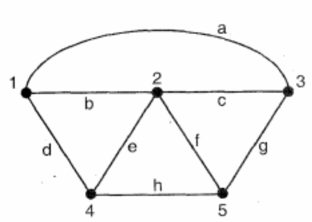
ELECTRONICS & COMMUNICATION ENGINEERING

ONE MARK QUESTIONS

1. Identify which of the following is NOT a tree of the graph shown in the figure



(a.) begh

(b.) defg

(c.) adhg

(d.) aegh

2. A 2-port network is shown in the figure. The parameter h_{21} for this network can be given be

(a.) -1/2

(b.) +1/2

(c.) -3/2

(d.) +3/2

3. The early effect in a bipolar junction transistor is caused by

(a.) fast turn-on

(b.) fast turn-off

(c.) large collector-base reverse bias

(d.) large emitter-base forward bias

4. The first dominant pole encountered in the frequency response of a compensated op-amp is

(a.) 5 Hz

(b.) 10kHz

(c.) 1 MHz

(d.) 100 MHz

5. Negative feedback in an amplifier

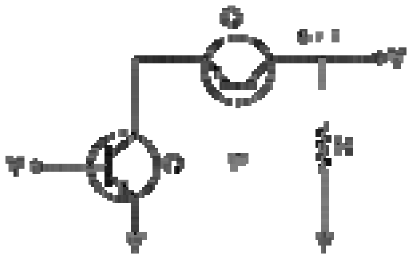
(a.) reduces gain

(b.) increases frequency and phase distortions

(c.) reduces bandwidth

(d.) increases noise

6. In the cascade amplifier shown in the figure, if the common-emitter stage (Q_1) has a trans-conductance g_{m1}, and the common base stage (Q_2) has a trans-conductance g_{m2}, then the overall trans-conductance g (= i_0/v_i) of the cascade amplifier is



(a.) g_{m1}

(b.) g_{m2}

(c.) $g_{m1}/2$

(d.) $g_{m2}/2$

7. Crossover distortion behaviour is characteristic of

(a.) Class A output stage

(b.) Class B output stage

(c.) Class AB output stage

(d.) Common-base output stage

8. The logical expression $y = A + \bar{A}B$ is equivalent to

(a.) y = AB

(b.) $y = \bar{A}B$

(c.) $y = \bar{A} + B$

(d.) y = A + B

9. A Darlington emitter-follower circuit is sometimes used in the output stage of a TTL gate in order to

(a.) increase its I_{OL}

(b.) reduce its I_{OH}

(c.) increase its speed of operation

(d.) reduce power dissipation

10. Commercially available ECL gears use two ground lines and one negative supply in order to

(a.) reduce power dissipation

(b.) increase fan-out

(c.) reduce loading effect

(d.) eliminate the effect of power line glitches or the biasing circuit

11. The resolution of a 4-bit counting ADC is 0.5 volts. For an analog input of 6.6 volts, the digital output of the ADC will be

(a.) 1011

(b.) 1101

(c.) 1100

(d.) 1110

12. The z-transform F(z) of the function f (nT) = a^{nT} is

(a.) $\dfrac{z}{z-a^{T}}$

(b.) $\dfrac{z}{z+a^{T}}$

(c.) $\dfrac{z}{z-a^{-T}}$

(d.) $\dfrac{z}{z+a^{-T}}$

13. If [f(t)]=F(s), then [f(t—T)J is equal to

(a.) $e^{sT}F(s)$

(b.) $e^{-sT}F(s)$

(c.) $\dfrac{F(s)}{1+e^{sT}}$

(d.) $\dfrac{F(s)}{1-e^{sT}}$

14. A signal x(t) has a Fourier transform X(ω). If x(t) is a real and odd function of t, then X(ω) is

(a.) a real and even function of ω

(b.) a imaginary and odd function of ω

(c.) an imaginary and even function of ω

(d.) a real and odd function of ω

15. For a second-order system with the closed-loop transfer function

$$T(s)=\frac{9}{s^{2}+4s+9}$$

the settling time for 2-percent band, in seconds, is

(a.) 1.5

(b.) 2.0

(c.) 3.0

(d.) 4.0

16. The gain margin (in dB) of a system having the loop transfer function

$G(s)H(s)=\dfrac{\sqrt{2}}{s(s+1)}$ is

(a.) 0

(b.) 3

(c.) 6

(d.) ∞

17. The system mode described by the state equations

$x\begin{bmatrix}0 & 1\\ 2 & -3\end{bmatrix}x+\begin{bmatrix}0\\ 1\end{bmatrix}u \quad Y=\begin{bmatrix}1 & 1\end{bmatrix}x$ is

(a.) controllable and observable

(b.) controllable, but not observable

(c.) observable, but not controllable

(d.) neither controllable nor observable

18. The phase margin (in degrees) of a system having the loop transfer function

$G(s)H(s)=\dfrac{2\sqrt{3}}{s(s+1)}$ is

(a.) 45°

(b.) -30°

(c.) 60°

(d.) 30°

19. The input to a channel is a band pass signal. It is obtained by linearly modulating a sinusoidal carrier with a single-tone signal. The output of the channel due to this input is given by

$y(t)=(1/100)\cos\left(100t-10^{-6}\right)\cos\left(10^{6}t-1.56\right)$

The group delay (t_g) and the phase delay (t_p) in seconds, of the channel are

(a.) $t_g=10^{-6}, t_p=1.56$

(b.) $t_g=1.56, t_p=10^{-6}$

(c.) $t_g=10^{-8}, t_p=1.56\times10^{-6}$

(d.) $t_g=10^{8}, t_p=1.56$

20. A modulated signal is given by,

$s(t)=m_1(t)\cos(2\pi f_c t)+m_2(t)\sin(2\pi f_c t)$ where the baseband signal $m_1(t)$ and $m_2(t)$ have bandwidths of 10 kHz and 15kHz, respectively. The bandwidth of the modulated signal, in kHz, is

(a.) 10

(b.) 15

(c.) 25

(d.) 30

21. A modulated signal is given by

$s(t) = e^{-at}\cos\left[(\omega_c + \Delta\omega)t\right]u(t)$ where a ω_c and $\Delta\omega$ are positive constants, and $\omega_c >> \Delta\omega$. The complex envelope of s(t) is given by

(a.) $\exp(-at)\exp\left[j(\omega_c + \Delta\omega)t\right]u(t)$

(b.) $\exp(-at)\exp(j\Delta\omega t)u(t)$

(c.) $\exp(j\Delta\omega t).u(t)$

(d.) $\exp\left[(j\omega_c + \Delta\omega)t\right]$

22. 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

23. Assuming perfect conductors of a transmission line, pure TEM propagation is NOT possible in

(a.) coaxial cable

(b.) air-filled cylindrical waveguide

(c.) parallel twin-wire line in air

(d.) semi-infinite parallel plate wave guide

24. Indicate which one of the following will NOT exist in a rectangular resonant cavity.

(a.) TE_{110}

(b.) TE_{011}

(c.) TM_{110}

(d.) TM111

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

(a.) $50e^{j(\omega t-3z)}$

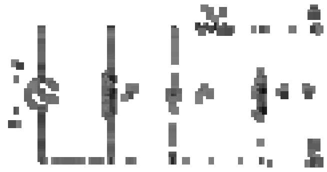
(b.) $\sin[\omega(10z + 5t)]$

(c.) $\cos(y^2 + 5t)$

(d.) $\sin(x)\cos(t)$

TWO MARKS QUESTIONS

26. The Thevenin equivalent voltage V_{TH} appearing between the terminals A and B of the network shown in the figure is given by



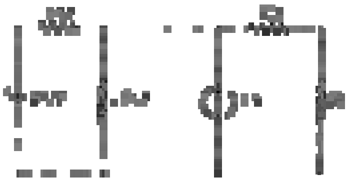
(a.) j16(3-j4)

(b.) j16(3+j4)

(c.) 16(3+j4)

(d.) 16(3-j4)

27. The value of R (in ohms) required for maximum power transfer in the network shown in the figure is



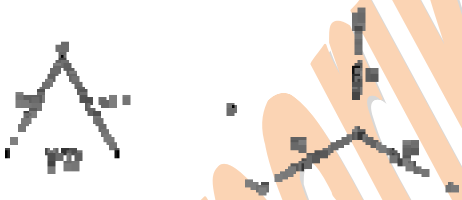
(a.) 2

(b.) 4

(c.) 8

(d.) 16

28. A Delta-connected network with its Wye-equivalent is shown in the figure. The resistances R_1, R_2 and R_3 (in ohms) are respectively



(a.) 1.5, 3 and 9

(b.) 3, 9 and l.5

(c.) 9, 3 and l.5

(d.) 3, 1.5 and 9

29. An n-channel I_{DSS}= 2 mA and Vp = -4V. Its transconductance g_m (in mA/V) for an applied gate to source voltage V_{GS} of -2V is

(a.) 0.25

(b.) 0.5

(c.) 0.75

(d.) 1.0

30. An npn transistor (with C 0.3 pF) has a unity - gain cutoff frequency f_T of 400 MHz at a dc bias current I_C= 1mA. The value of its C (in pF) is approximately (V_T = 26mV)

(a.) 15

(b.) 30

(c.) 50

(d.) 96

31. An amplifier has an open-loop gain of 100, an input impedance of 1kΩ, and an output impedance of 100 Ω. A feedback network with a feedback factor of 0.99 is connected to the amplifier in a voltage series feedback mode. The new input and output impedances, respectively, are

(a.) 10 Ω and 1 Ω
(b.) 10 Ω and 10 Ω
(c.) 100 kΩ and 1Ω
(d.) 100 kΩ and 1 kΩ

32. A dc power supply has a no-load voltage of 30V, and a full-load voltage of 25V at a full-load current of 1A. Its output resistance and load regulation, respectively, are

(a.) 5Ω and 20%

(b.) 25Ω and 20%

(c.) 5 Ω and 16.7%

(d.) 25Ω and 16.7%

33. An amplifier is assumed to have a single-pole high-frequency transfer function. The rise time of its output response to a step function input is 35 nsec. The upper —3 dB frequency (in MHz) for the amplifier to a sinusoidal input is approximately at

(a.) 4.55

(b.) 10

(c.) 20

(d.) 28.6

34. The minimized form of the logical expression $\left(\bar{A}\bar{B}\bar{C}+\bar{A}B\bar{C}+\bar{A}BC+AB\bar{C}\right)$ is

(a.) $\bar{A}\bar{C}+B\bar{C}+\bar{A}B$
(b.) $A\bar{C}+\bar{B}C+\bar{A}B$
(c.) $\bar{A}C+\bar{B}C+\bar{A}B$
(d.) $A\bar{C}+\bar{B}C+A\bar{B}$

35. For a binary half- subtractor having two inputs A and B, the correct set of logical expressions for the outputs D (=A minus B) and X (=borrow) are

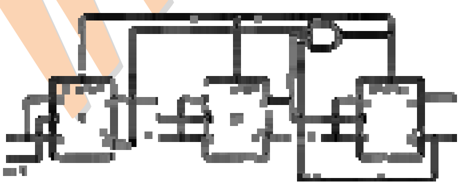
(a.) $D=AB+\bar{A}B, X=\bar{A}B$

(b.) $D=\bar{A}B+A\bar{B}+A\bar{B}, X=A\bar{B}$

(c.) $D=\bar{A}B+A\bar{B},\ X=\bar{A}B$

(d.) $D=AB+\bar{A}\bar{B},\ X=A\bar{B}$

36. The ripple counter shown in the figure works as a



(a.) mod-3 up counter

(b.) mod-5 up counter

(c.) mod-3 down counter

(d.) mod-5 down counter

37. If CS = $\bar{A}_{15}A_{14}A_{13}$ is used as the chip select logic of a 4K RAM in an 8085 system, then its memory range will be

(a.) 3000H-3FFFH

(b.) 7000 H -7 FFF H

(c.) 5000H-5FFFHand6000H-6 FFFH

(d.) 6000 H-6 FFF H and 7000 H-7 FFFH

38. The Fourier series representation of an impulse train denoted by $s(t)=\sum_{n=-\infty}^{\infty}\delta(t-nT_0)$ is given by

(a.) $\frac{1}{T_0}\sum_{n=-\infty}^{\infty}\exp-\frac{2j\pi nt}{T_0}$

(b.) $\frac{1}{T_0}\sum_{n=-\infty}^{\infty}\exp-\frac{j\pi nt}{T_0}$

(c.) $\frac{1}{T_0}\sum_{n=-\infty}^{\infty}\exp\frac{j\pi nt}{T_0}$

(d.) $\frac{1}{T_0}\sum_{n=-\infty}^{\infty}\exp\frac{j2\pi nt}{T_0}$

39. The z-transform of a signal is given by $C(z)=\frac{1z^{-1}(1-z^{-4})}{4(1-z^{-1})^2}$ (a) in. Its final value is

(a.) 1/4

(b.) zero

(c.) 1.0

(d.) infinity

40. If the closed-loop transfer function T(s) of a unity negative feedback system is given by

$$T(s)=\frac{a_{n+1}s+a_n}{s^n+a_1s^{n+1}+....+a_{n-1}s+a_n}$$

then the steady state error for a unit ramp input is

(a.) $\frac{a_n}{a_n-1}$

(b.) $\frac{a_n}{a_{n-2}}$

(c.) $\frac{a_{n-2}}{a_{n-2}}$

(d.) zero

41. Consider the points s1 = - 3 + j4 and s_2 = - 3 - j2 in the s-plane. Then, for a system with the open-loop transfer function

$$G(s)H(s)=\frac{K}{(s+1)^4}$$

(a.) s_1 is on the root locus, but not s_2

(b.) s_2 is on the root locus, but not s_1

(c.) both s_1 and s_2 are on the root locus

(d.) neither s_1 nor s_2 is en the root locus

42. For the system described by the state equation

$$\dot{x}=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ 0.5 & 1 & 2\end{bmatrix}x+\begin{bmatrix}0\\0\\1\end{bmatrix}u$$

If the control signal u is given by

u = [-0.5 -3 -5] x + v, then the eigen values of the closed-loop system will be

(a.) 0, -1, -2

(b.) 0, -1, -3

(c.) -1, -1, -2

(d.) 0, -1, -1

43. The Nyquist sampling frequency (in Hz) of a signal given by $6\times10^4 \sin c^3(400t)*10^6*\sin c^3(100t)$ is

(a.) 200

(b.) 300

(c.) 1500

(d.) 1000

44. The peak-to-peak input to an 8-bit PCM coder is 2 volts. The signal power-to-quantization noise power ratio (in dB) for an input of $0.5\cos(\omega_m t)$ is

(a.) 47.8

(b.) 43.8

(c.) 95.6

(d.) 99.6

45. The input to a matched filter is given by

$$s(t)=\begin{cases}10\sin\left(2x\times10^6\right) & 0<t<10^{-4}\sec\\ 0 & Otherwise\end{cases}$$

The peak amplitude of the filter output is

(a.) 10 volts

(b.) 5 volts

(c.) 10 milli volts

(d.) 5 milli volts

46. Four independent messages have bandwidths of 100Hz, 100 Hz, 200 Hz, and 400 Hz, respectively. Each is sampled at the Nyquist rate, and the samples are time division multiplexed (TDM) and transmitted. The transmitted sample rate (in Hz) is

(a.) 1600

(b.) 800

(c.) 400

(d.) 200

47. A transmitting antenna radiates 251W isotropic ally. A receiving antenna, located 100m away from the transmitting antenna, has an effective aperture of 500 cm^2. The total power received by the antenna is

(a.) 10 μW

(b.) 1 μW

(c.) 20 μW

(d.) 100 μW

48. In a twin-wire transmission line in air, the adjacent voltage maxima are at 12.5 cm and 27.5 cm. The operating frequency is

(a.) 300 MHz

(b.) 1 GHz

(c.) 2 GHz

(d.) 6.28 GHz

49. In air, a lossless transmission line of length 50cm with L = 10μH/m, C = 40pF/m is operated at 25 MHz. Its electrical path length is

(a.) 0.5 meters

(b.) λ meters

(c.) π/2 radians

(d.) 180 degrees

50. A plane wave propagating through a medium [$\varepsilon_r = 8$, $\mu_r = 2$, and $\sigma = 0$] has its electric field given by $\vec{E} = 0.5e^{-(z/3)}\sin(10^8 t - \beta z)V/m$. The wave impedance, in ohms is

(a.) 377

(b.) $198.5\angle 180°$

(c.) $182.9\angle 14°$

(d.) 188.3