ESE (P), 2020

ELECTRONICS ENGINEERING

1. A single-phase full wave rectifier uses semiconductor diodes. The transformer voltage is 35 Vrms to center tap. The load consists of a 40μF capacitor in parallel with a 250Ω resistor. The diode and transformer resistances and leakage reactance are neglected. If the power line frequency is 50 Hz, the dc current in the circuit will be
   (a) 132 mA   (b) 144 mA
   (c) 156 mA   (d) 168 mA

2. Silicon dioxide (SiO_2) is used in *ICs*, because it
   (a) Facilitates the penetration of diffusants
   (b) Has high heat conduction
   (c) Prevents diffusion of impurities
   (d) Controls the concentration of diffusants

3. Consider an n-channel *MOSFET* with parameters :
   $K_n = 0.25$ mA/V^2, $V_{TN} = 1$ V, $\lambda = 0$,
   $C_{gd} = 0.04$ pF and $C_{gs} = 0.2$ pF
   If the transistor is biased at $V_{GS} = 3$ V, the unity-gain bandwidth of an *FET* will be
   (a) 626 MHz   (b) 646 MHz
   (c) 663 MHz   (d) 683 MHz

4. The voltage gain of *CE* amplifier circuit can be approximated for an ideal input ac source and is given by

   (a) $A_{Vs} = \dfrac{r_e'}{(R_C \times R_L)}$

   (b) $A_{Vs} = -\dfrac{r_e'}{(R_C \parallel R_L)}$

   (c) $A_{Vs} = -\dfrac{(R_C \parallel R_L)}{r_e'}$

   (4) $A_{Vs} = -\dfrac{(R_C \times R_L)}{r_e'}$

   Where : R_L = Load resistance
   RC = Collector resistance
   r_e' = Effective resistance at input of transistor from emitter resistance R_E a

5. The advantage of using a Class-B push-pull transistor amplifier over a Class-A push-pull transistor amplifier is
   (a) A negligible power loss at no input signal
   (b) Harmonic distortion is lower
   (c) Self-bias can be used
   (d) Supply voltages have good regulation

6. The overall decibel (dB) voltage gain of a multistage amplifier is
   (a) The dB voltage gain of the first stage
   (b) The product of the dB voltage gains of the individual stages
   (c) The sum of the dB voltage gains of the individual stages
   (d) The dB voltage gain of the last stage

7. If an op-amp having specified signal bandwidth (BW) of 1MHz and closed loop gain $A_{CL} = 200$ V/mV, the cutoff frequency f_C will be
   (a) 25 Hz
   (b) 15 Hz
   (c) 5 Hz
   (d) 1 Hz

8. If the bias current in the *IC*-741 op-amp is $I_Q = 19$μA and the internal frequency compensation capacitor $C_1 = 30$pF, the slew rate of the op-amp, will be nearly
   (a) 1.58 V/μs
   (b) 1.26 V/μs
   (c) 0.93 V/μs
   (d) 0.63 V/μs

9. Which one of the following statements regarding slew rate is correct?
   (a) It signifies how rapidly the output of an op-amp can change in response to changes in the frequency of the input signal
   (b) It does not change with change in voltage gain
   (c) It should be smaller for high-speed op-amp applications
   (d) It is not fixed for an op-amp

10. Which one of the following is correct for an ideal operational amplifier?
  (a) Input resistance $R_i = \infty$, output resistance $R_o = 0$ and bandwidth $= 0$
  (b) Input resistance $R_i = 0$, output resistance $R_o = \infty$ and bandwidth $= 0$
  (c) Input resistance $R_i = \infty$, output resistance $R_o = 0$ and bandwidth $= \infty$
  (d) Input resistance $R_i = 0$, output resistance $R_o = 0$ and bandwidth $= \infty$

11. The advantage of *ILD* over *LED* is
  (a) *ILD* emits incoherent light whereas *LED* emits coherent light
  (b) In *ILD* it is difficult to couple light whereas in *LED* it is easy to couple light
  (c) In *ILD* coupling loss is more whereas in *LED* coupling loss is less
  (d) *ILD* emits coherent light whereas *LED* emits incoherent light

12. The quantum efficiency η for the photo-detector is
  (a) $\dfrac{I_{ph}}{P_0}$
  (b) $\dfrac{I_{ph}/e}{P_0/(hc/\lambda)}$
  (c) $\dfrac{P_0}{I_{ph}}$
  (d) $\dfrac{P_0/(hc/\lambda)}{I_{ph}/e}$

  where : I_{ph} = Average photocurrent
  P_o = Average incident optical power
  hc/λ = Incident photon energy

13. According to Kirchhoff's voltage law, the algebraic sum of all the voltage in any closed loop of a network is always
  (a) Negative
  (b) Positive
  (c) Zero
  (d) Determined by the battery emf

14. Ohm's law is applicable to
  (a) DC circuit only
  (b) AC circuit only
  (c) DC circuit as well as AC circuit, provided account is taken of the induced emf resulting from the self-inductance of circuit and of the distribution of current in cross-section of circuit
  (d) DC circuit as well as AC circuit, provided account is taken of the induced emf resulting from mutual-inductance of circuit and of the distribution of current in cross-section of circuit

15. A car having an axle of 2 m length is travelling with 72 km/h at a vertical component of the earth's magnetic field of 40 μWb/m^2, the emf generated in the axle of a car will be
  (a) 1.2mV
  (b) 1.6mV
  (c) 2.2mV
  (d) 2.6mV

16. Crest factor for an alternating current source is the ratio of
  (a) Maximum value to RMS value
  (b) RMS value to Maximum value
  (c) RMS value to Average value
  (d) Maximum value to Average value

17. A 200 kVA, 3300/240 V, 50 Hz single-phase transformer has 80 turns on the secondary winding. Assuming an ideal transformer, the primary current I_1 and secondary current I_2 on full load are nearly
  (a) 60.6 A and 833 A
  (b) 72.2 A and 833 A
  (c) 60.6 A and 720 A
  (d) 72.2 A and 720 A

18. Consider the following data regarding the name plate of 1-phase, 4-pole induction motor:
  Output = 373 W; 230 V, frequency = 50 Hz, input current = 2.9 A, power factor = 0.71, speed =1410 rpm. The efficiency of motor will be nearly
  (a) 72·8%
  (b) 78.8%
  (c) 84.4%
  (d) 88.4%

19. Two capacitors of 80 μF and 50 μF are connected in series. When 200 V at 50 Hz are applied across the series circuit, the maximum energy stored in the circuit will be
  (a) 0.63 J
  (b) 1.23 J
  (c) 2.66 J
  (d) 3.26 J

20. In a 4-pole dynamo the flux/pole is 15mWb. If armature is driven at 600rpm, the average emf induced in one of the armature conductors will be
  (a) 0.3 V
  (b) 0·4 V
  (c) 0.5 V
  (d) 0.6 V

21. Two coils are connected in parallel and a voltage of 200 V is applied to the terminals. The total current taken is 15 A and the power dissipated in one of the coils is 1500 W, the resistance of each coil will be nearly
  (a) 26.7Ω and 23.4Ω
  (b) 22.4Ω and 23.4Ω
  (c) 26·7Ω and 26·7Ω
  (d) 22.4Ω and 26.7Ω

22. The value of total potential difference created between the electrodes, when the cell is not connected to an external circuit is known as its
  (a) Electromotive force
  (b) Electrostatic force
  (c) Electromagnetic force
  (d) Electrochemical force

23. The cells are connected in two rows in parallel to pass a current of 6" " A through an external resistance 0.7Ω. If the electromotive force of each cell is $2{\cdot}1$ volts and internal resistance 0.5Ω, the minimum number of cells will be
  (a) 10 cells   (b) 12 cells
  (c) 14 cells   (d) 16 cells

24. Which of the following are the active materials of a lead acid cell?
  Lead Peroxide (PbO_2) for positive plate
  Sponge Lead (Pb) for negative plate
  Concentrated Sulphuric acid ($H_2 SO_4$) as electrolyte
  Dilute Sulphuric acid ($H_2 SO_4$) as electrolyte
  (a) 1,2 and 3 only   (b) 1,2 and 4 only
  (c) 1 and 3 only   (d) 2 and 4 only

25. Which of the following materials are used for high-technology applications?
  1. Semi conductors
  2. Bio materials
  3. Smart materials
  (a) 1 and 2 only   (b) 1 and 3 only
  (c) 2 and 3 only   (d) 1,2 and 3

26. The theoretical density ρ for the crystal structure of metallic solid is
  (a) $\dfrac{nV_C}{AN_A}$ (b) $\dfrac{nN_A}{AV_C}$
  (c) $\dfrac{n_A}{V_C N_A}$ (d) $\dfrac{n_A N_A}{V_C}$
  where : n = Number of atoms associated with each unit cell
  V_C = Volume of unit cell
  A = Volume of unit cell
  N_A = Avogadro's number

27. A circular dislocation loop has edge character all round the loop and this dislocation can glide only on a surface that contains
  (a) Burgers vector
  (b) Both burgers vector and t vector
  (c) t vector
  (d) No vector

28. The critical stress σ_c for crack propagation in a brittle material, using the principles of fracture mechanics is
  (a) $\left(\dfrac{2E\gamma_s}{3\pi a}\right)^{\frac{1}{2}}$ (b) $\left(\dfrac{3E\gamma_s}{2\pi a}\right)^{\frac{1}{2}}$
  (c) $\left(\dfrac{3E\gamma_s}{\pi a}\right)^{\frac{1}{2}}$ (d) $\left(\dfrac{3E\gamma_s}{\pi a}\right)^{\frac{1}{2}}$
  where : E = Modulus of elasticity
  γ_s = Specific surface energy
  a = One half the length of an internal crack

29. Ceramic materials are
  (a) Organic and metallic
  (b) Inorganic and metallic
  (c) Inorganic and non metallic
  (d) Organic and non metallic

30. Which of the following points are important on the viscosity scale in the fabrication and processing of glasses?
  1. Softening point
  2. Working point
  3. Melting point
  (a) 1 and 2 only   (b) 1 and 3 only
  (c) 2 and 3 only   (d) 1,2 and 3

31. Which one of the following is commonly used piezoelectric ceramics?
  (a) Yttrium oxide ($Y_2 O_3$)
  (b) Boron carbide ($B_4 C$)
  (c) Barium titanate ($BaTiO_3$)
  (d) Tungsten carbide (WC)

32. The detailed information regarding the mechanism of fracture is available from microscopic examination, normally using scanning electron microscopy, and its study is termed as
  (a) Microscopic   (b) Fractographic
  (c) Atroscopic   (d) Nanoscopic

33. A transformer core is wound with a coil carrying an alternating current at a frequency of 50 Hz, The magnetization is uniform throughout the core volume of 0.01 m^3, the hysteresis loop has an area of 60,000 units when the axes are drawn in units of 10^{-4} Wb m^{-2} and 10^2 A m^{-1}. The power loss due to hysteresis will be
  (a) 200 W   (b) 250 W
  (c) 300 W   (d) 350 W

34. In a 440 V,50 Hz transformer, the total iron loss is 2300 W. When the applied voltage is 220 V at 25 Hz, the total iron loss is 750 W. The eddy current loss at the normal voltage and frequency will be
(a) 1600 W
(b) 1400 W
(c) 1200 W
(d) 1000 W

35. Type-I classified superconducting materials on the basis of magnetic response are completely in diamagnetic state where magnetic field is excluded from the body of material due to the phenomenon, known as
(a) Anisotropic effect
(b) Meissner effect
(c) Magnetic effect
(d) Electrical effect

36. Which of the following statements are correct for superconductors?
1. A substance loses its electrical resistance below certain temperature.
2. Superconducting elements have greater electrical resistivity at room temperature
3. On adding impurities to superconducting elements its transition temperature is increased
(a) 1,2 and 3
(b) 1 and 2 only
(c) 1 and 3 only
(d) 2 and 3 only

37. Which one of the following is composed of two characteristics: conformity and the number of significant figures to which a measurement may be made?
(a) Sensitivity
(b) Resolution
(c) Accuracy
(d) Precision

38. A 1-mA meter movement with an internal resistance of 100Ω is to be converted into a 0-100 mA ammeter. The value of shunt resistance will be
(a) 2.41Ω
(b) 2.01Ω
(c) 1.41Ω
(d) 1.01Ω

39. Which of the following methods are used for producing damping torque in analog instruments?
1. Air friction damping
2. Fluid friction damping
3. Eddy current damping
4. Electromagnetic damping
(a) 1,2 and 3 only
(b) 1,2 and 4 only
(c) 1,3 and 4 only
(d) 1,2,3 and 4

40. Which of the following methods are used for measurement of low resistance?
1. Ammeter voltmeter method
2. Kelvin's double bridge method
3. Maxwell's bridge method
4. Potentiometer method
(a) 1,2 and 3 only
(b) 1,2 and 4 only
(c) 1,3 and 4 only
(d) 2,3 and 4 only

41. A thermometer reads 95.45°C and the static correction given in the correction curve is – 0.08°C. The true value of temperature will be
(a) 95.37°C
(b) 95.45°C
(c) 95.65°C
(d) 95. 73°C

42. Unit step response of first order system with transfer function $G(s) = \dfrac{1}{1+\tau s}$ is
(a) $1 - e^{-t/\tau}$
(b) $1 + e^{-t/\tau}$
(c) $1 + e^{t/\tau}$
(d) $1 - e^{t/\tau}$

43. What are the advantages of resistance potentiometer?
1. They are inexpensive
2. They are useful for measurement of large amplitudes of displacement
3. Their electrical efficiency is very high and they provide sufficient output to permit control operations without further amplification
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1,2 and 3

44. What are the salient features of thermistors?
1. They are compact, rugged and inexpensive
2. They have good stability when properly aged
3. The response time of thermistors can vary from a fraction of a second to minutes, depending on the size of the detecting mass and thermal capacity of the thermistor
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1,2 and 3

45. Which of the following land line telemetry systems are available?
1. Voltage telemetry systems
2. Current telemetry systems
3. Position telemetry systems
4. Resistive telemetry systems
(a) 1,2 and 3 only
(b) 1,2 and 4 only
(c) 1,3 and 4 only
(d) 2,3 and 4 only

46. A platinum thermometer has a resistance of 100 Ω at 25°C. The resistance at 65°C for its resistance temperature co-efficient of 0.00392/°C will be nearly
(a) 107.3Ω
(b) 115.7Ω
(c) 123·3Ω
(d) 131.7Ω

47. The capacitive transducer works on the principle of change of capacitance which may be caused by change in
1. Dielectric constant
2. Overlapping area of plates
3. Distance between the plates
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1,2 and 3

48. What are the advantages of capacitive transducers?
1. They are extremely sensitive
2. They have a high input impedance and therefore the loading effects are minimum
3. They have a good frequency response
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1,2 and 3

49. What are the properties of a tree in a network graph?
1. It consists of all the nodes of the graph
2. If the graph has N number of nodes, the tree will have $(N–1)$ branches
3. There will be only one closed path in the tree
(a) 1,2 and 3
(b) 1 and 3 only
(c) 1 and 2 only
(d) 2 and 3 only

50. Which one of the following is the property of incidence matrix?
(a) Determinant of the incidence matrix of a closed loop is zero
(b) The number of independent nodepair terminal is equal to the number of tree branches
(c) Algebraic sum of the row entries of an incidence matrix is zero
(d) Algebraic sum of the column entries of an incidence matrix is always one

51. The Laplace transform of a function $f(t)$ is
$$F(s) = \frac{s+2}{(s+2)^2 + 10^2}$$
The value of $f(0)$ will be
(a) –1
(b) 0
(c) 1
(d) 2

52. A function, in Laplace domain is given by
$$F(s) = \frac{2}{s} - \frac{1}{s+3}$$
Its value by final value theorem in t domain will be
(a) $\lim_{t\to\infty} f(t) = 3$
(b) $\lim_{t\to\infty} f(t) = 2$
(c) $\lim_{t\to\infty} f(t) = 1$
(d) $\lim_{t\to\infty} f(t) = 4$

53. Consider the following experimental readings for a two-port network:

	V_1	V_2	I_1	I_2
Output Open	100 V	60 V	10 A	0
Input Open	30 V	40 V	0	3 A

The values of Z_{11}, Z_{12}, Z_{21} and Z_22 respectively are
(a) 10Ω, 10Ω, 6Ω and 13.33Ω
(b) 6Ω, 10Ω, 10Ω and 6Ω
(c) 10Ω, 6Ω, 10Ω and 13.33Ω
(d) 6Ω, 10Ω, 6Ω and 10Ω

54. The Laplace transform of
$f(t) = 1 - e^{-2t}$ is
(a) $\dfrac{2}{s(s+2)}$
(b) $\dfrac{1}{s(s+2)}$
(c) $\dfrac{2}{s(s-2)}$
(d) $\dfrac{1}{s(s-2)}$

55. For a two-port network, the condition of Symmetry in terms of z-parameters is
(a) $z_{12} = z_{21}$
(b) $z_{11} = z_{22}$
(c) $z_{11} = z_{21}$
(d) $z_{12} = z_{22}$

56. For a two-port network, the condition of Reciprocity in terms of h-parameter is
(a) $h_{12} = h_{21}$
(b) $h_{12} = h_{22}$
(c) $h_{12} = -h_{21}$
(d) $h_{12} = -h_{22}$

57. The initial current is $i(0^+)$, clockwise, and the circuit current being $i(t)$ and

$$v(t) = L.\frac{di(t)}{dt}$$

The above representation in Laplace transform is
(a) $V(s) = [sLI(s) - Li(0^+)]$
(b) $V(s) = [sLI(s)]$
(c) $V(s) = [Li(0^+)]$
(d) $V(s) = [sLI(0^+) + Li(s)]$

58. In a series R-L circuit, R is 10 Ω and L is 20 mH, if the circuit current is 10 sin 314 t A, the phase angle θ between v and i will be
(a) $\tan^{-1}(0.2\,\pi)$ (b) $\tan^{-1}(0.4\,\pi)$
(c) $\tan^{-1}(0.6\,\pi)$ (d) $\tan^{-1}(0.8\,\pi)$

59. A 4 Ω resistor is connected in series with a 10 mH inductor, across a 100 V, 50 Hz voltage source. The impedance of the circuit will be
(a) $5 - j\,3.14$ (b) $5 + j\,3.14$
(c) $4 - j\,3.14$ (d) $4 + j\,3.14$

60. A 100 V, 50 Hz a.c. supply is applied across a series RLC circuit having $R = 10$ Ω, $L = 100$ mH and $C = 1000$ μF.
The current through the circuit will be
(a) $4.33 \angle - 70.5°$A
(b) $3.33 \angle - 70.5°$A
(c) $2.33 \angle - 50.5°$A
(d) $1.33 \angle - 50.5°$A

61. A three-phase full wave rectifier with resistive load has a ripple factor
(a) 0.482   (b) 1.000
(c) 0·055   (d) 0.500

62. If $T_A = 50°C$, $T_J = 200°C$ and $\theta_{J-A} = 100°C/W$, the power that a transistor, 2N1701 can safely dissipate in free air will be
(a) 0.5 W   (b) 1.5 W
(c) 2.5 W   (d) 3.5 W

63. In a differential amplifier, there are two sets of input signals. In first set, $v_1 = +50\mu V$ and $v_2 = -50\mu V$ and in second set, $v_1 = 1{,}050\ \mu V$ and $v_2 = 950\mu V$. If the common mode rejection ratio is 100, the percentage difference in the output voltage for the two sets of input signals will be
(a) 10%   (b) 15%
(c) 20%   (d) 25%

64. A linear ramp ADC uses a 10 bit counting register and a 15kHz clock frequency. The register output is 1111111111 when the input voltage is 100mV. The required ramp rate-of change and the ADC conversion time are nearly
(a) 1.5 V/s and 75 ms
(b) 2.5 V/s and 90 ms
(c) 1.5 V/s and 90 ms
(d) 2.5 V/s and 75 ms

65. An 8-bit DAC produces $V_{out} = 0.05$ V for a digital input of 00000001. The full scale output will be nearly
(a) 12·8 V   (b) 17.8 V
(c) 22·8 V   (d) 27·8 V

66. Master-Slave flip-flop is also called
(a) Pulse triggered flip-flop
(b) Latch
(c) Level triggered flip-flop
(d) Buffer

67. The resolution of 6-bit DAC will be nearly
(a) 4.6%   (b) 3.2%
(c) 1.6%   (d) 1.2%

68. An expression $f = \overline{\overline{ABA} + AB}$ can be reduced to
(a) A (b) B
(c) 0   (d) 1

69. K-map is used to minimize the number of
(a) Flip-flops in digital circuits
(b) Layout spaces in digital circuits for fabrication
(c) Functions of 3,4,5 or 6 variables
(d) Registers in CPU

70. A finite state machine
(a) is same as that of abstract model of sequential circuit
(b) consists of combinational logic circuits only
(c) contains infinite number of memory devices
(d) does not exist in practice

71. A logic circuit that accepts several data inputs and allows only one of them at a time to get through to the output is called
(a) Multiplexer   (b) De-multiplexer
(c) Transmitter   (d) Receiver

72. The memory technology which needs the least power is
    (a) *ECL*   (b) *MOS*
    (c) *CMOS*   (d) *TTL*

73. The mapping function that assigns a number to each outcome is called
    (a) Sample space
    (b) Random variable
    (c) Discrete variable
    (d) Event

74. A device has 200 Ω equivalent noise resistance, 300 Ω input resistor and the bandwidth of the amplifier being 6 MHz. If the operating temperature of the amplifier is 290°K, the noise voltage at the input of a television RF amplifier will be nearly
    (a) 7μV   (b) 5μV
    (c) 3μV   (d) 1μV

75. When unmodulated carrier alone is transmitted, the antenna current is 9A. When sinusoidal modulation is present, the antenna current is 11 A. The modulation index used will be nearly
    (a) 0.994   (b) 0.764
    (c) 0.546   (d) 0.326

76. Frequency modulated signal with single-tone modulation has a frequency deviation of 15kHz and bandwidth of 50kHz. The frequency of the modulating signal will be
    (a) 05kHz
    (b) 10kHz
    (c) 20kHz
    (d) 30kHz

77. When the carrier and one of the sidebands are suppressed in an AM wave modulated to a depth of 50%, the power saving will be
    (a) 84.4%   (b) 88.6%
    (c) 94.4%   (d) 98·6%

78. An output of balanced modulator contains
    (a) Carrier, *LSB* and *USB*
    (b) Modulation frequency, carrier frequency and *LSB*
    (c) Modulation frequency, carrier frequency and *USB*
    (d) Modulation frequency, *LSB* and *USB*

79. The temperature of a particular place varies between 14°C and 34°C. For the purpose of transmitting the temperature record of that place using *PCM* the record is sampled at an appropriate sampling rate and the samples are quantized. If the error in the representation of the samples due to quantization is not to exceed ±1% of the dynamic range, the minimum number of quantization levels that can be used will be
    (a) 40   (b) 50
    (c) 60   (d) 70

80. A telephone signal band limited to 4kHz is to be transmitted by *PCM*. If the signal to quantization noise is to be at least of 40 dB, the number of levels into which the signal is to be encoded will be
    (a) 32   (b) 64
    (c) 81   (d) 128

81. To avoid slope overload error in delta modulation, the maximum amplitude of the input signal is
    (a) $A \le 2\pi f_m$ (b) $A \le \sin 2\pi f_m$
    (c) $A \le \dfrac{2\pi f_m}{\Delta f_s}$ (d) $A \le \dfrac{\Delta f_s}{2\pi f_m}$

82. If bandwidth is of primary concern, which one of the following scheme is generally not considered?
    (a) *PSK*   (b) *ASK*
    (c) *DPSK*   (d) *FSK*

83. The process of assigning to each one of the sample values of the message signal, a discrete value from a prescribed set of a finite number of such discrete values is called
    (a) Filtering   (b) Noise removal
    (c) Decoding   (d) Quantization

84. Which one of the following types of fiber suffers with modal dispersion?
    (a) Single-mode step-index fiber
    (b) Multimode graded-index fiber
    (c) Multimode step-index fiber
    (d) Single-mode graded-index fiber

85. An inductor is described by input-output relation as

$$y(t) = \frac{1}{L} \int_{-\infty}^{t} x(\tau) d\tau$$

The operation representing the inverse system $x(t)$ will be

(a) $L \dfrac{d}{dt} y(t)$

(b) L

(c) $\dfrac{d}{dt} y(t)$

(d) $Ly(t)$

86. Step response of the system is defined as
   1. The output due to a unit step input signal
   2. The running sum of impulse response
   3. The running integral of impulse response for a continuous-time system
   (a) 1 and 2 only
   (b) 1 and 3 only
   (c) 2 and 3 only
   (d) 1,2 and 3

87. The signal flow graph of a system is constructed from its
   (a) Differential equations
   (b) Algebraic equations
   (c) Algebraic equations through the cause-and-effect relations
   (d) Differential equations through the cause-and-effect relations

88. If all the roots of the characteristic equation have negative real parts, the system is
   (a) Stable
   (b) Unstable
   (c) Marginally stable
   (d) Conditionally stable

89. A unity feedback system is characterized by the open loop transfer function

$$G(s) = \frac{1}{s(0.5s+1)(0.2s+1)}$$

The steady state errors for unit-step and unit-ramp inputs are respectively
   (a) 0 and 0
   (b) 0 and 1
   (c) 1 and 0
   (d) 1 and 1

90. Which of the following statements are correct?
   1. A continuous time system is said to be time invariant if the parameters of the system do not change with time
   2. The characteristics of timeinvariant system are fixed over a time
   3. If the input to the time invariant system is delayed by t_0 seconds, the characteristics of the output response is also delayed by t_0 seconds
   (a) 1 and 2 only
   (b) 1 and 3 only
   (c) 2 and 3 only
   (d) 1,2 and 3

91. If any root of the characteristic equation has a positive real part or if there is a repeated root on the $j\omega$-axis, then the system is
   (a) Limitedly stable
   (b) Conditionally stable
   (c) Stable
   (d) Unstable

92. The angle of departure from a real open-loop pole and the angle of arrival at a real open-loop zero is always equal to
   (a) $0°$ only
   (b) $90°$ only
   (c) $180°$ only
   (d) $0°$ or $180°$

93. The important aspects in the study of feedback systems are to control
   1. Sensitivity
   2. Effect of an internal disturbance
   3. Distortion in a nonlinear system
   (a) 1 and 2 only
   (b) 1 and 3 only
   (c) 2 and 3 only
   (d) 1,2 and 3

94. In a type-1, second-order system, the first undershoot occurs at a time t (with standard notations) is

(a) $\dfrac{\pi}{\omega_d}$

(b) $\dfrac{2\pi}{\omega_d}$

(c) $\dfrac{\pi}{2\omega_d}$

(d) $\dfrac{2\omega_d}{\pi}$

95. The compensator required to improve the steady state response of a system is
   (a) Lag
   (b) Lead
   (c) Lag-lead
   (d) Zero

96. Which one of the following types of controller is sometimes called automatic reset?
   (a) Proportional
   (b) Integral
   (c) Derivative
   (d) PID

97. The transfer time T of the disk is

(a) $\dfrac{2b}{rN}$ (b) $\dfrac{rb}{N}$

(c) $\dfrac{rN}{b}$ (d) $\dfrac{b}{rN}$

where : b = Number of bytes to be transferred

N = Number of bytes on a track track

r = Rotation speed in rps

98. A core of processor chip consists of
1. ALU
2. Instruction logic
3. Load/store logic
4. L3 cache
5. L1 data cache
(a) 1,2,3 and 4 only   (b) 1,2,3 and 5 only
(c) 2,3,4 and 5 only   (d) 1,4 and 5 only

99. Which of the following will cause internal interrupt to CPU?
1. Stack overflow
2. Attempt to divide by zero
3. I/O device finished transfer of data
4. Power failure
(a) 1 and 2 only   (b) 2 and 3 only
(c) 3 and 4 only   (d) 1 and 4 only

100. In an assembly language program END is a/an
(a) Machine instruction
(b) Pseudo instruction
(c) Micro instruction
(d) Interrupt

101. Booth algorithm is associated with
(a) Binary division
(b) Binary integer multiplication
(c) Sorting binary integers
(d) Searching of binary data

102. The memory that communicates directly with CPU is called
(a) Auxiliary memory
(b) USB storage
(c) Main memory
(d) Micro-program memory

103. Virtual memory is normally implemented by
(a) Demand paging   (b) Buses
(c) Device drivers   (d) Bus Matrix

104. Which of the following are the computer memory performance parameters?
1. Access time (Latency)
2. Memory cycle time
3. Transfer rate
(a) 1 and 2 only   (b) 1 and 3 only
(c) 2 and 3 only   (d) 1,2 and 3

105. What are the components of a memory management unit?
1. A facility for dynamic storage relocation
2. Provision for preventing users for sharing programs stored in memory by different users
3. Protection of information against unauthorized access
4. Provision for users for changing operating system functions
(a) 1 and 3 only   (b) 1 and 4 only
(c) 2 and 3 only   (d) 2 and 4 only

106. Which one of the following makes permanently recorded transaction in the database?
(a) View
(b) Commit
(c) Roll back
(d) Flash back

107. The advantage of optimistic locking is
(a) The lock is obtained only after the transaction has processed
(b) The lock is obtained only before the transaction has processed
(c) The lock never needs to be obtained
(d) The lock transactions are best suited with a lot of activity

108. The ability to query information from the database, insert, delete and modify the tuples is
(a) Data Definition Language (DDL)
(b) Data Manipulation Language (DML)
(c) Storage Definition Language (SDL)
(d) Relational Schema

109. In a pair of straight parallel bus bars of circular cross-section spaced 23 cm between centres, each carry a current of 70,000 A. The force required to withstand will be nearly
(a) 4,800 N/m
(b) 4,620 N/m
(c) 4,440 N/m
(d) 4,260 N/m

110. Consider the following two points $M(2, 5, -3)$ and $N(-3, 1, 4)$
The distance from the origin to the mid-point of the line MN will be nearly
(a) 3·1 units   (b) 2.3 units
(c) 1.5 units   (d) 0.7 units

111. Consider $\vec{D} = 10x\bar{a}_x - 4y\bar{a}_y + kz\bar{a}_z \mu C/m^2$ and $\vec{B} = 2\vec{a}_y mT$, to satisfy the Maxwell's equation for region $\sigma = 0$ and $\rho_v = 0$, the value k will be
(a) $-8\mu C/m^3$
(b) $-6\mu C/m^3$
(c) $-4\mu C/m^3$
(d) $-2\mu C/m^3$

112. A 4-pole, wave wound armature having 45 slots with 18 conductors/ slot is driven at 1200 *rpm*. If the flux per pole is 0.016 Wb, the generated emf will be
(a) 534.4 V   (b) 526.8 V
(c) 518.4 V   (d) 502.8 V

113. for a terminated uniform transmission line, the impedance Z_x at a distance x from the load will be
(a) $Z_0 \dfrac{Z_L + Z_0 \tan h\gamma x}{Z_0 + Z_L \tan h\gamma x}\Omega$
(b) $Z_L \dfrac{Z_L + Z_0 \tan h\gamma x}{Z_0 + Z_L \tan h\gamma x}\Omega$
(c) $Z_0 \dfrac{Z_L + jZ_0 \tan h\gamma x}{Z_0 + jZ_L \tan h\gamma x}\Omega$
(d) $Z_L \dfrac{Z_L + jZ_0 \tan h\gamma x}{Z_0 + jZ_L \tan h\gamma x}\Omega$
Where: Z_0 = Characteristic impedance of line, Ω
Z_L = Load impedance, Ω
γ = Propagation constant = $\alpha + j\beta$, m^{-1}
α = Attenuation constant, Np m^{-1}
β = Phase constant, rad m^{-1}

114. The depth of penetration δ of a plane electromagnetic wave incident normally on a good conductor is
(a) $\dfrac{1}{\sqrt{2\pi f \mu\sigma}}$ (b) $\dfrac{1}{\sqrt{\pi f \mu\sigma}}$
(c) $\dfrac{2}{\sqrt{3\pi f \mu\sigma}}$ (d) $\dfrac{2}{\sqrt{\pi f \mu\sigma}}$
Where : f = Frequency in Hz
σ = Conductivity in Siemens per meter

115. A rectangular waveguide is 5.1 cm by 2.4 cm (inside measurements). The cutoff frequency of the dominant mode will be nearly
(a) 5.38 GHz   (b) 4.54 GHz
(c) 3.78 GHz   (d) 2.94 GHz

116. If aperture efficiency is 70%, the directivity D of a parabolic dish antenna as a function of its radius is
(a) $20\left(\dfrac{r}{\lambda}\right)^2$ (b) $28\left(\dfrac{r}{\lambda}\right)^2$
(c) $36\left(\dfrac{r}{\lambda}\right)^2$ (d) $44\left(\dfrac{r}{\lambda}\right)^2$

117. An antenna radiates isotropically over a half-space above a perfectly conducting flat ground plane. If E = 50 mV m^{-1} *rms* at a distance of 1 km and the antenna terminal current I = 3.5. A, the radiation resistance will be
(a) 3.4 Ω (b) 4.3 Ω
(c) 5.2 Ω (d) 6.1 Ω

118. Which one of the following is the correct relationship between an antenna gain G and an effective area A_e?
(a) $G = \dfrac{4\pi f^2 A_e}{c^2}$ (b) $G = \dfrac{3\pi f^2 A_e}{c^2}$
(c) $G = \dfrac{2\pi f^2 A_e}{c^2}$ (d) $G = \dfrac{0.5\pi f^2 A_e}{c^2}$
Where : f = Carrier frequency
c = Speed of light

119. The signal-to-noise ration $\dfrac{S}{N}$ for isotropic antenna is
(a) $\dfrac{\lambda^2}{16\pi^2 r^2 kT_{sys}B}$ (b) $\dfrac{\lambda^2}{14\pi^2 r^3 kT_{sys}B}$
(c) $\dfrac{\lambda^2}{12\pi^2 r^4 kT_{sys}B}$ (d) $\dfrac{\lambda^2}{10\pi^2 r^4 kT_{sys}B}$
Where : λ = Wavelength, m
r = distance from transmitter to receiver, m
T_{sys} = system temperature, K
B = Bandwidth, Hz
k = Boltzmann's constant

120. consider a cube defined by

$$x, y, z \in [1, 3]$$

If Vector, $A = 2x^2 y a_x + 3x^2 y^2 a_y,$

$\nabla \cdot \vec{A}$ at the centre of the cube will be

(a) 72 (b) 64

(c) 60 (d) 48

121. Which of the following steps are followed by HIS during synthesis?
1. Data model generation
2. Data flow analysis
3. Scheduling and allocation
4. Data path optimization
5. Control optimization

(a) 1, 3 and 5 only
(b) 2, 4 and 5 only
(c) 1, 2, 3 and 4 only
(d) 1, 2, 3, 4 and 5

122. Pipelining
1. Reduces clock period of long combinational operations
2. Allows large combinational functions to be broken down into pieces whose delays are balanced with the rest of the system components

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

123. Superscalar processor consists of
(a) Single pipeline for instruction execution
(b) Multiple-instruction pipelines for instruction execution
(c) No pipelines for instruction execution
(d) Multiple combination of hardware for execution

124. Which of the following statements is/are correct?
1. In hybrid parameter representation, both short and open circuit terminal conditions are utilized
2. The voltage of output port and the current of input port are expressed in terms of current of output and voltage of input port

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

125. Consider the following measurements on a two terminal network :
1. When a voltage of $100\angle 0°$ volts applied at input port with output port open, $I_1 = 20\angle 0°$ A and $V_2 = 25\angle 0°$ V
2. When a voltage of $100\angle 0°$ volts applied at output port with input port open, $I_2 = 10\angle 0°$ A and $V_1 = 50\angle 0°$V

The driving point impedances Z_{11}, Z_{22} and transfer impedances Z_{21}, Z_{12} respectively are

(a) 5Ω, 10Ω and 1.25Ω, 5Ω
(b) 10Ω, 5Ω and 1.25Ω, 5Ω
(c) 5Ω, 1.25Ω and 5Ω, 10Ω
(d) 10Ω, 1.25Ω and 5Ω, 5Ω

126. In a second order digital notch filter having notch frequency of 60 Hz and a 3-dB notch bandwidth of 6 Hz and sampling frequency employed is 400 Hz. The normalized angular notch frequency ω_0 and the normalized angular 3-dB bandwidth $\Delta\omega_{3dB}$ are

(a) $0.3\,\pi$ and $0.03\,\pi$ (b) $0.6\,\pi$ and $0.03\,\pi$
(c) $0.3\,\pi$ and $0.06\,\pi$ (d) $0.6\,\pi$ and $0.06\,\pi$

127. The two channel bank with multirate digital filter structure that employs two decimators in the signal analysis section and two interpolators in the signal synthesis section is called
(a) Multirate signal processing bank
(b) Sub-coding and analysis bank
(c) Sub-band speech coder bank
(d) Quadrature mirror filter bank

128. Which of the following are the advantages of digital filters over analog. filters?
1. Highly flexible
2. Portable
3. Negligible noise interference
4. Lumped *RLC* components

(a) 1, 2 and 3 only
(b) 1, 2 and 4 only
(c) 1, 3 and 4 only
(d) 2, 3 and 4 only

129. The realization of a length *M FIR* filter for a linear phase structure, the number of multipliers required is

(a) $\left[\dfrac{M+1}{2}\right]$ (b) $2M$

(c) M (d) $M - 1$

130. Which one of the following statements is not correct regarding a usage of virtual memory?
    (a) To free user programs from the need to carryout storage allocation and to permit efficient sharing of the available memory space among different users
    (b) To make program independent of the configuration and capacity of the physical memory for their execution
    (c) To achieve higher CPU performance.
    (d) To achieve the very low access time and cost per bit that is possible with a memory hierarchy

131. In the 8051 microcontroller, direct addressing mode is used in
    (a) Internal data memory
    (b) External data memory
    (c) Internal program memory
    (d) External program memory

132. PUSH and POP operations are performed by
    (a) Program counter register
    (b) General purpose register
    (c) Stack pointer register
    (d) Link register

133. Network Interface Card (NIC) has a unique six-byte permanent address as
    (a) IP address
    (b) MAC address
    (c) DNS address
    (d) Local address

134. The data-link layer is responsible for
    (a) Incoming bit stream and simply repeats to other devices connected
    (b) An error free communication across the physical link connecting primary and secondary stations within a network
    (c) An end-to-end integrity of data message propagated through the network between two devices
    (d) Logical connection at application layer

135. The transmit carrier frequency f_t and receive carrier frequency f_r for AMPS channels-3 are nearly
    (a) 875 MHz and 870 MHz
    (b) 825 MHz and 870 MHz
    (c) 875 MHz and 830 MHz
    (d) 825 MHz and 830 MHz

136. Which one of the following mode is called a two-way simultaneous, communication between two stations?
    (a) Simplex (SX)
    (b) Half duplex (HDX)
    (c) Full duplex (FDX)
    (d) Full/Full duplex (F/FDX)

137. Blocked calls may be handled in one of two ways. First blocked calls can be put in a queue awaiting a free channel. This is termed as
    (a) Lost Calls Cleared (LCC)
    (b) Lost Calls Delayed (LCD)
    (c) Lost Calls Held (LCH)
    (d) Lost Calls Hand off

138. Satellite communication among stations in different areas can be achieved if the satellite has the ability to switch time slots from one beam to another. This is known as satellite switched
    (a) TDMA   (b) TSMA
    (c) FAMA   (d) SCPC

139. A coherent binary phase shift keyed (BPSK) transmitter operates at a bit rate of 20 Mbps. For a probability of error $P(e)$ of 10^{-4}, the ratio $\frac{C}{N} = 8.8 dB$, the minimum theoretical $\frac{E_b}{N_0}$ ration for a receiver bandwidth equal to the minimum double-sided Nyquist bandwidth will be
    (a) 4.8 dB   (b) 6.4 dB
    (c) 8.8 dB   (d) 10.4 dB

140. For a total transmit power (P_t) of 1000 W and for a transmission rate of 50 Mbps, the energy per bit (E_b) will be
    (a) 10 μJ (b) 20 μJ
    (c) 30 μJ (d) 40 μJ

141. A combination of direct sequence and frequency hopping is called
    (a) Direct sequence hopping
    (b) Hybrid direct frequency hopping
    (c) Direct sequence frequency hopping
    (d) Hybrid direct sequence frequency hopping

142. Each earth station's transmission is encoded with a unique binary word called
    (a) Station code   (b) Chip code
    (c) Access code   (d) Gold code

143. For a 300 m optical fibre cable with *BLP* of 600 MHz-km, the bandwidth will be
(a) 8 GHz   (b) 6 GHz
(c) 4 GHz   (d) 2 GHz

144. Numerical aperture (*NA*) in optical fibre transmission is used to describe
(a) Light spreading ability
(b) Light gathering or light collecting ability
(c) Light output from external shield
(d) Light leakage ability

Directions :
Each of the next Six (06) items consists of two statements, one labelled as the 'Statement (I)' and the other as 'Statement (II)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :

Codes:
(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)
(c) Statement (I) is true but Statement (II) is false
(d) Statement (I) is false but Statement (II) is true

145. **Statement (I) :** Channel vocoder (voice coder) is an analysis synthesis system.

Statement (II) : For voiced signal, the excitation is a white noise and for an unvoiced signal, the excitation is a periodic signal.

146. **Statement (I) :** Control logic in *CMOS* is constructed using two-level *SOP* logic and multilevel logic.
Statement (II) : Typical *PLA* uses multilevel logic.

147. **Statement (I):** *ABCD* parameters are widely used in analysis of power transmission engineering and termed as circuit parameters.

Statement (II) : *ABCD* parameters are called as transmission parameters.

148. **Statement (I) :** Non-stationary signals such as an image require time-frequency analysis.

Statement (II) : The short time Fourier transform (*STFT*) can map a one dimensional function $f(t)$ into the two-dimensional function, *STFT* (*f*).

149. **Statement (I) :** *PCM* requires a very complex encoding and quantization circuitry.
Statement (II) : *PCM* requires a less bandwidth compared to analog systems.

150. **Statement (I) :** For an unstable feedback system, the gain margin is negative or the phase margin is positive.

Statement (II) : For a stable feedback system, both gain margin and phase margin must be positive.

○○○○