CET(PG)-2015

Sr. No. : 221041

Question Booklet Series : A

Subject : M.E. (Electronics & Communication Engineering)

Time : 90 minutes   Number of Questions : 75   Maximum Marks : 75

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SEAL

1. Twelve 6 Ω resistors are used as edge to form a cube. The resistance between two diagonally opposite corners of the cube is :

   (A) $\frac{5}{6}\Omega$

   (B) $\frac{6}{5}\Omega$

   (C) 5 Ω

   (D) 6 Ω

2. A capacitor is charged by a constant current of 2 mA and results in a voltage increase of 12 V in a 10 sec interval. The value of the capacitance is :

   (A) 0.75 mF

   (B) 1.66 mF

   (C) 1.33 mF

   (D) 0.6 mF

3. A network has 8 nodes and 5 independent loops. The number of branches in the network is :

   (A) 11

   (B) 12

   (C) 8

   (D) 6

4. Consider a 24 V battery of internal resistance r = 4 Ω connected to variable resistance R. The rate of heat dissipated in the resistor is maximum when the current drawn from the battery is i. The current drawn from the battery will be $\frac{i}{2}$ when R is equal to :

   (A) 2 Ω

   (B) 4 Ω

   (C) 8 Ω

   (D) 12 Ω

5. Parameters for an RLC circuit are R = 2 Ω, L = 1 H, C = 1 F. If these are connected in series first and then parallel. The system response for both the circuits will be :

   (A) Under-damped, undamped

   (B) Critically-damped, over-damped

   (C) Critically damped, under-damped

   (D) Under-damped, critically-damped

6. The current through a 4 H inductor is given by $I_L(s) = \frac{10}{s(s+2)}$. The initial voltage across inductor is :

   (A) 40 V

   (B) 20 V

   (C) 10 V

   (D) 5 V

7. For a 2-port symmetrical bilateral network, if the transmission parameters are $A = 3$, $B = 1$, the value of parameter C is :

   (A) 3

   (B) 8

   (C) 9

   (D) 7

8. An electronic test circuit produces a resonant curve with half-power points at 434 Hz and 456 Hz. If $Q = 20$, the resonant frequency of the circuit is :

   (A) 22 Hz

   (B) 220 Hz

   (C) 440 Hz

   (D) 445 Hz

9. In silicon at $T = 300$ K, the thermal equilibrium concentration of electrons is $n_0 = 5 \times 10^4$ cm^{-3} and Intrinsic carrier concentration is $n_i = 1.5 \times 10^{10}$ cm^{-3}. The hole concentration is :

   (A) 3.33×10^{-6}

   (B) 7.5×10^{14}

   (C) 0.3×10^6

   (D) 4.5×10^{15}

10. A silicon p-n junction diode at a temperature of 20°C has a reverse saturation current of 10 mA. The reverse saturation current at 40°C for the same bias is approximately :

    (A) 10 mA

    (B) 20 mA

    (C) 40 mA

    (D) 60 mA

11. A silicon p-n junction diode under reverse bias has depletion width of 10 μm. The relative permittivity of silicon, $\epsilon_r = 11.7$ and the permittivity of the free space $\epsilon_0 = 8.85 \times 10^{-12}$ F/m. The depletion capacitance of the diode per square meter is approximately :

    (A) 100 μF

    (B) 10 μF

    (C) 1 μF

    (D) 20 μF

12. The leakage current of a transistor are $I_{CBO} = 5$ μA and $I_{CEO} = 0.4$ mA, and $I_B = 30$ μA. The value of β is :

    (A) 79

    (B) 81

    (C) 80

    (D) 83

13. A diffused resistor in an IC :

    (A) Is fabricated before transistor diffusion

    (B) Is fabricated after transistor diffusion

    (C) Can be fabricated with precision for any resistance value

    (D) Is formed along with fabrication of transistors

14. The chemical reaction involved in epitaxial growth in IC chips take place at a temperature of about :
    (A) 500 °C   (B) 800 °C
    (C) 1200 °C   (D) 2000 °C

15. Monolithic integrated circuit system offer greater reliability than discrete component systems because :
    (A) There are fewer interconnections   (B) High temperature metalizing is used
    (C) Electric voltage are low   (D) Electric elements are closely matched

16. Silicon dioxide layer is used in IC chips for :
    (A) Providing mechanical strength to chips   (B) Providing mask against diffusion
    (C) Diffusing elements   (D) Providing contacts

17. If a resistor is introduced in the emitter of a CE amplifier then :
    (A) Both input impedance and voltage gain increase
    (B) Input impedance increases and voltage gain decreases
    (C) Input impedance decreases and voltage gain increases
    (D) Both input impedance and voltage gain decrease

18. Which of the following amplifier has high input impedance, low output impedance and low voltage gain ?
    (A) Common-gate   (B) Common-drain
    (C) Common-source   (D) None of these

19. Input impedance of an instrumentation amplifier compared with a difference amplifier is :
    (A) High   (B) Low
    (C) Same   (D) Cannot be determined

20. In an amplifier, series-series feedback results in :
    (A) Input impedance increases and output impedance decreases
    (B) Both input impedance and output impedance increase
    (C) Input impedance decreases and output impedance increases
    (D) Both input impedance and output impedance decrease

21. The impulse response of a system $\dfrac{d^2y}{dt^2} + y(t) = x(t)$ will be :

    (A) A constant   (B) A sinusoid
    (C) An impulse function   (D) Exponentially Decaying Function

22. ROC of a causal system is :

    (A) Entire s-plane

                                  (B) Left Half of s-plane

    (C) Right half of s-plane

                                  (D) Doesn't exist

23. The Fourier transform of a discrete time signal is :

    (A) Continuous-time periodic signal

                                  (B) Discrete-time periodic signal

    (C) Continuous-time Aperiodic signal

                                  (D) Discrete-time Aperiodic signal

24. The value of expression

$$\sum_{n=-\infty}^{2} 3^n \, \delta(n-3) \text{ is :}$$

    (A) 27

                                  (B) −27

    (C) 9

                                  (D) 0

25. The Fourier series of a real, even periodic signal will contain only :

    (A) Cosine terms

                                  (B) Sine terms

    (C) Even harmonics

                                  (D) Odd harmonics

26. The nyquist interval for the signal $x(t) = \sin c(200t) + \sin c^2(200t)$ are given by :

    (A) 1.25 ms

                                  (B) 2.5 ms

    (C) 5 ms

                                  (D) 10 ms

27. A filter impulse response is $h(t) = -\delta(t) + 2e^{-t} u(t)$. The zero state response of this filter for the input $x(t) = e^t u(-t)$ is :

    (A) $e^{-t} u(t)$

                                  (B) $e^{-t} u(t) + 2e^{-t} u(-t)$

    (C) $e^{-2t} u(t)$

                                  (D) c

28. The laplace transform of the signal $u(t) - u(t-2)$ is :

    (A) $\dfrac{e^{-2s} - 1}{s}$

                                  (B) $\dfrac{1 - e^{-2s}}{s}$

    (C) $\dfrac{2}{s}$

                                  (D) $\dfrac{-2}{s}$

29. The energy of the signal $y(t) = \int_{-\infty}^{t} [\delta(\tau + 2) - \delta(\tau - 2)] \, d\tau$ is equal to :

    (A) Zero

                                  (B) 1

    (C) 4

                                  (D) Infinity

30. The value of signal u[n] + u[−n] is equal to :

(A) 2

(B) 1 + δ[n]

(C) 2 + δ[n]

(D) 1

31. A 4-bit ripple counter and a 4-bit synchronous counter are made by flip-flops having a propagation delay of 10 ns each. If the worst case delay in the ripple counter and the synchronous counter be R and S respectively, then :

(A) R = 10 ns, S = 40 ns

(B) R = 40 ns, S = 10 ns

(C) R = 10 ns, S = 30 ns

(D) R = 30 ns, S = 10 ns

32. A 4-bit modulo-6 ripple counter uses JK flip-flops. If the propagation delay of each FF is 50 ns, the maximum clock frequency that can be used is equal to :

(A) 4 MHz

(B) 5 MHz

(C) 10 MHz

(D) 20 MHz

33. Four memory chips of 16 × 4 have their address buses connected together. This system will be of size :

(A) 64 × 4

(B) 32 × 8

(C) 16 × 16

(D) 256 × 1

34. For the given logic families, the correct order of their increasing noise margin is :

(A) RTL, ECL, MOS, DTL

(B) RTL, ECL, DTL, MOS

(C) ECL, RTL, MOS, DTL

(D) ECL, RTL, DTL, MOS

35. The full scale output of a DAC is 10 mA. If the resolution is to be less than 40 μA, then the required number of bits are :

(A) 8

(B) 9

(C) 10

(D) 11

36. A digital voltmeter uses a 10 MHz clock and has a voltage controlled generator which provides a width of 10 μs per volt of unit signal. 10 V of input signal would correspond to a pulse count of :

(A) 1500

(B) 1000

(C) 750

(D) 500

37. The advantage of using a dual slope ADC in a digital voltmeter is that :

  (A) Its conversion time is small

  (C) It gives output in BCD format

  (B) Its accuracy is high

  (D) It does not require a comparator

38. In 8085, if the clock frequency is 5 MHz, the time required to execute an instruction of 18 T-states is :

  (A) 3.0

  (C) 4.2

  (B) 3.6

  (D) 6.4

39. Which of the following is NOT a vectored interrupt ?

  (A) TRAP

  (C) RST 3

  (B) INTR

  (D) RST 7.5

40. If the accumulator of 8085 microprocessor contains 37 H and the previous operation has set the carry flag, the instruction ACI 56 H will result in :

  (A) 8D H

  (C) 17 H

  (B) 8E H

  (D) 18 H

41. The contents of accumulator after the execution of following instructions will be :

      MVI   A, B7 H

      ORA   A

      RAL

  (A) 6E H

  (C) EE H

  (B) 6F H

  (D) EF H

42. Consider the loop :

      XRA A

      LXI B, 0007 H

      Loop : DCX B

      JNZ loop

      This loop will be executed

  (A) 1 times

  (C) 8 times

  (B) 7 times

  (D) Infinite times

3. The system $y(n) = \log_{10} |x(n)|$ is :

(A) Non-linear, causal, stable

(B) Linear, Non-causal, stable

(C) Non-linear, causal, Unstable

(D) Linear, Non-causal, Unstable

44. Sub-band coding is used for :

(A) Improving the coding efficiency

(B) Coding the information in a particular band more accurately

(C) Dividing the coding information

(D) Reducing the bit-rate for all bands

45. Wavelet transform provides multi-resolution analysis using :

(A) Windowed sines and cosines

(B) Shifted sines and cosines

(C) Dilated windows

(D) Shifted windows

46. Chebyshev filter has :

(A) Maximally flat pass-band and Equiripple stop-band

(B) Equiripple pass-band and Maximally flat stop-band

(C) Maximally flat pass-band and stop-band

(D) Equiripple pass-band and stop-band

47. A system is described by the difference equation

$$y[n] - \frac{1}{2} y[n-1] = 2\, x[n-1].$$

The impulse response of the system is :

(A) $\dfrac{1}{2^{n-2}} u[n-1]$

(B) $\dfrac{1}{2^{n-2}} u[n+1]$

(C) $\dfrac{1}{2^{n-2}} u[n-2]$

(D) $\dfrac{-1}{2^{n-2}} u[n-2]$

48. The Fourier transform of the signal $e^{-4|t|}$ is :

(A) $\dfrac{8}{16+\omega^2}$

(B) $\dfrac{-8}{16+\omega^2}$

(C) $\dfrac{4}{16+\omega^2}$

(D) $\dfrac{-4}{16+\omega^2}$

[Turn over

49. The Fourier transform of the signal sgn(t) is :

   (A) $\dfrac{-2}{j\omega}$

   (B) $\dfrac{4}{j\omega}$

   (C) $\dfrac{2}{j\omega}$

   (D) $\dfrac{1}{j\omega}+1$

50. In FIR filter window design method, maximum stop-band attenuation is given by :

   (A) Bartlett window

   (C) Hanning window

   (B) Hamming window

   (D) Blackman window

51. The forward transfer function of a unity feedback system is $G(s) = \dfrac{K(s^2+1)}{(s+1)(s+2)}$. The system is stable for :

   (A) K < −1

   (C) K < −2

   (B) K > −1

   (D) K > −2

52. The open loop transfer function of a unit feedback control system is $G(s) = \dfrac{K(s+2)}{(s+1)(s-7)}$.
For K > 6, the stability characteristic of the open-loop and closed-loop configurations of the system are respectively :

   (A) Stable and unstable

   (C) Unstable and stable

   (B) Stable and stable

   (D) Unstable and unstable

53. A second order system with no zeros, has its poles located at −3 + j4, and −3 − j4 in the s plane. The undamped natural frequency and the damping ratio of the system are respectively :

   (A) 5 rad/s and 0.6

   (C) 5 rad/s and 0.8

   (B) 3 rad/s and 0.6

   (D) 3 rad/s and 0.8

54. A second order system exhibits 100% overshoot. Its damping coefficient is :

   (A) 0

   (C) Less than 1

   (B) 1

   (D) Greater than 1

55. A system has position error constant Kp = 3. The steady state error for the input of 8t u(t) is :

   (A) 2.65

   (C) 0

   (B) 2

   (D) Infinity

56. The characteristic equation of a closed-loop system is s(s + 1) (s + 2) + K = 0. The centroid of the asymptotes in root-locus will be :

(A) 3

(B) –1

(C) 1

(D) –3

57. In the bode plot of a unity feedback control system, the value of magnitude of $G(j\omega)$ at the phase crossover frequency is 0.5. The gain margin is :

(A) 2

(B) 0.5

(C) 0.33

(D) 3

58. Derivative control :

(A) Has the same effect as output rate control

(B) Reduces damping

(C) Is predictive in nature

(D) Increases the order of system

59. A pre-emphasis circuit provides extra noise immunity by :

(A) Boosting the bass frequencies

(B) Amplifying the high audio frequencies

(C) Pre-amplifying the whole audio band

(D) Converting the frequency modulation to PM

60. Practically the sampling frequency is greater than nyquist rate to :

(A) Avoid the possible overlapping of adjacent spectrums

(B) Avoid the need of an ideal low pass filter for reconstruction

(C) Decrease the bandwidth

(D) Improve the shape of spectrum

61. A 1 MHz sinusoidal carrier is amplitude modulated by a symmetrical square wave of period 100 μs. 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

62. An FM signal has a carrier swing of 100 KHz, when the modulating signal has a frequency of 8 KHz. The modulation index is :

(A) 6.25

(B) 12.5

(C) 7.5

(D) 15

63. An analog signal is quantized and transmitted using a PCM system. The tolerable error in the sample amplitude is 0.5% of the peak-to-peak full scale value. The minimum binary digits required to encode a sample is :

(A) 5

(B) 6

(C) 7

(D) 8

64. A PCM system uses a uniform quantizer followed by an 8-bit encoder. The bit rate of the system is equal to 10^8 bits/s. The maximum message bandwidth for which the system operates satisfactorily is :

(A) 25 MHz

(B) 12.5 MHz

(C) 6.25 MHz

(D) 50 MHz

65. A signal has a bandwidth of 1 MHz. It is sampled at a rate 50% higher than the Nyquist rate and quantized into 256 levels using a μ-law quantizer with μ = 255. The signal to quantization noise ratio is :

(A) 34.91 dB

(B) 38.06 dB

(C) 42.05 dB

(D) 48.76 dB

66. The entropy of a message source generating four messages with probabilities 0.5, 0.25, 0.125, and 0.125 is :

(A) 1 bit/message

(B) 1.75 bits/message

(C) 3.32 bits/message

(D) 5.9 bits/message

67. The channel capacity under the Gaussian noise environment for a discrete memory-less channel with a bandwidth of 4 MHz and SNR of 31 is :

(A) 20 Mbps

(B) 16 Mbps

(C) 8 Mbps

(D) 4 Mbps

68. A CDMA system is designed based on DS spread spectrum with a processing gain of 1000 and BPSK modulation scheme. If user has equal power and desired level of performance of an error probability of 10^{-6}, the number of users will be :

(A) 89

(B) 117

(C) 147

(D) 216

69. A vector from the origin to the point A is given as $(6, -2, -4)$ and the unit vector directed from the origin towards the point B is $\left(\frac{2}{3}, \frac{-2}{3}, \frac{1}{3}\right)$. If point A and B are ten units apart, the coordinates of point B is :

(A) $(7.83, -7.83, 3.92)$

(B) $(3.92, -7.83, 7.83)$

(C) $(7.83, -7.83, -3.92)$

(D) $(-7.83, -7.83, 3.92)$

70. Four 5 nC positive charges are located in the $z = 0$ plane at the corners of a square 8 mm on a side. A fifth 5 nC positive charge is located at a point 8 mm distance from each of the other charge. The magnitude of the total force on this fifth charge is :

(A) 2×10^{-4} N

(B) 4×10^{-4} N

(C) 0.014 N

(D) 0.01 N

71. A rod of length 2 m rotates about the z-axis with an angular velocity 2 rad/sec. If $B = 4 u_z$ Wb/m², the voltage induced on the conductor is :

(A) 32 V

(B) 18 V

(C) 16 V

(D) 9 V

72. An electromagnetic wave from an underwater source with perpendicular polarization is incident on a water-air interface at angle 20° with normal to surface. For water, assume $\varepsilon_r = 81$, $\mu_r = 1$. The critical angle θ_c is :

(A) 83.62°

(B) 6.38°

(C) 8.62°

(D) 48.2°

73. A 2 cm by 3 cm rectangular waveguide is filled with $\varepsilon_r = 6$. The waveguide is operating at 20 GHz with TM_{11} mode. The cutoff frequency is :

(A) 1.84 GHz

(B) 3.68 GHz

(C) 9.02 GHz

(D) 16.04 GHz

74. Consider a 150 m long air-filled hollow rectangular waveguide with cutoff frequency 6.5 GHz. If a short pulse of 7.2 GHz is introduced into the input end of the guide, the time taken by the pulse to return to the input end is :

(A) 920 ns

(B) 460 ns

(C) 230 ns

(D) 430 ns

75. An FM signal with a frequency deviation 'd' is passed through a mixer, and has its frequency reduced five-fold. The deviation in the output of the mixer is :

(A) 5.d

(B) d/5

(C) d

(D) Indeterminate