Question Booklet Series

A

Electrical Engineering

CODE :- 08

Time Allowed: Two Hours

Marks: 100

Name:- _____ Roll No. _____

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4. There are FOUR options to each question. Darken only one to which you think is the right answer. There will be no Negative Marking.
5. Answer Sheets will be collected after the completion of examination and no candidate shall be allowed to leave the examination hall earlier.
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SEAL

1. A polynomial $f(x) = a_4x^4+a_3x^3+a_2x^2+a_1x - a_0$ with all coefficients positive has:
   (A) no real roots
   (B) no negative real root
   (C) odd number of real roots
   (D) at least one positive and one negative real root

2. The value of the integral $\oint_c \frac{-3Z+4}{Z^2+4z+5}\,dz$, where c is the circle $|z| = 1$ is given by:
   (A) 0 (B) $\frac{1}{10}$ (C) $\frac{4}{5}$ (D) 1

3. The steady-state error of a feedback control system with an acceleration input becomes finite in a
   (A) type 0 system. (B) type 1 system.
   (C) type 2 system. (D) type 3 system.

4. The impulse response of a LTI system is a unit step function, then the corresponding transfer function is
   (A) 1/s (B) $1/s^2$ (C) 1 (D) S

5. Given a unity feedback control system with $G(s) = \frac{K}{S(S+4)}$ the value of K for a damping ratio of 0.5 is
   (A) 1 (B) 16 (C) 32 (D) 64

6. If the transfer function of a first-order system is $G(s) = \frac{10}{1+2S}$ then the time constant of the system is
   (A) 10 (B) 1/10 (C) 2 (D) 1/2

7. A good control system has all the following features except
   (A) good stability (B) slow response
   (C) good accuracy (D) sufficient power handling capacity

8. Which of the following is the best method for determining the stability and transient response?
   (A) Root locus (B) Bode plot
   (C) Nyquist plot (D) None of the above

9. Addition of zeros in transfer function causes which of the following ?
   (A) Lead-compensation (B) Lag-compensation
   (C) Lead-lag compensation (D) None of the above

10. The control system design specification for a chemical process is described as short settling time, improved damping and zero steady state error. What control do we choose?
   (A) P (B) PI (C) ID (D) PID

11. When a system's frequency response crosses the –1 point
   (A) the Gain Margin is 1 dB (B) the Gain Margin is ∞
   (C) the Phase Margin is zero (D) the Phase Margin is 180^o

12. The Laplace transform of e^{-2t} Sin2ωt is :
   (A) $\frac{2s}{(s+2)^2+2\omega^2}$ (B) $\frac{2\omega}{(s-2)^2+4\omega^2}$
   (C) $\frac{2\omega}{(s+2)^2+4\omega^2}$ (D) $\frac{2s}{(s+2)^2-2\omega^2}$

13. The fourier transform of a continuous time signal $X(t) = \exp(-a|t|)$, $a > 0$ is

(A) $\frac{-a}{a^2+\omega^2}$ (B) $\frac{2a}{a^2+\omega^2}$

(C) $\frac{1}{a^2+\omega^2}$ (D) $\frac{-1}{a^2+\omega^2}$

14. Maxwell's equations involve_____.

(A) Charge density (B) Current density

(C) Magnetic intensity (D) All of these

15. Electric Potential Energy V is given by the expression:

(A) $\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{R^2}$ (B) $\frac{1}{4\pi\varepsilon_0}\frac{R^2}{q_1q_2}$

(C) $\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{R}$ (D) $\frac{1}{4\pi\varepsilon_0}\frac{R}{q_1q_2}$

16. Which of the following is a low-gain antenna?

(A) Dish antenna on a space craft (B) Wi-Fi antenna

(C) Both (A) and (B) (D) None of the above

17. Magnetic vector potential for volume current is expressed as

(A) $\int_s \frac{\mu_0 JdV}{4\pi r}$

(B) $\int_s \frac{\mu_0 JdV}{4\pi r^2}$

(C) $\int_s \frac{\mu_0 JdV}{2\pi r}$

(D) $\int_s \frac{\mu_0 JdV}{2\pi r^2}$

18. For a good dielectric medium_____.

(A) $\frac{\sigma}{\omega\varepsilon} = 0$ (B) $\frac{\sigma}{\omega\varepsilon} << 1$

(C) $\frac{\sigma}{\omega\varepsilon} >> 1$ (D) $\frac{\sigma}{\omega\varepsilon} = \infty$

19. Gold and silver are

(A) dielectric materials (B) low resistivity conducting materials

(C) magnetic materials (D) insulating materials

20. Hall effect may be used for which of the following

(A) determining whether the semiconductor is p or n type

(B) determining the carrier concentration

(C) calculating the mobility

(D) All the above

21. The property due to which the resistance of some metal or compound vanishes under certain conditions is known as
(A) Semi conductivity. (B) Magnetostriction.
(C) Curie point. (D) Super conductivity.

22. A 32 to 1 multiplexer has the following features.
(A) 32 inputs, one output and 5 control signals
(B) 32 outputs, one input and 5 control signals
(C) 5 inputs, one control signal and 32 outputs
(D) 5 inputs 32 control signals and one output

23. What J-K input condition will always set 'Q' upon the occurrence of the active clock transition?
(A) J = 0, K = 0 (B) J = 1, K = 1
(C) J = 1, K = 0 (D) J = 0, K = 1

24. How many comparators would a 12-bit flash ADC require?
(A) 4095 (B) 3095 (C) 4000 (D) 2512

25. The number of states in its counting sequence that a ring counter consisting of 'n' flip-flop scan have is
(A) $2^n - 1$ (B) 2^{n-1} (C) n (D) 2^{n+1}

26. In a sample and hold circuit the following statement is false:
(A) Sample time is much smaller than hold time.
(B) Aperture time is the delay between the time that the pulse is applied to the switch and the actual time the switch closes.
(C) Acquisition time is the time it takes for the capacitor to charge from one voltage to another voltage.
(D) The voltage across the hold capacitor changes by 50% during hold time.

27. The fastest switching logic family is
(A) CMOS (B) TTL (C) DTL (D) ECL

28. A bridge rectifier provides 50mA current at 150V, the average current and PIV rating of each diode, respectively are:
(A) 79mA, 167V (B) 25mA, 236V
(C) 12.5mA, 167V (D) 25mA, 120V

29. A dc power supply has a no-load voltage of 30V, and a full load voltage of 25V at a full load current of 1A. Its output resistance and load regulation respectively are:
(A) 5Ω, 20% (B) 25Ω, 20%
(C) 5 Ω, 16.7% (D) 25 Ω, 16.7%

30. Compared to bipolar transistor, a JFET has
(A) lower input impedance
(B) higher voltage gain
(C) higher input impedance and high voltage gain
(D) higher input impedance and low voltage gain

31. Input impedance of MOSSFET is
(A) less than of FET but more than BJT
(B) more than that of FET and BJT
(C) more than that of FET but less than BJT
(D) less than that of FET and BJT

32. A 3 x 8 decoder with two enable inputs is to be used to address 8 blocks of memory. What will be the size of each memory block when addressed from a sixteen bit bus with two MSBs used to enable the decoder
(A) 2K (B) 4K (C) 16K (D) 64K

33. The decimal value for the BCD coded number 00010010 is
(A) 6 (B) 10 (C) 12 (D) 18

34. In a DMA write operation the data is transferred
(A) from I/O to memory.
(B) from memory to I/O.
(C) from memory to memory.
(D) from I/O to I/O.

35. Pseudo instructions are basically
(A) false instructions.
(B) instructions that are ignored by the microprocessor.
(C) assembler directives.
(D) instructions that are treated like comments.

36. For attenuation of high frequencies we should use
(A) Shunt Capacitance
(B) Series Capacitance
(C) Inductance
(D) Resistance

37. A 400 W carrier is amplitude modulated with $m = 0.75$. The total power in AM is
(A) 400 (B) 588 (C) 650 (D) 512

38. A 1000 kHz carrier is simultaneously modulated with 300 Hz, 800 Hz and 2 kHz audio sine waves. Which of the following frequency is least likely to be present in the output?
(A) 1002 (B) 1000 (C) 998.2 (D) 998.8

39. Push pull amplifier is
(A) Voltage amplifier
(B) Current amplifier
(C) Power amplifier
(D) None of the above

40. In an FM system, when the AF is 500 Hz and the AF voltage is 2.4 V, the deviation is 4.8 kHz. If the AF voltage is now increased to 7.2 V, the new deviation will be:
(A) 4.8kHz (B) 14.4kHz (C) 28.8kHz (D) 9.6kHz

41. In phase controlled rectification power factor (PF)
(A) Remains unaffected
(B) Improves with increase of firing angle α
(C) Deteriorates with increase of α
(D) Is unrelated to α

42. Snubber circuit is used to limit the rate of
(A) Rise of current across SCR
(B) Conduction period
(C) Rise of voltage across SCR
(D) None of the above

43. While working in series operation, equalising circuits are added across each SCR to provide uniform
(A) Voltage distribution
(B) Firing of SCRs
(C) Current distribution
(D) None of the above

44. During forward blocking state, the SCR has
(A) Low current, medium voltage
(B) Low current, large voltage
(C) Medium current, large voltage
(D) Large current, low voltage

45. A three-phase, fully controlled thyristor bridge converter is used as line commutated inverter to feed 50 kW power 420 V dc to a three-phase, 415V(line), 50 Hz ac mains. Consider dc link current to be constant. The rms current of the thyristor is
(A) 119.05A
(B) 79.37A
(C) 39.68A
(D) 68.73A

46. When the firing angle α of a single phase fully controlled rectifier feeding constant dc current into a load is 30° , the displacement power factor (DSF) of the rectifier is:
(A) 1 (B) 0.5 (C) 0.866 (D) 1/3

47. AC-to-DC circulating current dual converters are operated with the following relationship between their triggering angles (α_1 and α_2)
(A) $\alpha_1+\alpha_2=180^{\circ}$
(B) $\alpha_1+\alpha_2=360^{\circ}$
(C) $\alpha_1-\alpha_2=180^{\circ}$
(D) $\alpha_1+\alpha_2=90^{\circ}$

48. Expression of average output voltage(V_o) of a step up chopper in terms of applied input dc voltage V_i and duty cycle α is:
(A) $\frac{V_i}{\alpha}$ (B) $\frac{V_i}{1+\alpha}$ (C) $\frac{V_i}{1-\alpha}$ (D) αV_i

49. What is the condition to be satisfied (for under damping) in the selection of L and C in a series inverter?
(A) $R^2<\frac{2L}{C}$ (B) $R^2>\frac{4L}{C}$ (C) $R^2=\frac{4L}{C}$ (D) $R^2<\frac{4L}{C}$

50. The consideration involved in the selection of the type of electric drive for a particular application depends on
(A) Speed control range and its nature
(B) Starting torque
(C) Environmental conditions
(D) All of the above.

51. When quick speed reversal is a consideration, the motor preferred is
(A) dc motor
(B) squirrel cage induction motor
(C) wound rotor induction motor
(D) Synchronous motor

52. Average output voltage(V_o) in terms of maximum input voltage (V_m) of a Half Controlled Bridge converter at firing angle $\alpha = 90^o$ is:
(A) $2V_m / \pi$ (B) V_m / π (C) $\sqrt{2}V_m / \pi$ (D) 0

53. The speed of a D.C. shunt motor more than its full-load speed can be obtained by
(A) decreasing the field current (B) increasing the field current
(C) decreasing the armature current (D) increasing the armature current

54. In squirrel cage induction motors, the rotor slots are usually given slight skew in order to reduce
(A) windage losses (B) eddy currents
(C) accumulation of dirt and dust (D) magnetic hum

55. A 3-phase 440 V, 50 Hz induction motor has 4% slip. The frequency of rotor e.m.f. will be
(A) 200 Hz (B) 50 Hz (C) 2 Hz (D) 0.2 Hz

56. In a three-phase induction motor, the number of poles in the rotor winding are always
(A) zero
(B) more than the number of poles in stator
(C) less than number of poles in stator
(D) equal to number of poles in stator

57. A single-phase induction motor is
(A) inherently self-starting with high torque
(B) inherently self-starting with low torque
(C) inherently non-self-starting
(D) none of the above

58. Which of the following single phase motors will operate at high power factor ?
(A) Shaped pole motor (B) Split phase motor
(C) Capacitor start motor (D) Capacitor run motor

59. The X : R ratio of 220 kV line as compared to 400 kV line is
(A) greater (B) smaller
(C) equal (D) it could be anything

60. The corona loss on a particular system at 50 Hz is 1 kW/phase /km. The corona loss on the same system with supply frequency 25 Hz will be
(A) 1 kW/phase/km (B) 0.5 kW/phase/km
(C) 0.667 kW/phase/km (D) None of the above

61. The main criterion for selection of the size of distribution for a radial distribution system is :
(A) voltage drop (B) corona loss
(C) temperature rise (D) capital cost

62. If an induction machine is run at above synchronous speed, it acts as
(A) a synchronous motor (B) an indcution generator
(C) an inductor motor (D) None of the above

63. The non-uniform distribution of voltage across the units in a string of suspension type insulators is due to
(A) unequal self-capacitance of the units
(B) non-uniform distance of separation of the units from the tower body
(C) the existence of stray capacitance between the metallic junctions of the units and the tower body
(D) non-uniform distance between the cross-arm and the units

64. An alternator has a phase sequence of **RYB** for its phase voltage. In case the direction of rotation of alternator is reversed, the phase sequence will become
(A) RBY (B) RYB (C) YRB (D) BRY

65. An alternator is said to be over excited when it is operating at
(A) unity power factor (B) leading power factor
(C) lagging power factor (D) none of the above

66. Which of the following contributes to the improvement of efficiency of Rankine cycle in a thermal power plant ?
(A) Reheating of steam at intermediate stage
(B) Regeneration use of steam for heating boiler feed water
(C) Use of high pressures
(D) All of the above.

67. Zero sequence currents doesn't exist in the following fault
(A) L-G (B) L-L (C) L-L-G (D) L-L-L-G

68. Insulators in EHV lines are designed based on
(A) switching voltages (B) peak voltages
(C) corona (D) lightning voltages

69. Which special type of motor has rotor movements in discrete steps
(A) stepper motor (B) reluctance motor
(C) hysteresis motor (D) servomotors

70. A 550 V, 55 kVA single phase alternator having effective resistance of 0.2 Ω. A field current of 200A on short circuit end and an emf of 400 V on open circuit. The synchronous impedance will be
(A) 4.25 Ω (B) 3.25 Ω (C) 2.14 Ω (D) 2.25 Ω

71. Three 6 Ω resistors are connected to form a triangle. What is the resistance between any two corners ?
(A) 3/2 Ω (B) 6 Ω (C) 4 Ω (D) 8/3 Ω

72. With three resistances connected in parallel, if each dissipates 20 W the total power supplied by the voltage source equals
(A) 10 W (B) 20 W (C) 40 W (D) 60 W

73. "In any linear bilateral network, if a source of e.m.f. E in any branch produces a current I in any other branch, then same e.m.f. acting in the second branch would produce the same current in the first branch". **The statement is associated with:-**

(A) compensation theorem
(B) superposition theorem
(C) reciprocity theorem
(D) Millman's theorem

74. In Thevenin's theorem, to find Z_{th}

(A) all independent current sources are short circuited and independent voltage sources are open circuited.
(B) all independent voltage and current sources are open circuited.
(C) all independent voltage and current sources are short circuited.
(D) all independent voltage sources are short circuited and all independent current sources are open circuited.

75. In a DC circuit the Thevenin voltage across load is 15V and Norton current is 3A. The maximum amount of power that can be transferred to the load is:

(A) 30.25W (B) 45W (C) 11.25W (D) 22.5W

76. Zero input response of a circuit is:

(A) The response when time t=0
(B) The response when initial conditions are zero
(C) The response when applied input is zero
(D) The response when transients are zero

77. A series RC circuit has R = 5Ω and C = 2.5μF, the time constant of the circuit is

(A) 12.5μsec.
(B) 0.5μsec.
(C) $2x10^{6}$sec.
(D) 2.5μsec.

78. A dynamometer wattmeter can be used for

(A) AC measurement only
(B) Both AC & DC measurement
(C) DC measurement only
(D) None of the above

79. In a 3-phase power measurement by two wattmeter method, both the watt meters had identical readings. The power factor of the load is:

(A) 0.8 lagging
(B) 0.8 leading
(C) Zero
(D) Unity

80. For measuring a very high resistance we should use

(A) Kelvin's double bridge
(B) Wheat stone bridge
(C) Meggar
(D) None of the above

81. Various adjustments in an energy meter include

(A) lag and creep
(B) overload and voltage compensation
(C) temperature compensation
(D) All of the above

82. De Sauty's bridge best suited for

(A) capacitors with dielectric loss
(B) lossless air capacitors
(C) high Q
(D) low Q

83. In an Anderson bridge, the unknown inductance is measured in terms of
(A) known inductance and resistance (B) known capacitance and resistance
(C) known resistance (D) known inductance

84. If an instrument has cramped scale for larger values, then it follows
(A) logarithmic law (B) square law
(C) uniform law (D) None of the above

85. If 25 W of power are applied to the primary of an ideal transformer with a turns ratio of 10, the power delivered to the secondary load is
(A) 250W (B) 2.5W (C) 25W (D) 0W

86. In a certain loaded transformer, the secondary voltage is one-fourth the primary voltage. The secondary current is
(A) one-fourth the primary current (B) four times the primary current
(C) sixteen times the primary current (D) two times the primary current

87. The path of magnetic flux in a transformer should have
(A) high reluctance (B) high resistance
(C) low resistance (D) low reluctance

88. No-load current in a transformer
(A) lags behind the applied voltage by about 75^{o}
(B) leads the applied voltage by about 75^{o}
(C) lags behind the applied voltage by about 15^{o}
(D) leads the applied voltage by about 15^{o}

89. A buchholz relay can be installed on
(A) Auto transformer (B) air cooled transformer
(C) welding transformers (D) oil cooled transformer

90. A transformer can have zero voltage regulation at
(A) leading power factor (B) unity power factor
(C) lagging power factor (D) zero power factor

91. In a Delta -Delta connected transformer, if one of the transformer winding is open, the capacity will reduce to:
(A) 66.67% (B) 57.74% (C) 50% (D) 33.33%

92. Scott connections are used for:
(A) Single phase to three phase transformation
(B) Three phase to single phase transformation
(C) Three phase to two phase transformation
(D) None of the above

93. The excessive temperature rise in the Transformer causes maximum damage to:
(A) Winding insulation (B) Core laminations
(C) Copper wining (D) Dielectric strength of the oil

94. The Power- factor at resonance in R-L-C circuit is
(A) zero
(B) unity
(C) 0.5 lagging
(D) 0.5 leading

95. Which of the following will improve the mutual coupling between primary and secondary circuits:
(A) Transformer oil of high breakdown voltage
(B) High reluctance magnetic core
(C) Winding material of high resistivity
(D) Low reluctance magnetic core

96. A control system with excessive noise, is likely to suffer from
(A) saturation in amplifying stages
(B) loss of gain
(C) vibrations
(D) oscillations

97. Which of the following methods is used to control speed of 25 kV, 50 Hz single phase traction?
(A) Reduced current method
(B) Tap changing control of transformer
(C) Series parallel operation of motors
(D) All of the above

98. Induction type single phase energy meters measure electric energy in
(A) kW
(B) VA
(C) kWh
(D) VAR

99. In majority of instruments damping is provided by
(A) fluid friction
(B) spring
(C) eddy currents
(D) None of the above

100. A network that does not have either voltage or current sources is called
(A) Active network
(B) Passive network
(C) Resistive network
(D) Dummy network