Ph.D ENTRANCE EXAMINATION-2016

Name of the candidate: _____ DATE: 16.06.2016
TIME: 2 HOURS   MAX. MARKS: 100

ANSWER ALL QUESTIONS

1. Norton's theorem states that a complex network connected to a load can be replaced with equivalent impedance
 (A) in series with a current source   (B) in parallel with a voltage source
 (C) in series with a voltage source   (D) in parallel with a current source

2.A silicon bar is doped with donor impurities $N_D = 2.25 \times 10^{15}$ atoms / cm3 . Given the intrinsic carrier concentration of silicon at T = 300 K is $n_i = 1.5 \times 10^{10}$ cm -3. Assuming complete impurity ionization, the equilibrium electron and hole concentrations are
(A) $n_0 = 1.5 \times 10^{16}$ cm -3 , $p_0 = 1.5 \times 10^{5}$ cm -3   (B) $n_0 = 1.5 \times 10^{10}$ cm -3 , $p_0 = 1.5 \times 10^{15}$ cm -3 (C) $n_0 = 2.25 \times 10^{15}$ cm -3 , $p_0 = 1.5 \times 10^{10}$ cm -3   (D) $n_0 = 2.25 \times 10^{15}$ cm -3 , $p_0 = 1 \times 10^{5}$ cm -3

3.An increase in the base recombination of a BJT will increase
 (A) the common emitter dc current gain β (B) the breakdown voltage BVCEO
 (C) the unity-gain cut-off frequency fT   (D) the transconductancegm

4.In CMOS technology, shallow P-well or N-well regions can be formed using
 (A) low pressure chemical vapour deposition   (B) low energy sputtering
(C) low temperature dry oxidation   (D) low energy ion-implantation

5. The feedback topology in the amplifier circuit (the base bias circuit is not shown for simplicity) in the figure is
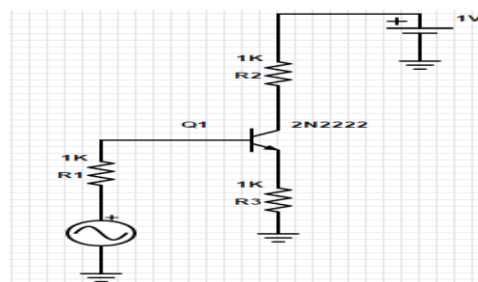
 (A) Voltage shunt feedback   (B) Current series feedback
(C) Current shunt feedback   (D) Voltage series feedback

6. In the differential amplifier shown in the figure, the magnitudes of the common-mode and differential-mode gains are Acm and Ad, respectively. If the resistance RE is increased, then
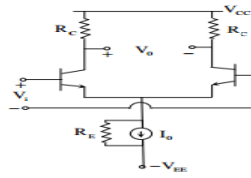
(A) Acm increases

(B) common-mode rejection ratio increases

(C) Ad increases

(D) common-mode rejection ratio decreases

7. For an n-variable Boolean function, the maximum number of prime implicants is

(A) $2^{(n-1)}$

(B) n/2

(C) 2n

(D) $2(n-1)$

8. The number of bytes required to represent the decimal number 1856357 in packed BCD (Binary Coded Decimal) form is _____ .

(A) 2

(B) 3

(C) 5

(D) 4

9. In a half-subtractor circuit with X and Y as inputs, the Borrow (M) and Difference (N = X - Y) are given by

(A) $M = X, \oplus Y, N = XY$

(B) $M = XY, N = X \oplus Y$

(C) $M = X Y , \oplus N = X \oplus Y$

(D) $M = XY \; N = X Y$

10. An FIR system is described by the system function $H(z)=1+\frac{7}{2}z^{-1} +\frac{3}{2}z^{-2}$.The system is

(A) Maximum phase

(B) minimum phase

(C) Mixed phase

(D) zero phase

11. A bulb in a staircase has two switches, one switch being at the ground floor and the other one at the first floor. The bulb can be turned ON and also can be turned OFF by any one of the switches irrespective of the state of the other switch. The logic of switching of the bulb resembles

(A) an AND gate

(B) an OR gate

(C) an XOR gate

(D) a NAND gate

12. Frequencies in the UHF range propagate by means of

A. space wave

B. surface waves

C. sky waves

D. ground waves

13. Which of the following can be accessed only sequentially?

A.Floppy disk

B.Hard disk

C.Magnetic tap

D.ROM

14. Which of the following is not an integer constant?

A.0   B.-8   C. -8.1   D.+1074

15. Which of the following can not be used as a variable name in C?

A.   else   B.   coal   C.   ram   D.   vendy

16. A 256 x 4 EPROM has

A.8 address pins and 4 data pins   B. 8 address pins and 8 data pins

C.4 address pins and 8 data pins   D.4 address pins and 4 data pins

17. Which of the following is a computer language?

A.   MS WORD   B. Page maker   C.   MS EXCEL   D.   LISP

18. Z flag is reset if an ALU operation results in 0.

A.   True   B.   False

19. Maximum efficiency of class B power amplifier is 50%.

A.   True   B.   False

20. Which power amplifier can deliver maximum load power?

A.   Class A   B.   Class AB   C.   Class B   D.   Class C

21. When a transistor is to be at a temperature above 25°C

A.   smaller heat sink be provided

B.   maximum power rating be derated

C.   biasing circuit must be strengthened

D.   earth connections must be connected through a resistor

22. The most widely used LC oscillator is

A.   Hartley oscillator

B.   Crystal oscillator

C.   Colpitt's oscillator

D.   Clapp's oscillator

23. The current through common emitter resistor of a differential amplifier is called

A. differential current   B. emitter current   C. ground current   D. tail current

24. Magnetic flux density has the dimensions

A. $MI^{-1}T^{-2}$

B. $M^{-1}I^{-2}T^{-2}$

C. $ML^{-3}T^{-2}$

D. $MI^{-1}T^{-3}$

25. If C is spring constant and θ is deflection, controlling torque is

A. $C\theta$

B. C/θ

C. θ/C

D. $C^2\theta$

26. $Z_L = 200\ \Omega$ and it is desired that $Z_i = 50\ \Omega$ The quarter wave transformer should have a characteristic impedance of

A. $100\ \Omega$ B. $40\ \Omega$ C. $10000\ \Omega$ D. $4\ \Omega$

27. The radiation resistance of a $\lambda/16$ wire dipole in free space will be nearly

A. $1\ \Omega$ B. $3\ \Omega$ C. $13\ \Omega$ D. $30\ \Omega$

28. For an incident wave which is normal on the perfect dielectric the reflection factor is given by (where ε_1 and ε_2 are the permittivities of 1st and 2nd medium respectively)

A. $\dfrac{\sqrt{\varepsilon_1}}{\varepsilon_1 + \varepsilon_2}$ B. $\dfrac{2\sqrt{\varepsilon_1}}{\sqrt{\varepsilon_1} + \sqrt{\varepsilon_2}}$ C. $\dfrac{\varepsilon_1}{\varepsilon_1 + \varepsilon_2}$ D. $\dfrac{\varepsilon_2}{\varepsilon_1 - \varepsilon_2}$

29. For an antenna radiation and induction fields are

A. $\dfrac{\lambda}{3\pi}$ B. $\dfrac{\lambda}{2\pi}$ C. $\dfrac{\lambda}{4\pi}$ D. $\dfrac{\lambda}{\pi}$

30. A folded dipole antenna is conveniently connected to

A. shielded line   B. two wire line   C. coaxial line   D. flat ribbon type transmission line

31. The velocity factor of a transmission line depends on

A. temperature

B. skin effect

C. relative permittivity of dielectric

D.   none of the above

32. The reflection coefficient on a line is 0.2 ∠45°. The SWR is

A.   0.8   B.   1.1

C.   1.2   D.   1.5

33. The system y(t) = x(t) + 2x(t + 3) is
A. causal system.   B. non-causal system   C. partly (a) and partly (b)   D. none of
these

34. The system $\dfrac{dy(t)}{dt} + 3y(t) = x(t)$ is a

A. time invariant system   B. time-variant system C. partly (a) and partly (b)   D. none of
these

35. An energy signal has G(f) = 10. Its energy density spectrum is

A.   10   B.   100

C.   50   D.   20

36. If $H(f) = \dfrac{y(t)}{x(t)}$ then for this to be true $x(t)$ is

A.   exp   B.   exp (-   C.   exp   D.   exp (-
      (j2□ f/t)   j2□ f/t)   (j2□ ft)   j2□ f/t)

37. An electric field on a plane is described by its potential $V = 20(r^{-1} + r^{-2})$ where r is the
distance from the source. The field is due to
(a) a monopole   (b) a dipole   (c) both a monopole and a dipole   (d) a quadrupole

38. Identify which one of the following will NOT satisfy the wave equation.

(a) $50e^{j(\omega t - 3z)}$ (b) $\sin[\omega(10z + 5t)]$ (c) $\cos(y^2 + 5t)$ (d) $\sin(x) . \cos(t)$
39. The unit of $\nabla \times H$ is
(a) Ampere   (b) Ampere/meter   (c) Ampere/meter^2 (d) Ampere-meter

40. Consider a closed surface S surrounding a volume V. If $\hat{r}$ is the position vector of a point
inside S, with $\hat{n}$ the unit normal on S, the value of the integral $\oint 5\vec{r} \cdot \hat{n}\, ds$ is

(a) 3 V   (b) 5 V   (c) 10 V
(d) 15 V

41. Consider a vector field $\bar{A}(\bar{r})$. The closed loop line integral $\oint \vec{A} \cdot \vec{dl}$ can be expressed as

(a) $\oiint (\nabla \times \vec{A}) \cdot \vec{ds}$ over the closed the closed volume bounded by the loop
(b) $\oiiint (\nabla \cdot \vec{A}) \, dv$ over the closed volume bounded by the loop
(c) $\iiint (\nabla \times \vec{A}) \, dv$ over the open volume bounded by the loop
(d) $\iint (\nabla \times \vec{A}) \cdot \vec{ds}$ over the open surface bounded by the loop

42. The divergence of the vector field $\vec{A} = x\hat{a}x + y\hat{a}y + z\hat{a}z$ is

(a) 0   (b)1/3   (c) 1   (d)3

43. In the system shown below, $x(t) = (\sin t)u(t)$. In steady-state, the response $y(t)$ will be

(a) $1/\sqrt{2} \sin (t - \pi/4)$ (b) $1/\sqrt{2} \sin (t + \pi/4)$

(c) $1/\sqrt{2} \, e^{-t} \sin t$ (d) $\sin t - \cos t$

44. A system with the transfer function $Y(S)/X(S) = S/S+P$ has an output $y(t) = \cos (2t - \pi/3)$ for the input signal $x(t) = p \cos (2t - \pi/2)$. Then, the system parameter 'p' is
(a) $\sqrt{3}$ (b) $2/\sqrt{3}$ (c) 1   (d)$\sqrt{3}/2$

45. Non-minimum phase transfer function is defined as the transfer function

(a) which has zero in the right-half s-plane   (b)which has zero only in the left-half s-plane (c) which has poles in the right-half s-plane   (d)which has poles in the left-half s-plane

46. Which of the following analog modulation scheme requires the minimum transmitted power and minimum channel band-width?

(a) VSB   (b)DSB-SC   (c) SSB
(d)AM

47. Suppose that the modulating signal is $m(t) = 2 \cos(2\pi f_m t)$ and the carrier signal is $x_C(t) = A_C \cos(2\pi f_c t)$. Which one of the following is a conventional AM signal without over-modulation?

(a) $x(t) = A_C m(t) \cos(2\pi f_c t)$ (b)$x(t) = A_C [1 + m(t)] \cos(2\pi f_c t)$ (c) $x(t) = A_C \cos(2\pi f_c t) + A_C/4 \, m(t) \cos(2\pi f_c t)$ (d)$x(t) = A_C \cos(2\pi f_m t) \cos(2\pi f_c t) + A_C \sin(2\pi f_m t) \sin(2\pi f_c t)$

48. A 1 MHz sinusoidal carrier is amplitude modulated by a symmetrical square wave of period 100 μsec. Which of the following frequencies will not be present in the modulated signal?

(a) 990 kHz   (b)1010 kHz   (c) 1020 kHz   (d)1030 kHz

49. A fair is tossed repeatedly until a 'Head' appears for the first time. Let L be the number of tosses to get this first 'Head'. The entropy H(L) in bits is _____

(a) 2   (b)3   (c) 4   (d)8

50. A source alphabet consists of N symbols with the probability of the first two symbols being the same. A source encoder increases the probability of the first symbol by a small amount e. After encoding, the entropy of the source

(a) increases   (b)remains the same   (c) increases only if $N = 2$ (d)decreases

51. A bandlimited signal is sampled at the Nyquist rate. The signal can be recovered by passing the samples through

(a) an RC filter   (b) an envelope detector   (c) a PLL
(d) an ideal low-pass filter with the appropriate bandwidth

52. Flat top sampling of low pass signals

(a) gives rise to aperture effect   (b)implies oversampling
(c) leads to aliasing   (d)introducing delay distortion

53. A 1.0 KHz signal is flat top sampled at the rate of 1800 samples/sec and the samples are applied to an ideal rectangular LPF with cut-off frequency of 1100 Hz, then the output of the filter contains

(a) only 800 Hz component   (b)800 Hz and 900 Hz components
(c) 800 Hz and 1000 Hz components   (d)800 Hz, 900 Hz and 100 Hz components

54. The line code that has zero dc component for pulse transmission of random binary data is

(a) non-return to zero (NRZ)   (b)return to zero (RN)
(c) alternate mark inversion (AM)   (d)none of the above

55. The bandwidth required for the transmission of a PCM signal increases by a factor of _____ when the number of quantization levels is increased from 4 to 64.

(a)12   (b)3   (c) 4   (d)8

56. An analog signal is band-limited to 4 KHz, sampled at the Nyquist rate and the samples levels are assumed to be independent and equally probable. If we transmit two quantized samples per second, the information rate is
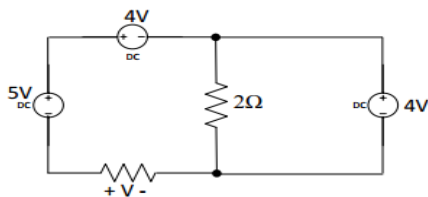
 (a) 1 bit/sec   (b)2 bits/sec   (c) 3 bits/sec   (d)4 bits/sec

57. The value of the resistance, R, connected across the terminals, A and B, (ref. Fig.) which will absorb the maximum power, is
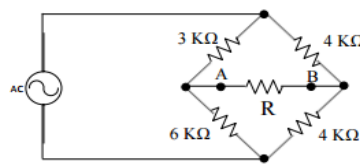
(a) 4.00kΩ   (b) 4.11kΩ   (c) 8.00kΩ   (d) 9.00kΩ

58. The Voltage V in Figure is equal to

(a) 3 V   (b) -3 V   (c) 5 V   (d) None of these

59. The average power delivered to an impedance $(4 - j3)\Omega$ by a current $5 \cos (100\pi t + 100)$ A is

(a) 44.2 W   (b) 50 W   (c) 62.5 W   (d) 125 W

60. A ramp voltage, v(t) = 100 t volts, is applied to an RC differentiating circuit with R = 5 kΩ and C = 4 μF. The maximum output voltage is
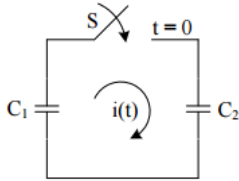
 (a) 0.2 volt   (b) 2.0 volts   (c) 10.0 volts   (d) 50.0 volts

61. A 2 mH inductor with some initial current is in figure. Where s is the laplace transform variable. The value of initial current is
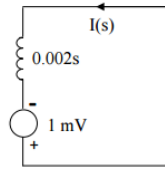
(a) 0.5 A   (b) 2.0 A   (c) 1.0 A   (d) 0.3 A

62. In the following figure C1 and C2 are ideal capacitors. C1 had been charged to 12V before the ideal switch S is closed at t = 0. The current i(t) for all t is

(a) Zero (b) A step function (c) An exponentially decaying function (d) An impulse function

63. D/A converters are generally
a. Weighted resistor network   b. Binary ladder network
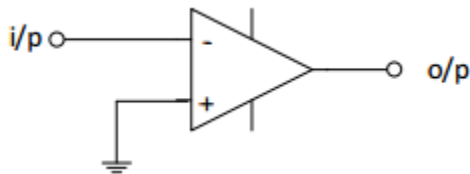c. Either (a) or (b)   d. Neither (a) nor (b)

64. The accuracy of A/D conversion is generally
a. $\pm 1/2\ LSB$ b. $\pm 1/4 LSB$ c. $\pm 5/4\ LSB$ d. None of the above

65. The number of counter states which an 8 bit stair step A/D converter has to pass through before conversion is
a. 1   b. 8   c. 255   d. 256

66. . If the input to the circuit of figure is a sine wave the output will be + i/p - o/p

a. A half wave rectified sine wave   b. A full-wave rectified sine wave
 c. A triangular wave   d. A square wave

67. One input terminal of high gain comparator circuit is connected to ground and a sinusoidal voltage is applied to the other input. The output of comparator will be

a. a sinusoid   b. a full rectified sinusoid   c. a half rectified sinusoid   d. a square wave

68. If a JFET has IDSS=8mA and VP=4V, then RDS equals

a. 200Ω   b. 320 Ω   c. 500 Ω   d. 5K Ω

69. A transconductance amplifier has
 a. High input impedance and low output impedance
 b. Low input impedance and high output impedance
 c. High input and output impedances
 d. Low input and output impedances

70. The main advantage of C-MOS is its
a. High power rating   b. Small signal operation
 c. Switching capability   d. Low power consumption

71. The VGS(on) of an N channel E-MOSFET is
 a. Less than threshold voltage   b. Equal to gate source
cutoff voltage c. Greater than VDS(on)   d. Greater
than VGS(th)
72. The current I_{CBO} flows in the
a. emitter and base leads   b. collector and base leads
 c. emitter and collector leads   d. none of these

73. Let $x(n) = (1/ 2)^n u(n)$, $y(n) = x^2 (n)$ and $Y(e j\omega)$ be the Fourier Transform of $y(n)$.
Then $y(e^{j0})$ is
(a) 1/ 4   (b) 2   (c) 4   (d) 4/ 3

74. The power in the signal $s(t) = 8cos (20\pi t - \pi/ 2) + 4sin(15\pi t)$ is
 (a) 40   (b) 41   (c) 42   (d) 82

75. If a signal f(t) has energy E, the energy of the signal f(2t) is equal to
 (a) E   (b)E/2   (c) 2E   (d)4E

76. The trigonometric Fourier series of a periodic time function can have only
 (a) cosine terms   (b)sine terms   (c) cosine and sine terms   (d)dc and cosine terms

77. A 10 bit D/A converter given a maximum output of 10.23V. The resolution is
 a. 10 mV   b. 20 mV   c. 15 Mv   d. 25 mV

78. The bit rate of a digital communication system is R kbits/s. The modulation used is 32-QAM.
The
minimum bandwidth required for ISI free transmission is
(A)R/10 Hz   (B) R/10 kHz   (C) R/5 Hz   (D) R/5 kHz

79. Which term applies to the maintaining of a given signal level until the next sampling?
   a) Holding   c) Aliasing
   b) Shannon frequency sampling   d) "Stair-stepping"
80. What is the minimum frequency at which a crystal will oscillate?
   a) seventh harmonic   c) third harmonic
   b) fundamental   d) second harmonic
81. Doppler shift is given by_____
   (a) 2ct/Vr   (b)2I/Vr   (c)2VrC/t   (d)2Vr/t
82. A hollow rectangular waveguide acts as a
   (a) High pass filter   (b) Low pass filter
   (c) Band pass filter   (d) Low frequency radiator

83. Leakage power is inversely proportional to ___.
a) Frequency b) Load Capacitance c) Supply voltage d) Threshold Voltage

84. A bulb rated at 60W, 120V is used for 30 minutes. The charge associated with this operation is

 (a) 3600 C   (b) 900 C (c) 7200 C (d) 60C

85. Which one of the following conditions will not gurantee a distortionless transmission line

 (A) R = 0 = G   (B) RC = LG   (C) very low
frequency range (R>>ωL, G >> ωC)   (D) very high frequency range (R<<< ωC)

86. Refer to the given figure. If the zener diode had a rating of 1.7 V, the output voltage would be
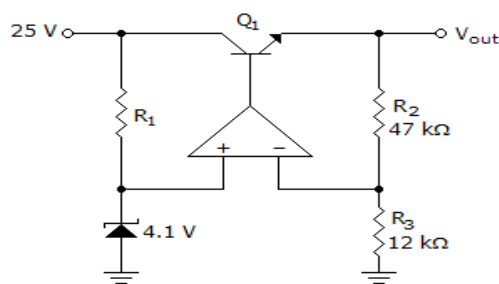
   A.   2.13 V.   B.   8.36 V.   C.   20.16 V.   D.   25 V.

87. Calculate the voltage regulation of a power supply having V_{NL} = 50 V and V_{FL} = 48 V.

   A.   4.17%   B.   5.2%

   C.   6.2%   D.   7.1%

88. A diode which behaves like a variable capacitor on applying a reverse bias --------------------
        a. P-N Junction Diode   b. Varactor Diode   c. Schottky Diode   d. PIN Diode

89. In VMOS, the drain current is in the order of _____
    a.Tens of amperes   b.Hundreds of amperes
    c.Tens of miliamperes   d.Hundreds of microamperes

90. Deep junction and very high concentrations are not possible in
    a.oxidation   b.diffusion   c.ion implanation   d.photolithography

91. _____ theorem is useful in finding out whether the given network function is Physically realizable.
    a.Brune   b.Hurwitz   c.Bott-Duffin   d.Residue

92.How long is an IPv6 address?

 A.   32 bits   B.   128 bytes C. 64 bits   D.   128 bits

93. Which one of the following is not a function of network layer?
a) Routing
b) inter-networking
c) congestion control
d) none of the mentioned

94. De-emphasis circuit is used_____

a.after modulation   b.after demodulation

c.prior to demodulation   d.prior to modulation

95. A network that provides a constant bandwidth for the complete duration of a message transfer is a:
 a.cell switched network.   b.circuit switched network.
 c.packet switched network.   d. none of these.

96.The operational modes of DCF used in IEEE 802.11 networks are:
a.CSMA/CA and RTS/CTS.   b.CSMA/CD and RTS/CTS.
c.Polling and RTS/CTS.   d.Polling and CSMA/CA.

97.Mod-6 and mod-12 counters are most commonly used in:
    a) frequency counters   b) multiplexed displays   c) digital clocks
    d) power consumption meters

98.How much flux is there in a magnetic field when its flux density is 5000 μ T and its cross-sectional area is 300 mm^2?
    a)16.67 mWb   b) 5.0 μ Wb   c) 3.0 mWb   d) 1.5 μ Wb

99.Which protocol does DHCP use at the Transport layer?

 A.   IP   B.   TCP   C.   UDP   D.   ARP

100.Which one of the following routing algorithm can be used for network layer design?
a) shortest path algorithm
b) distance vector routing
c) link state routing
d) all of the mentioned