1. Which one of the following statements is true for all real symmetric matrices?
   (A) All the eigenvalues are real
   (B) All the eigenvalues are positive
   (C) All the eigenvalues are distinct
   (D) Sum of all the eigenvalues is zero

2. $[A]$ is a square matrix which is neither symmetric nor skew-symmetric and $[A]^T$ is its transpose. The sum and difference of these matrices are defined as $[S]=[A]+[A]^T$ and $[D]=[A]-[A]^T$, respectively. Which of the following statements is true?
   (A) both $[S]$ and $[D]$ are symmetric
   (B) both $[S]$ and $[D]$ are skew –symmetric
   (C) $[S]$ is skew-symmetric and $[D]$ is symmetric
   (D) $[S]$ is symmetric and $[D]$ is skew-symmetric

3. The product of matrices $(PQ)^{-1}P$ is
   (A) P^{-1}
   (B) Q^{-1}
   (C) $P^{-1}Q^{-1}P$
   (D) PQP^{-1}

4. A square matrix B is skew-symmetric if
   (A) $B^T=-B$
   (B) $B^T=B$
   (C) $B^{-1}=B$
   (D) $B^{-1}=B^T$

5. For the set of equations $x_1+2x_2+x_3+4x_4=2$; $3x_1+6x_2+3x_3+12x_4=6$
   (A) Only the trivial solution $x_1=x_2=x_3=x_4=0$ exists
   (B) There are no solutions
   (C) A unique non-trivial solution exists
   (D) Multiple non-trivial solutions exist

6. All the four entries of the 2 × 2 matrix $P = \begin{bmatrix} P_{11} & P_{12} \\ P_{21} & P_{22} \end{bmatrix}$ are nonzero, and one of its eigenvalues is zero. Which of the following statements is true?

(A) $P_{11}P_{22} - P_{12}P_{21} = 1$

(B) $P_{11}P_{22} - P_{12}P_{12} = 1$

(C) $P_{11}P_{22} - P_{12}P_{21} = 0$

(D) $P_{11}P_{22} + P_{12}P_{21} = 0$

7. As x is increased from $-\infty$ to ∞, the function $f(x) = \dfrac{e^x}{1+e^x}$

(A) Monotonically increases

(B) Monotonically decreases

(C) Increases to a maximum value and then decreases

(D) Decreases to a minimum value and then increases

8. The function $f(x) = |x+1|$ on the interval [–2, 0]

(A) Continuous and differentiable

(B) Continuous on the interval but not differentiable at all points

(C) Neither continuous nor differentiable

(D) Differentiable but not continuous

9. The $\lim\limits_{x\to 1} \dfrac{x^2-1}{x-1}$ is

(A) ∞

(B) 0

(C) 2

(D) 1

10. The $\lim\limits_{x\to 0} \dfrac{\sin\left(\frac{2}{3}x\right)}{x}$ is

(A) 2/3

(B) 1

(C) 3/2

(D) ∞

11. Which one of the following function is strictly bounded?

(A) $1/x^2$

(B) e^x

(C) x^2

(D) e^{-x^2}

12. If $z = f(x,y)$, dz is equal to

(A) $(\partial f/\partial x)dx + (\partial f/\partial y)dy$

(B) $(\partial f/\partial y)dx + (\partial f/\partial x)dy$

(C) $(\partial f/\partial x)dx - (\partial f/\partial y)dy$

(D) $(\partial f/\partial y)dx - (\partial f/\partial x)dy$

13. The minimum value of function $y = x^2$ in the interval [1, 5] is

(A) 0

(B) 1

(C) 25

(D) Undefined

14. Given $y = x^2 + 2x + 10$, the value of $\left.\frac{dy}{dx}\right|_{x=1}$ is equal to

(A) 0

(B) 4

(C) 12

(D) 13

15. Stokes theorem connects

(A) A line integral and a surface integral

(B) A surface integral and a volume integral

(C) A line integral and a volume integral

(D) Gradient of a function and its surface integral

16. The order of the differential equation $\frac{d^2y}{dt^2}+\left(\frac{dy}{dt}\right)^3+y^4+2=e^{-t}$ is

(A) 1

(B) 2

(C) 3

(D) 4

17. $\frac{d^2y}{dx^2}+\left(x^2+4x\right)\frac{dy}{dx}+y=x^8-8$

The above equation is a

(A) Partial differential equation

(B) Nonlinear differential equation

(C) Non-homogeneous differential equation

(D) Ordinary differential equation

18. A regression model is used to express a variable Y as a function of another variable X. This implies that

(A) There is a causal relationship between Y and X

(B) A value of X may be used to estimate a value of Y

(C) Values of X exactly determine values of Y

(D) There is no causal relationship between Y and X

19. Two coins are simultaneously tossed. The probability of two heads simultaneously appearing is

(A) 1/8

(B) 1/6

(C) 1/4

(D) 1/2

20. Given that $F(s)$ is the one-sided Laplace transform of $f(t)$, the Laplace transform of $\int_0^t f(\tau)d\tau$ is

(A) $sF(s)-f(0)$

(B) $\frac{1}{2}F(s)$

(C) $\int_0^t f(\tau)d\tau$

(D) $\frac{1}{2}[F(s)-f(0)]$

21. Laplace transform for the function $f(x)=\cosh(ax)$ is

(A) $\frac{a}{s^2-a^2}$

(B) $\frac{s}{s^2-a^2}$

(C) $\frac{a}{s^2+a^2}$

(D) $\frac{s}{s^2+a^2}$

22. Let $Y(s)$ be the Laplace transformation of the function $y(t)$, then final value of the function is

(A) $\lim_{s\to 0} Y(s)$

(B) $\lim_{s\to \infty} Y(s)$

(C) $\lim_{s\to 0} sY(s)$

(D) $\lim_{s\to \infty} sY(s)$

23. The defect that occurs due to a displacement of an ion is known as

(A) Vacancy defect

(B) Schottky defect

(C) Frankel defect

(D) Interstitial defect

24. By increasing impurity content in the metal alloy, the residual resistivity always

(A) Decreases

(B) Increases

(C) Remains constant

(D) Becomes temperature independent

25. Porcelain is a type of ———————— ceramic.

(A) Whiteware

(B) Stone
(C) Abrasive
(D) Cement

26. What is the other name of Polymer Insulator?
(A) Moisture insulator
(B) Core insulator
(C) Composite insulator
(D) Mixed insulator

27. Which of the following is a diamagnetic material?
(A) Sodium
(B) Calcium
(C) Oxygen (at STP)
(D) Nitrogen (at STP)

28. Which of the following conditions are desired in the core of an electromagnet?
(A) High permeability and High retentivity
(B) Low permeability and High retentivity
(C) High permeability and Low retentivity
(D) Low permeability and Low retentivity

29. Which property of nanoparticles provides a driving force for diffusion?
(A) Optical Properties
(B) High surface area to volume ratio
(C) Sintering
(D) There is no such property

30. The phenomena of super conductors was first discovered by
(A) Kammerlingh Onnes
(B) Neils Bohr
(C) Richard Smalley
(D) Otto Lehman

31. Find the force (in newton) between 2C and –1C separated by a distance 1m in air.
(A) 18×10^{9}
(B) -18×10^{9}
(C) 18×10^{-9}
(D) -18×10^{-9}

32. Find the conductivity of a material with conduction current density 100 units and electric field of 4 units.

(A) 25
(B) 400
(C) 0.04
(D) 1600

33. In free space, the Poisson equation becomes
(A) Maxwell equation
(B) Ampere equation
(C) Laplace equation
(D) Steady state equation

34. The continuity equation is a combination of which of the two laws?
(A) Ohm's law and Gauss law
(B) Ampere law and Gauss law
(C) Ohm's law and Ampere law
(D) Maxwell law and Ampere law

35. The potential due to the dipole on the midpoint of the two charges will be
(A) 0
(B) Unity
(C) ∞
(D) $-\infty$

36. The charge density of an electrostatic field is given by
(A) $\nabla \times E$
(B) $\nabla \, . \, E$
(C) $\nabla \times D$
(D) $\nabla . D$

37. The gradient of the magnetic vector potential can be expressed as
(A) $-\mu \varepsilon \frac{dV}{dt}$
(B) $\mu\varepsilon \frac{dE}{dt}$
(C) $-\mu\varepsilon \frac{dA}{dt}$
(D) $\mu\varepsilon \frac{dB}{dt}$

38. The divergence of *H* will be

(A) 1

(B) – 1

(C) ∞

(D) 0

39. Find the displacement current when the flux density is given by $3t^2$ at 3 seconds.

(A) 3

(B) 6

(C) 18

(D) 27

40. The reactance offered by a capacitor to an alternating current of frequency 'f' is 10Ω. If the frequency is made to operate at '$2f$', then the reactance becomes equal to

(A) 40Ω

(B) 6Ω

(C) 20Ω

(D) 5Ω

41. An inductor having an inductance of 0.14 H and a resistance of 6Ω is connected in series with a capacitor across 50 Hz supply. Calculate the capacitive reactance required to give the circuit power factor 0.6 lagging. Assume supply voltage to be sinusoidal.

(A) 140Ω

(B) 36Ω

(C) 27.5Ω

(D) 45Ω

42. An LC circuit cannot produce oscillations, when

(A) Resistance is low

(B) Resistance is large

(C) Inductance is large

(D) Capacitance is large

43. If $i(t) = 50\cos(100\pi t + 10^\circ)$ is the expression of a sinusoidal current, find the maximum amplitude.

(A) 100 A

(B) 85.5 A

(C) 50 A

(D) 70.7 A

44. A DC voltage source has a source resistance variable from 5 Ω to 25 Ω and it is connected to a load of 10 Ω. For maximum power transfer, the source resistance should be

(A) 5 Ω

(B) 10 Ω

(C) 15 Ω

(D) 20 Ω

45. Superposition theorem is valid for

(A) Linear circuits

(B) Nonlinear circuits

(C) Both linear and nonlinear circuits

(D) Circuits with active elements

46. Reciprocity theorem cannot be applied to the circuits having

(A) Linear elements

(B) Dependent sources

(C) Bilateral elements

(D) Passive elements

47. For *h* parameters, the condition for symmetry is:

(A) $h_{21} h_{12} - h_{12} h_{21} = 1$

(B) $h_{11} h_{22} - h_{12} h_{21} = 1$

(C) $h_{21} h_{12} - h_{11} h_{22} = 1$

(D) $h_{21} h_{22} - h_{11} h_{22} = 1$

48. ABCD parameters are used in analysis of

(A) Short circuit

(B) Electronic circuit

(C) Open circuit

(D) Transmission circuit

49. In pure inductive circuit if the supply frequency is reduced to half the current will be:
    (A) Reduced to one fourth
    (B) Reduced by half
    (C) Doubled
    (D) Four times at high

50. Two heaters rated at 1000 W, 250 V each are connected in series across a 250 V, 50 Hz AC mains. The total power drawn from the supply would be
    (A) 1000 W
    (B) 500 W
    (C) 250 W
    (D) 2000 W

51. Notch filter is a
    (A) Band pass filter
    (B) Low pass filter
    (C) High pass filter
    (D) Band stop filter

52. If τ is time constant and ω is the applied frequency, a low pass RC filter acts as a pure integrator when
    (A) $\omega\tau = 0$
    (B) $\omega\tau >> 1$
    (C) $\omega\tau = 1$
    (D) $\omega\tau << 0$

53. Total inductance of a group of two series connected and unshielded inductance when flux produced by one opposes the flux produced by the other is equal to
    (A) $L_1 + L_2$
    (B) 2M
    (C) $L_1 + L_2 + 2M$
    (D) $L_1 + L_2 - 2M$

54. Two coupled coils with $L_1 = L_2 = 0.5$ H having a coupling coefficient of $k = 0.75$. The turn ratio $N_1/N_2 = ?$
    (A) 4
    (B) 0.5
    (C) 2
    (D) 1

55. Three identical resistors connected in star consume 4000 W when connected across balanced $3-\phi$ supply. What is the power consumed, if the three resistors are connected in delta across the same supply?
    (A) 20000 W
    (B) 16000 W
    (C) 4000 W
    (D) 12000 W

56. What is the rms value of rectangular voltage wave with amplitude of 100 V?
    (A) $50\sqrt{2}V$
    (B) $100V$
    (C) 110 V
    (D) $150\sqrt{2}$

57. If one of the control springs of a permanent magnet coil ammeter is broken then it will read
    (A) Zero
    (B) Half the correct value
    (C) Twice the correct value
    (D) An infinite value

58. A 0 to 300 V voltmeter has an error of ±2% for full scale reading. What is the range of readings if true voltage is 30 V?
    (A) 24−36 V
    (B) 20−40 V
    (C) 29.4−30.6 V
    (D) None of the above

59. The most stable type of ammeter to measure currents at radio frequency is
    (A) moving-iron type

(B) moving-coil type
(C) induction type
(D) thermocouple type

60. Hay's bridge used for measurement of inductance is suited for
(A) Low Q coils
(B) High Q coils
(C) Medium Q coils
(D) Low and medium Q coils

61. A 2000 Ω/V meter is used to measure a resistance on 120 V scale. The meter resistance is
(A) 16.67 kΩ
(B) 0.0005 Ω
(C) 240 kΩ
(D) 240 Ω

62. A signal of 20 mV at 100 kHz is to be measured with a meter. The type of meter most suitable for measurement is
(A) Induction type
(B) Dynamometer type
(C) Electrostatic voltmeter
(D) CRO

63. Which one of the following is not a torque produced in an integrating type of instrument?
(A) Operating torque
(B) Braking torque
(C) Damping torque
(D) None of the above

64. The resistances of the current coil and the potential coil in an electrodynamometer type wattmeter are respectively,
(A) high and low
(B) low and high
(C) high and high
(D) low and low

65. In a PMMC-type instrument, the magnetic field produced by the eddy currents
(A) Does not affect the motion of the coil

(B) Acts in the same direction of the motion of the coil

(C) Acts in the direction opposite to the motion of the coil

(D) None of the above

66. What is the function of control lines in RAM?

(A) Connects RAM and difficult Disks

(B) Connect CPU and RAM

(C) Hold data that is being transferred to or from memory

(D) None of these

67. In computer CAD stands for

(A) Computer Add Dialog

(B) Computer Aided Design

(C) Computer Aided Data

(D) Computer Add Disk

68. What is the binary equivalent of the decimal number 67.625?

(A) 1000010.110

(B) 1000011.110

(C) 1000010.101

(D) 1000011.101

69. Which of the following is used in main memory?

(A) DDR

(B) DRAM

(C) SRAM

(D) PRAM

70. Which of the following layers of the OSI model provides access control?

(A) Physical

(B) Presentation

(C) Session

(D) Data link

71. RS 232 communication is

(A) Full duplex

(B) Half duplex

(C) Simplex

(D) Command response system

72. Which of the following processor has a fixed length of instructions?

(A) CISC
(B) RISC
(C) EPIC
(D) Multi-core

73. A circuitry that processes that responds to and processes the basic instructions that are required to drive a computer system is
(A) Memory
(B) ALU
(C) CU
(D) Processor

74. Causing the CPU to step through a series of micro operations is called
(A) Execution
(B) Runtime
(C) Sequencing
(D) Pipelining

75. What does RAID stand for?
(A) Redundant Array of Independent Disks
(B) Redundant Array of Inexpensive Disks
(C) Redundant Array of Intermediate disks
(D) Redundant Array of Improper Disks

76. The depletion region (or) space charge region (or) transition region in a semiconductor *p-n* junction diode has
(A) Electrons and holes
(B) Positive ions and electrons
(C) Positive and negative ions
(D) Negative ions and holes

77. As temperature is increased, the voltage across a diode carrying a constant current
(A) Increases
(B) Decreases
(C) Remains constant
(D) May increase or decrease depending upon the doping levels in the junction

78. The mobility of an electron in a conductor expressed in terms of
(A) $cm^2 / V - \sec$
(B) $cm / V - \sec$
(C) cm^2 / V
(D) $cm^2 / \sec$

79. In a BJT, if the collector-base junction and the base-emitter junction are both reverse-biased, which region is the BJT operating in?
    (A) Saturation region
    (B) Active region
    (C) Cutoff region
    (D) Reverse active region

80. Bandwidth of amplifier is
    (A) Difference between upper cut-off frequency and lower cut-off frequency
    (B) Sum of upper cut-off frequency and lower cut-off frequency
    (C) Average of upper cut-off frequency and lower cut-off frequency
    (D) Independent to cut-off frequency

81. If the output power from an audio amplifier is measured at 100 W when the signal frequency is 1 kHz, and 1 W when the signal frequency is 10 kHz. Calculate the dB change in power.
    (A) –10 dB
    (B) –20 dB
    (C) –30 dB
    (D) 15 dB

82. For any cascaded amplifier network, which of these are incorrect?
    (A) Cascading increases gain
    (B) Overall input resistance is equal to the input resistance of the first amplifier
    (C) The overall output resistance is less than the lowest output resistance in all amplifiers used
    (D) Loading effect occurs

83. Which of the following amplifier cannot be used for audio frequency amplification?
    (A) Class A
    (B) Class C
    (C) Class AB
    (D) Class B push-pull

84. In an ideal op-amp, which is not true?
    (A) Open loop voltage gain is infinite
    (B) Input resistance is infinite
    (C) Slew rate is infinite
    (D) CMRR is zero

85. What is the use of the compensation capacitor in op-amp?
    (A) Improves the amplification of op-amp
    (B) Decreases the slew rate of op-amp
    (C) Increases the bandwidth of op-amp
    (D) Op-amp acts as all pass filter

86. A major advantage of active filters is that they can be realized without using
    (A) Op-amps
    (B) Inductors
    (C) Resistors
    (D) Capacitors

87. A low-pass filter with a cut-off frequency of 30 Hz is cascaded with a high-pass filter with a cut-off frequency of 20 Hz. The resultant system of filters
    (A) an all-pass filter
    (B) an all-stop filter
    (C) a band stop (band-reject) filter
    (D) a band-pass filter

88. The cascade amplifier is a multistage configuration of
    (A) CC-CB
    (B) CE-CB
    (C) CB-CC
    (D) CE-CC

89. Which of the following is correct about photo diode electronic devices?
    (A) P-N junction is connected in reverse bias
    (B) Electron-hole pairs are generated by impurity injection in depletion layer
    (C) It is a photovoltaic cell
    (D) No external voltage is applied

90. Which type of semiconductor is used in Tunnel Diode?
    (A) Compound semiconductor
    (B) Elemental semiconductor
    (C) Degenerated semiconductor
    (D) Extrinsic semiconductor

91. In which region does BJT act as the OFF switch in electronic circuits?
    (A) Cut-off
    (B) Saturation

(C) Active
(D) Reverse saturation

92. What is the use of coupling capacitors in CE amplifier?
(A) Blocks DC
(B) Pass AC
(C) Reduce distortion
(D) Pass **AC** and blocks **DC**

93. What is the application of a high input resistance in transistor amplifier circuit?
(A) Positive feedback
(B) Voltage gain
(C) Power gain
(D) Impedance matching

94. The effective channel length of a MOSFET in saturation decreases with increase in which of the following parameter?
(A) Gate voltage
(B) Drain voltage
(C) Source voltage
(D) Body voltage

95. What will happen if gate voltage applied is positive to pinch off voltage?
(A) Device burns
(B) More current flows
(C) Nothing happens
(D) Current remains the same

96. Which of the following is true for a pnp transistor in saturation region?
(A) CB junction is reversed bias and the EB junction is forward bias
(B) CB junction is forward bias and the EB junction is forward bias
(C) CB junction is forward bias and the EB junction is reverse bias
(D) CB junction is reversed bias and the EB junction is reverse bias

97. The Early Effect is also called as
(A) Base-width modulation effect
(B) Base-width amplification effect
(C) Both of the mentioned
(D) None of the mentioned

98. BCD numbers are obtained by
(A) Converting decimal number to binary number
(B) Converting decimal to octal number

(C) Each decimal digit is represented by a farm bit binary

(D) None of the above

99. How is J-K flip-flop made to toggle?

(A) J = 0, K = 0

(B) J = 1, K = 0

(C) J = 0, K = 1

(D) J = 1, K = 1

100. When adding an even parity bit to the code 110010 the result is

(A) 1110010

(B) 1110101

(C) 1100011

(D) 001101

101. Multiplexer can be used for

(A) Data generation

(B) Serial to parallel conversion

(C) Data selection

(D) None of the above

102. The flip-flop belongs to a category of logic circuits known as

(A) monostable multivibrator

(B) astable multivibrator

(C) bistable multivibrator

(D) one shots

103. Gray code for number 7 is

(A) 1100

(B) 1001

(C) 0100

(D) 0110

104. Basic comparator is a

(A) NOR gate

(B) OR gate

(C) Ex-OR gate

(D) AND gate

105. How many flip-flops are required to construct a decade counter?

(A) 10

(B) 3
(C) 4
(D) 2

106. ROC of $x_1(n)$ and $x_1(-n)$ is the
(A) same
(B) reciprocal of each other
(C) negative of each other
(D) complement of each other

107. A causal system is always
(A) stable
(B) unstable
(C) may or may not be stable
(D) cannot be determined

108. A finite impulse response (FIR) system has the ROC
(A) inside the circle
(B) outside the circle
(C) entire z-plane except $z=0$
(D) entire z-plane except $z=\infty$ and $z=0$

109. A real signal $x(t)$ has Fourier transform $x(f)$. Which one of the following is correct?
(A) Magnitude of $x(f)$ has even symmetry, while phase of $x(f)$ has odd symmetry
(B) Magnitude of $x(f)$ has odd symmetry, while phase of $x(f)$ has even symmetry
(C) Both magnitude and phase of $x(f)$ have even symmetry
(D) Both magnitude and phase of $x(f)$ have odd symmetry

110. Which of the following is the correct relation?
(A) $FT(at)\leftrightarrow aFT(\omega/a)$
(B) $FT(at)\leftrightarrow aFT(a\omega)$
(C) $FT(t/a)\leftrightarrow aFT(\omega/a)$
(D) $FT(at)\leftrightarrow(1/a)FT(\omega/a)$

111. What is the period of the sinusoidal signal $X(n)=5\cos[0.2\pi n]$?
(A) 10
(B) 5
(C) 1

(D) 0

112. The system characterised by the equation $y(t)=ax(t)+b$ is

(A) linear for any value of b

(B) linear if $b>0$

(C) linear if $b<0$

(D) non-linear

113. A continuous time periodic signal $x(t)$, having a period T, is convolved with itself. The resulting signal is

(A) not periodic

(B) periodic with a period T

(C) periodic having a period 2T

(D) periodic having a period T/2

114. The final value of $x(t)=[2+e^{-2t}]u(t)$ is

(A) 2

(B) 3

(C) e^{-3t}

(D) 0

115. Discrete time system is stable if the poles are

(A) Within unit circle

(B) Outside unit circle

(C) On the unit circle

(D) None of the above

116. Fourier transform of exponential signal e^{jwt} is

(A) constant

(B) rectangular gate

(C) an impulse

(D) a series of impulse

117. Which of the following is true?

(A) A finite signal is always bounded

(B) A bounded signal always possesses finite energy

(C) A bounded signal is always zero outside the interval, $[-t_0, t_0]$ for some t_0

(D) A bounded signal is always finite

118. The system represented by the input-output relationship $y(t)=\int_{-\infty}^{5t} x(\tau)d\tau$, $t>0$, $\tau>0$ is

(A) linear and causal

(B) linear but not causal

(C) causal but not linear

(D) neither linear nor causal

119. Two systems with impulse responses $h_1(t)$ and $h_2(t)$ are connected in cascade. Then the overall impulse response of the cascaded system is given by

(A) product of $h_1(t)$ and $h_2(t)$

(B) sum of $h_1(t)$ and $h_2(t)$

(C) convolution of $h_1(t)$ and $h_2(t)$

(D) subtraction of $h_1(t)$ and $h_2(t)$

120. For a periodic signal $v(t)=30\sin 100t+\ 10\cos 300t+6\sin(500t+\pi/4)$, the fundamental frequency in rad/s is

(A) 100

(B) 300

(C) 500

(D) 1500

121. A band-limited signal with a maximum frequency of 5 kHz is to be sampled. According to the

sampling theorem, the sampling frequency in kHz which is not valid is

(A) 5

(B) 12

(C) 15

(D) 20

122. The feedback control system with negative feedback is

(A) equally sensitive to both forward and feedback path parameter changes

(B) insensitive to both forward and feedback path parameter changes

(C) less sensitive to the feedback path parameter changes and more sensitive to forward path parameter changes

(D) less sensitive to the forward path parameter changes and more sensitive to feedback path parameter changes

123. A second-order system has 5% peak overshoot for a unit step input, if the amplitude of the input is increased five times, then the percent peak overshoot will be

(A) 10%

(B) 5%

(C) 15%

(D) 25%

124. The Nyquist plot can be used to determine

(A) stability and transient response

(B) steady-state errors

(C) absolute as well as relative stability

(D) absolute as well as relative stability and number of closed-loop poles in right half of s-plane

125. For a system with open-loop transfer function $G(s)=10/(s^2+2s+10)$ the resonant frequency is given by

(A) 2

(B) 6

(C) 2.707

(D) 2.828

126. Unit step response of a system can be obtained from the unit impulse response by

(A) differentiating the impulse response

(B) integrating the impulse response

(C) multiplying the impulse response by $1-e^{-t}$

(D) none of above

127. Signal flow graphs are

(A) the technique to simplify the graphical representation and obtain a single block representing overall transfer function

(B) graphical technique to obtain transfer function using analytical results

(C) arrangements of subcomponents in a feed forward manner only

(D) none of the above

128. The transfer function of a second-order all pass network is

(A) $\frac{s^2}{s^2+\alpha s+\beta}$

(B) $\frac{s^2+1}{s^2+\alpha s+\beta}$

(C) $\frac{s}{s^2+\alpha s+\beta}$

(D) $\frac{s^2-\alpha s+\beta}{s^2+\alpha s+\beta}$

129. In a force-voltage analogy, the mass *M*, stiffness *k* and viscous friction *f* are equivalent to which of the following corresponding electrical quantities (in order) as

(A) *R*, *L*, *C*

(B) *L*, *C*, *R*

(C) *C*, *L*, *R*

(D) *R*, *C*, *L*

130. A system with $G(s)=1/(s+2)$ is controlled using an integral controller by inserting integrator in the forward path. The steady-state error for the overall system to step commands is

(A) ∞

(B) $-\infty$

(C) 2/3

(D) 0

131. The number of positive real roots of the characteristic equation $s^3 - 2s + 2 = 0$ are
(A) 1
(B) 2
(C) 0
(D) cannot be obtained

132. The root locus technique can be used for which of the following
(A) transient response study
(B) variation of the poles of the closed-loop system
(C) calculate the number and angle of asymptotes
(D) all of above

133. The root locus for a unity feedback, with open-loop transfer function having gain parameter *K*, exist on real axis if and only if the angle subtended by poles and zeros is
(A) $k\pi$
(B) $(2k+1)\pi$
(C) $2k\pi$
(D) None of these

134. An open-loop transfer function has three zeros at infinity, then the relationship between the number of poles (*P*) and the number of zeros (*Z*) is given by
(A) $P - Z = 3/2$
(B) $3P = Z$
(C) $P - Z = 3$
(D) $Z - P = 3$

135. The Nyquist plot of a system passes through $-1 + j0$ point, then the phase margin of the system is given by
(A) 45°
(B) 90°
(C) 180°
(D) 0°

136. The phase lead compensation is used to
(A) increase rise time and decrease overshoot
(B) decrease both rise time and overshoot
(C) increase both rise time and overshoot
(D) decrease rise time and increase overshoot

137. A second-order unity feedback system is found to be oscillating with high frequency. The oscillations
   (A) can be eliminated using proportional action
   (B) can be eliminated using integral action
   (C) can be eliminated using derivative action
   (D) cannot be reduced

138. PD controllers are used to improve
   (A) transient response
   (B) steady-state accuracy
   (C) increase stability
   (D) both (A) and (C)

139. Given an autonomous system $\dot{x} = Ax$ non-singular A matrix and non-zero initial state $x(0)$, the state transition matrix is
   (A) $[sI - A]^{-1}$
   (B) $[sI - A]^{-1}x(0)$
   (C) $e^{At}x(0)$
   (D) Laplace inverse of $[sI - A]^{-1}$

140. A 240 V DC shunt motor with an armature resistance of 0.5 Ω has a full load current of 40 A. Find the ratio of the stalling torque to the full load torque when a resistance of 1 Ω is connected in series with the armature?
   (A) 4
   (B) 12
   (C) 6
   (D) none of these

141. A 240 V DC series motor takes 40 A when giving its rated output at 1500 rpm. Its resistance is 0.3 Ω. The value of resistance which must be added to obtain rated torque at 1000 rpm is
   (A) 6 Ω
   (B) 5.7 Ω
   (C) 2.2 Ω
   (D) 1.9 Ω

142. A 4-point starter is used to start and control the speed of a
   (A) DC shunt motor with armature resistance control
   (B) DC shunt motor with field weakening control
   (C) DC series motor

(D) DC compound motor

143. Two transformers of identical voltage but of different capacities are operating in parallel. For satisfactory load sharing
   (A) impedances must be equal
   (B) per unit impedances must be equal
   (C) per unit impedances and X/R ratios must be equal
   (D) impedances and X/R ratios must be equal

144. The efficiency of a 100 kVA transformer is 0.98 at full as well as at half load. For this transformer at full load the copper loss
   (A) is less than core loss
   (B) is equal to core loss
   (C) is more than core loss
   (D) none of these

145. Which three-phase connection can be used in a transformer to introduce a phase difference of 30° between its output and corresponding input line voltages?
   (A) Star-Star
   (B) Star-Delta
   (C) Delta-Delta
   (D) Delta-Zigzag

146. An induction motor having full load torque of 60 N-m when delta connected, develops a starting torque of 120 N-m. For the same supply voltage, if the motor is changed to star connection the starting torque developed will be
   (A) 40 Nm
   (B) 60 Nm
   (C) 90 Nm
   (D) 120 Nm

147. No-load test on a 3-phase induction motor is conducted at different supply voltages and a plot of input power versus voltage is drawn. This curve was extrapolated to intersect the y-axis. This intersection point yields
   (A) Core loss
   (B) Stator copper loss
   (C) Stray load loss
   (D) Friction and windage loss

148. In a constant V/f induction motor drive, the slip at the maximum torque

(A) is directly proportional to the synchronous speed

(B) remains constant with respect to the synchronous speed

(C) has an inverse relation with the synchronous speed

(D) has no relation with the synchronous speed

149. A three-phase 400 V, 6 pole, 50 Hz, squirrel cage induction motor is running at a slip of 5%. The speed of stator magnetic field with respect to rotor magnetic field and speed of rotor with respect to stator magnetic field are

(A) 0, –50 rpm

(B) 0, 950 rpm

(C) 1000 rpm, –50 rpm

(D) 1000 rpm, 950 rpm

150. The torque angle of a synchronous machine operating from a constant voltage bus, is usually defined as the space angle between

(A) Rotor mmf wave and stator mmf wave

(B) Rotor mmf wave and resultant flux density

(C) Stator mmf wave and resultant flux density

(D) Stator mmf wave and resultant mmf wave

151. Two 550 KVA alternators operate in parallel to supply the following loads

(i) 250 kW at 0.95 power factor lag

(ii) 100 kW at 0.8 power factor lead

One machine is supplying 200 kW at 0.9 power factor lag. The power factor of the other machine must be

(A) 0.89 lead

(B) 0.95 lead

(C) 0.95 lag

(D) 0.89 lag

152. A 4-pole, 3-phase, double-layer winding is housed in a 36-slot stator for an AC machine with 60° phase spread. Coil span is 7 short pitched. Number of slots in which top and bottom layers belong to different phases is

(A) 24

(B) 18

(C) 12

(D) 0

153. Distributed winding and short chording employed in AC machines will result in

(A) increase in emf and reduction in harmonics

(B) reduction in emf and increase in harmonics
(C) increase in both emf and harmonics
(D) reduction in both emf and harmonics

154. In a synchronous machine, hunting is predominantly damped by
(A) mechanical losses in the rotor
(B) iron losses in the rotor
(C) copper losses in the stator
(D) copper losses in the rotor

155. In an induction motor, if the air gap is increased
(A) speed will reduce
(B) efficiency will improve
(C) power factor will be lower
(D) breakdown torque will reduce

156. When the supply voltage to an induction motors reduced by 10%, the maximum torque will decrease by approximately
(A) 5%
(B) 10%
(C) 20%
(D) 40%

157. In a transformer, zero voltage regulation at full load
(A) not possible
(B) possible at unity power factor load
(C) possible at leading power factor load
(D) possible at lagging power factor load

158. Which type of motor is most suitable for computer printer drive?
(A) Reluctance motor
(B) Hysteresis motor
(C) Shaded pole motor
(D) Stepper motor

159. For a given stepper motor, the following torque has the highest numerical value
(A) Detent torque
(B) Pull-in torque
(C) Pull-out torque
(D) Holding torque

160. The following motor definitely has a permanent magnet rotor
   (A) DC commutator motor
   (B) Brushless DC motor
   (C) Stepper motor
   (D) Reluctance motor

161. The type of single-phase induction motor having the highest power factor at full load is
   (A) shaded pole type
   (B) split-phase type
   (C) capacitor-start type
   (D) capacitor-run type

162. The use of high-speed circuit-breakers
   (A) reduces the short circuit current
   (B) improves system stability
   (C) decreases system stability
   (D) increases the short circuit current

163. Corona loss increases with which of the following?
   (A) decrease in conductor size and increase in supply frequency
   (B) increase in both conductor size and supply frequency
   (C) decrease in both conductor size and supply frequency
   (D) increase in conductor size and decrease in supply frequency

164. In load flow analysis, the load connected at a bus is represented as
   (A) constant current drawn from the bus
   (B) constant impedance connected at the bus
   (C) voltage and frequency dependent source at the bus
   (D) constant real and reactive power drawn from the bus

165. At slack bus, which of the following combinations of variables is specified?
   (A) $|V|, \delta$
   (B) P, Q
   (C) $P, |V|$
   (D) $Q, |V|$

166. The critical clearing time of a fault in power system is related to
   (A) reactive power limit

(B) short-circuit current limit

(C) steady-state stability limit

(D) transient stability limit

167. The values of A, B, C and D constants for a short transmission line are, respectively

(A) Z, 0, 1 and 1

(B) 0, 1, 1 and Z

(C) 1, Z, 0 and 1

(D) 1, 1, Z and 0

168. A 12-bus power system has three voltage controlled buses. The dimensions of the Jacobian matrix will be

(A) 21 × 21

(B) 21 × 19

(C) 19 × 19

(D) 19 × 21

169. In the case of a HVDC system, there is

(A) charging current but no skin effect

(B) no charging current but skin effect

(C) neither charging current, nor skin effect

(D) both charging current and skin effect

170. Shunt compensation in an EHV line is used to improve

(A) stability and fault level

(B) fault level and voltage profile

(C) voltage profile and stability

(D) stability, fault level and voltage profile

171. If all the sequence voltages at the fault point in a power system are equal, then the fault is a

(A) three-phase fault

(B) line to ground fault

(C) line to line fault

(D) double line to ground fault

172. If *A, B, C* and *D* are generalised circuit constants, then which one of the following equation is correct?

(A) $-AB+CD=-1$

(B) $AD+CB=1$

(C) $AB-CD=-1$

(D) $-AD+BC=-1$

173. Bundled conductors are mainly used in high voltage overhead transmission lines to
(A) reduce transmission line losses
(B) increase mechanical strength of the line
(C) reduce corona
(D) reduce sag

174. The interrupting time of a circuit breaker is the period between the instant of
(A) initiation of short circuit and the arc extinction on an opening operation
(B) energising of the trip circuit and the arc extinction on an opening operation
(C) initiation of short circuit and the parting of primary arc contacts
(D) energising of the trip circuit and the parting of primary arc contacts

175. The transmission line distance protection relay having the property of being inherently directional is
(A) impedance relay
(B) mho relay
(C) ohm relay
(D) reactance relay

176. High voltage DC (HVDC) transmission is mainly used for
(A) bulk power transmission over very long distances
(B) inter-connecting two systems with the same nominal frequency
(C) eliminating reactive power requirement in the operation
(D) minimizing harmonics at the converter stations

177. The inductance of a power transmission line increases with
(A) decrease in length
(B) increase in diameter of conductor
(C) increase in spacing between the phase conductors
(D) increase in load current carried by the conductors

178. A Buchholz relay is used for protection of
(A) transformer against all internal faults

(B) transformer against all external faults
(C) transformer against both internal and external faults
(D) induction motors

179. The transient stability of the power system can be effectively improved by
(A) excitation control
(B) phase shifting transformer
(C) single pole switching of circuit breakers
(D) increasing the turbine valve opening

180. Which of the following materials is used for cable insulation?
(A) Phenol formaldehyde
(B) Polytetrafluoroethylene
(C) Polyvinyl chloride
(D) Acrylonitrile butadiene styrene

181. Equal area criteria in power systems is used in the context of
(A) Deciding maximum loading for a given excitation
(B) Stability of a machine connected to infinite bus bar
(C) Stability of power systems in which many machines are connected to infinite bus bar
(D) Load distribution between a single machine and load drawn from infinite bus bar

182. In case of single line to ground fault
(A) All sequence networks are connected in parallel
(B) All sequence networks are connected in series
(C) Positive and negative sequence networks are connected in parallel
(D) Zero and negative sequence networks are connected in series

183. When a thyristor is reverse biased, the number of blocked *p*-*n* junctions is
(A) 1
(B) 2
(C) 3
(D) 4

184. For an SCR, dv/dt protection is achieved through the use of
(A) RL in series with SCR
(B) RC across SCR
(C) L in series with SCR
(D) RC in series with SCR

185. In a single-phase full converter, for continuous conduction, each pair of SCRs conduct for
   (A) $\pi - \alpha$
   (B) π
   (C) α
   (D) $\pi + \alpha$

186. A chopper can be used on
   (A) Pulse-width modulation only
   (B) Frequency modulation only
   (C) Amplitude modulation only
   (D) Both PWM and FM

187. In a CSI, if frequency of output voltage is *f* Hz, then frequency of voltage input to CSI is
   (A) *f*
   (B) 2*f*
   (C) *f*/2
   (D) 3*f*

188. The function of snubber circuit connected across an SCR is to
   (A) Suppress dv/dt
   (B) Increase dv/dt
   (C) Decrease dv/dt
   (D) Keep transient overvoltage at a constant value

189. In a 3-phase half-wave diode rectifier, if per-phase input voltage is 200 V, then the average output voltage is
   (A) 233.91 V
   (B) 116.95 V
   (C) 202.56 V
   (D) 101.28 V

190. In a 3-phase full converter, the output voltage pulsates at a frequency equal to
   (A) Supply frequency, *f*
   (B) 2*f*
   (C) 3*f*
   (D) 6*f*

191. Reverse recovery current in a diode depends upon
   (A) Forward field current
   (B) Storage charge
   (C) Temperature
   (D) PIV

192. During forward blocking state, a thyristor is associated with
   (A) Large current, low voltage
   (B) Low current, large voltage
   (C) Medium current, large voltage
   (D) Low current, medium voltage

193. In a 3-phase half-wave diode rectifier, the ratio of average output voltage to per-phase maximum AC voltage is
   (A) 0.955
   (B) 0.827
   (C) 1.654
   (D) 1.169

194. A chopper, in which current remains positive but voltage may be positive or negative, is known as
   (A) Type-A
   (B) Type-B
   (C) Type-C
   (D) Type-D

195. A VSI will have better performance if its
   (A) Load inductance is small and source inductance is large
   (B) Both load inductance and source inductance are small
   (C) Both load inductance and source inductance are large
   (D) Load inductance is large and source inductance is small

196. In DC choppers, the waveforms for input and output voltages are respectively
   (A) discontinuous, continuous
   (B) both continuous
   (C) both discontinuous

(D) continuous, discontinuous

197. A four quadrant operation requires
(A) two full converter in series
(B) two full converter connected back to back
(C) two full converter connected in parallel
(D) two semiconverter connected back to back

198. An electric motor, developing a starting torque of 15 Nm, starts with a load torque of 7 Nm on its shaft. If the acceleration at start is 2 rad/sec², the moment of inertia of the systems must be (neglecting viscous and Coulomb friction).
(A) 0.25 kg m²
(B) 0.25 Nm²
(C) 4 kg m²
(D) 4 Nm²

199. Which of the following motor can be referred as a universal motor?
(A) Permanent magnet motor
(B) DC shunt motor
(C) DC series motor
(D) DC compound motor

200. Which braking method is the best method for obtaining high braking torque?
(A) Plugging
(B) Regenerative braking
(C) Rheostatic braking
(D) Dynamic braking

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ROUGH WORK

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