

48. In a HRC fuse the time between the cut off and the final current zero is called ?
(1) Pre- arcing time (2) Arcing time
(3) Total operating time (4) Dead time

49. Bimetallic thermometer measures temperature in the following range :
(1) 0 to 400°C (2) –40 to 1000 °C (3) 700 to 1500 °C (4) 45 to 500°C

50. Thermistor is a transducer. Its temperature coefficient is :
(1) Negative (2) Positive (3) Zero (4) Infinite

51. Actual tripping of a static relay is obtained by :
(1) IGBTs (2) Thyristors
(3) UJTs (4) None of the above

52. By increasing the transmission voltage to double of its original value, the same power can be dispatched keeping the line loss :
(1) Equal to original value (2) Half the original value
(3) Double the original value (4) One-fourth of original value

53. For the synchronous generator connected to an infinite bus through a transmission line, how are the change of voltage (ΔV) and change of frequency (Δf) related to the active power (P) and the reactive power (Q) ?
(1) ΔV is proportional to P and Δf to Q (2) ΔV is proportional to Q and Δf to P
(3) Both ΔV and Δf are proportional to P (4) Both ΔV and Δf are proportional to Q

54. A lossless coaxial transmission line has a length of 10 cm. Find the lowest resonant frequency if the line is air filled :
(1) 374.5 MHz (2) 474 MHz (3) 581 MHz (4) 749 MHz

55. Which one of the following is valid for short transmission lines in terms of ABCD parameters ?
(1) $B = D = 0$ (2) $C = 0$ (3) $A = B = 1$ (4) $A = C = 1$

56. Two capacitors with capacitances C and 2C are connected in serices. The terminal voltage and energy stored of the series combination are V and Wse respectively. Next the capacitors are connected in parallel. The terminal voltage and energy stored of the parallel combination are V/2 and Wpa respectively. The ratio of Wse/Wpa is :
(1) 16/9 (2) 8/9 (3) 4/9 (4) 2/9

57. The complex electric and magnetic field intensities in an electromagnetic field in terms of real and imaginary parts are $E = (E_a + jE_i)a_x$ and $H = (H_a + jH_i)a_y$ where the quantities are amplitudes. Which of the following expressions gives the real part of the complex pointing vector :

(1) $(E_x(t)H_y(t) - E_Y(t)H_x(t))a_z$
(2) $(E_x(t)H_y(t) + E_y(t)H_x(t))a_z$
(3) $(E_x(t)H_x(t) - E_y(t)H_y(t))a_z$
(4) $(E_x(t)H_x(t) + E_y(t)H_y(t))a_z$

58. Which material is used for indoor bus bar ?

(1) Copper
(2) Aluminium
(3) Silver
(4) Galvanized steel

59. The load sharing between two steam driven alternators operating in parallel may be adjusted by varying the :

(1) Power factor
(2) Speed of the alternator
(3) Steam supply to the prime mover
(4) None of these

60. Overspeed protection of generator is done by :

(1) Differential relay
(2) Over current relay
(3) Alarm
(4) Governor

61. Which of the following is a desirable characteristic of an instrument ?

(1) High drift
(2) High measuring lag
(3) High fidelity
(4) Poor reproducibility

62. Which of the following in the flue gases going out of the furnace is measured by Zirconia probe ?

(1) Oxygen
(2) Carbon dioxide
(3) Carbon monoxide
(4) Temperature

63. Working principle of mercury in glass thermometer is based on following :

(1) Volumetric expansion
(2) Pressure rise with temperature
(3) Linear expansion
(4) Temperature rise with pressure

64. Gamma rays is used for the measurement of one of the following :

(1) Pressure (2) Temperature (3) Flow (4) Liquid level

65. Which of the following is not a differential pressure flow meter ?

(1) Rota meter (2) Flow nuzzle (3) Venturi meter (4) Orifice meter

66. Which of the following is not a variable area flow meter ?
(1) Rota meter
(2) Piston type meter
(3) Venturi meter
(4) Magnetic flow meter

67. Which one of the following uses the principle of hall effect in its construction ?
(1) Ammeter (2) Voltmeter (3) Galvanometer (4) Gauss meter

68. In automatic generation control the voltage and frequency is controlled by :
(1) Controlling the excitation
(2) Controlling the turbine action
(3) Excitation control for voltage and turbine speed control for frequency
(4) Turbine speed control for voltage and excitation control for frequency

69. Unit up- time in unit commitment problem is :
(1) A unit minimum operating time
(2) A unit minimum repair time
(3) A unit total life time
(4) A unit minimum designing time

70. ACSR conductor having seven steel standard surrounded by 25 aluminium conductor will be specified as :
(1) 7/25 (2) 7/32 (3) 25/7 (4) 25/32

71. A single diode operates as a :
(1) Capacitor
(2) Bridge Rectifier
(3) Full Wave Rectifier
(4) Half Wave Rectifier

72. The ratio of latching current / holding current in a 20 thyristor shall be :
(1) Less than 1 (2) More than 1 (3) Equal to 1 (4) Any of these

73. If an AC voltage wave is corrupted with an arbitrary number of harmonics, then the overall voltage waveform differs from its fundamental frequency component in terms of :
(1) Only the peak values
(2) Only the RMS values
(3) Only the Average values
(4) All of these

74. The anode current through a conducting SCR is 10A. If its gate current is doubled, then the anode current shall be :
(1) Zero (2) Doubled (3) Halved (4) Same

75. The RMS value of resultant current in a wire which carries a dc current of 10 A and a sinusoidal alternating current of peak value 20 A, is :

(1) 14.1 A (2) 17.3 A (3) 22.4 A (4) 30 A

76. The thyristor circuit that directly converts polyphase AC voltages from one frequency to another frequency is known as :

(1) Cycloconverter (2) Inverter

(3) Converter (4) Chopper

77. If a single diode, fed from an AC source, is supplying to a pure inductor, it will conduct for :

(1) 90° (2) 180° (3) 270° (4) 360°

78. A single-phase diode bridge rectifier supplying a highly inductive load with almost ripple free current to the load. The AC side current waveform shall be :

(1) sinusoidal (2) constant DC (3) triangular (4) square

79. Snubber circuit is used to limit the Rate of :

(1) Conduction period (2) Commutation Period

(3) Rise of voltage across device (4) Rise of Current

80. An SCR is considered to be a semi-controlled device because :

(1) It can be turned OFF but not ON by gate pulse

(2) It can be turned ON but not OFF gate pulse

(3) It conducts during only half cycle of AC wave

(4) It can be turned ON during only half cycle of AC wave

81. The Newton Raphson method is also called as :

(1) Tangent method (2) Secant method

(3) Chord method (4) Diameter method

82. For a given x–y plot, the value of y/x in terms of the angle θ is given by :

(1) Sec θ (2) Tan θ (3) Cot θ (4) Cosec θ

83. Laplace transform of $f(t) = e^{at}$ is :

(1) $s/(s + a)$ (2) $s/(s - a)$ (3) $1/(s + a)$ (4) $1/(s - a)$

84. Laplace transform of the unit step function u(t) :

(1) $1/s^3$ (2) $1/s^2$ (3) $1/s$ (4) 1

85. The Fourier series for $f\{x\} = \sin^2 x$ defined over range of $-\pi \leq x \leq \pi$ is :

(1) $\{\frac{1}{2} - (\text{Sin } 2x)/2\}$ (2) $\{\frac{1}{2} + (\text{Sin } 2x)/2\}$

(3) $\{\frac{1}{2} - (\text{Cos } 2x)/2\}$ (4) $\{\frac{1}{2} + (\text{Cos } 2x)/2\}$

86. The Fourier series expansion of X^3 in the range of $-1 < X < 1$ with periodic continuation has :

(1) Only Cosine Terms (2) Only Sine Terms

(3) Both Sine and Cosine Terms (4) Can't be said

87. Find the wrong one from the following statements :

(1) If A is diagonalizable and invertible, then A^{-1} is diagonalizable.

(2) If A is diagonalizable, then A^T is diagonalizable.

(3) If every eigenvalue of a matrix A has algebraic multiplicity 1, then A is diagonalizable.

(4) An n x n matrix with fewer than n distinct eigenvalues is not diagonalizable.

88. If A and B are square matrices of the same order, then tr(AB) =

(1) tr (BA) (2) tr (A + B) (3) tr (A) + tr (B) (4) tr (A) tr (B)

89. A linear system is called consistent if it has :

(1) At least one solution (2) infinitely solutions

(3) no solutions (4) None of these

90. Following method is used for finding the minima or maxima for a unimodal function :

(1) Exhaustive search (2) Interval halving

(3) Region elimination (4) All of these

91. The Average value of alternating current is representation of equivalent DC value in terms of :

(1) charge transfer (2) heat generation (3) mass transfer (4) voltage generation

92. The power density of a three phase system as compared to a single phase system is :

(1) higher (2) lower (3) equal (4) fluctuating

93. In the blocked rotor test of a three-phase induction motor, the obtained parameters are representative of :
(1) All losses
(2) Windage and friction losses
(3) Core losses
(4) Copper losses

94. The blocked rotor test of a three-phase induction motor is equivalent to :
(1) Heat run Test
(2) No load Test
(3) Open Circuit Test
(4) Short Circuit Test

95. The direct on line (DOL) starting in a three phase induction motor is provided for ratings :
(1) above 5 hp (2) above 10 hp (3) up to 5 hp (4) Not at all

96. The star-delta starter is used in a three phase induction motor to provide starting torque at :
(1) increased current
(2) reduced current
(3) increased voltage
(4) None

97. For high starting torque in a squirrel cage induction motor the rotor is made with provisions of :
(1) Double cage
(2) External resistance
(3) External supply
(4) All of these

98. An induction motor will run at synchronous speed :
(1) At no load (2) At light load (3) At rated load (4) Never

99. An 6 pole three-phase induction motor is running at 900 rpm. What is the speed of rotting magnetic field and rotor slip, respectively :
(1) 3000 rpm, 10% (2) 1500 rpm, 10% (3) 1000 rpm, 10% (4) 1000 rpm, 5%

100. The developed starting torque of an induction motor by an auto-transformer starter with a tapping of 30% is 80 Nm. If the tapping of auto-transformer starter is changed to 60%, then the starting torque shall be :
(1) 40 Nm (2) 160 Nm (3) 240 Nm (4) 320 Nm

Answer keys of PH.D (ELECTRICAL ENGG.)-UIET entrance exam dated 05.12.2024				
Q. NO.	A	B	C	D
1	1	3	3	2
2	2	4	1	1
3	4	2	1	3
4	3	1	4	3
5	3	3	1	2
6	2	1	4	3
7	4	3	4	3
8	1	2	3	2
9	1	2	1	3
10	4	2	3	1
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46	4	3	1	3
47	4	1	3	2
48	3	4	4	2
49	1	3	3	1
50	3	1	2	1

05.12.24

Answer keys of PH.D (ELECTRICAL ENGG.)-UIET entrance exam dated 05.12.2024				
Q. NO.	A	B	C	D
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95	2	3	3	3
96	3	2	3	2
97	1	4	2	1
98	4	1	2	4
99	3	1	4	3
100	1	4	2	4

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