

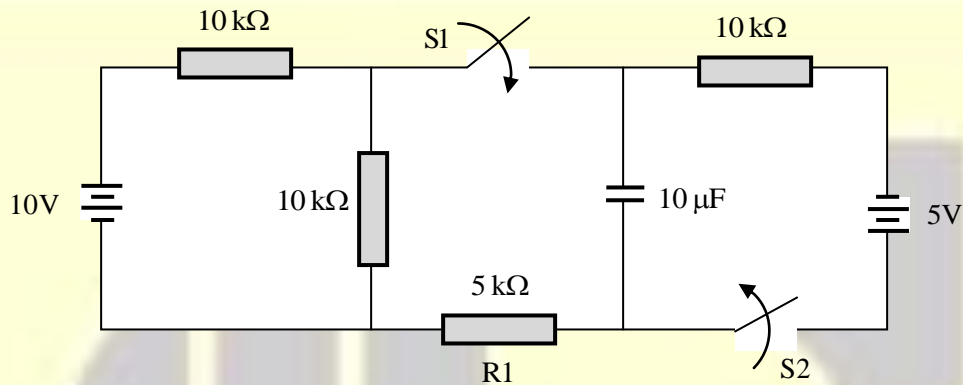


ISRO Previous Year Papers Electronics & Telecommunications

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1. In the circuit shown below, switch S1 and S2 are in open and close position respectively for long time. At $t = t_0$, switch S1 is closed and switch S2 is opened. What would be the current through R1 immediately after the transition of switches?



- (A) 0 mA (B) 1 mA (C) 0.5 mA (D) 2 mA

2. A digital board has a unipolar square clock of 250 MHz. If the clock on the board at all places should have all the harmonic components which have more than 10% of DC value, the board has to be designed for at least

- (A) 250 MHz (B) 750 MHz (C) 1250 MHz (D) 2500 MHz

3. A switch is connected in between a 12 V battery and an uncharged capacitor and a 1 kΩ resistor. At the time instant when the switch is closed, the voltage across the capacitor is

- (A) 6 V (B) 12 V (C) 0 V (D) 24 V

4. Which type of timing violation will occur, if a digital IC is operated at clock frequency which is higher than its specified maximum clock frequency?

- (A) Hold violation (B) Setup violation
(C) Propagation delay (D) All of above

5. If the maximum effective aperture of a radiating small loop of constant current is $\frac{3}{(32\pi)} \text{m}^2$, the wavelength of the radiated electromagnetic wave is
- (A) 5000 mm (B) 100 mm (C) 1000 mm (D) 500 mm

6. A radar system uses magnetron as high power RF source. Its transmitter emits 300 kW RF power at 10% duty factor. If the efficiency of radar transmitter during pulse is 60% and the power required during pulse off period is 1 kW. The average power dissipation in radar is,
- (A) 50.9 kW (B) 301 kW (C) 20.9 kW (D) 150.5 kW

7. Match the following:

| | |
|---------------------------------|--|
| A. Gaussian distribution | 1. Calls on a telephone channel |
| B. Rayleigh distribution | 2. Random number |
| C. Poisson distribution | 3. Thermal noise |
| D. Uniform distribution | 4. Fading channel in wireless communication |

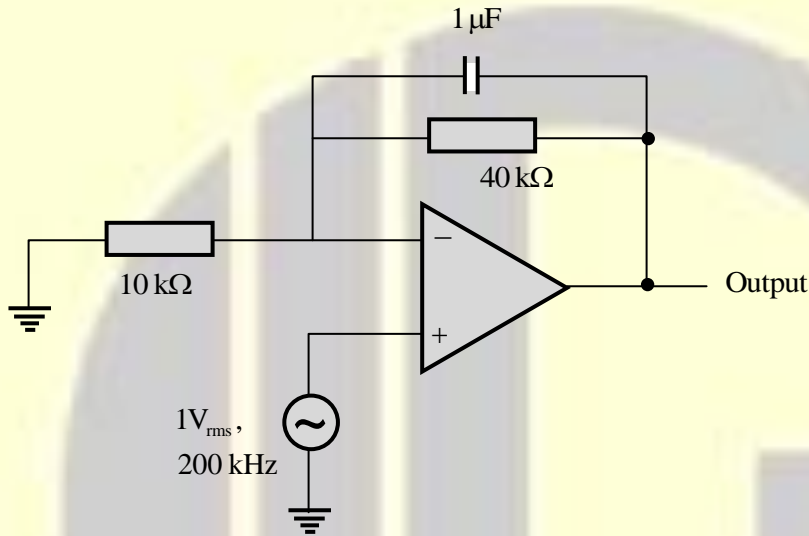
- (A) A-3, B-1, C-4, D-2 (B) A-3, B-4, C-2, D-1
(C) A-1, B-4, C-3, D-2 (D) A-3, B-4, C-1, D-2

8. In a fiber-optic cable, which phenomenon occurs for signal to propagate along the inner core?
- (A) Modulation (B) Reflection
(C) Refraction (D) All of the above

9. Which of the following computation will take minimum number of clock cycles, if it is implemented on 8051 micro-controller? Following is variable declaration in c code:
unsigned int a, b;
- (A) $b = a * a$ (B) $b = a * 3$ (C) $b = a/3$ (D) $b = a/4$

10. Using a quarter wave transformer of characteristics impedance 1Ω , a load impedance of 100Ω will be transformed to an input impedance of value
 (A) 1Ω (B) 100Ω (C) 0.01Ω (D) 0.1Ω

11. What is the output signal level of following circuit?



- (A) $\sim 5V_{rms}$ (B) $\sim 1V_{rms}$ (C) $\sim 4V_{rms}$ (D) $\sim 0.1V_{rms}$

12. The effect of channel coding in communication channel is
 (A) Reduced errors (B) Increased bandwidth
 (C) Reduced terminal size (D) All of above

13. For a point charge having electric flux density, $D = \frac{Q}{4\pi r^2} a_r$, where a_r is the unit vector in radial direction, volume charge density ρ_v is
 (A) 1 (B) 0 (C) Infinite (D) $\frac{Q}{4\pi}$

14. What is the discrete time Fourier transform (DTFT) of following signal?

$$x(n) = a^n \text{ where } n \geq 0, -1 < a < 1$$

(A) $X(\omega) = \frac{1}{(1 - ae^{-j\omega})}$

(B) $X(\omega) = \frac{1}{(1 + ae^{-j\omega})}$

(C) $X(\omega) = \frac{a}{(1 - ae^{-j\omega})}$

(D) $X(\omega) = \frac{a}{(1 + ae^{-j\omega})}$

15. In the near field, the radiated waves take the form of

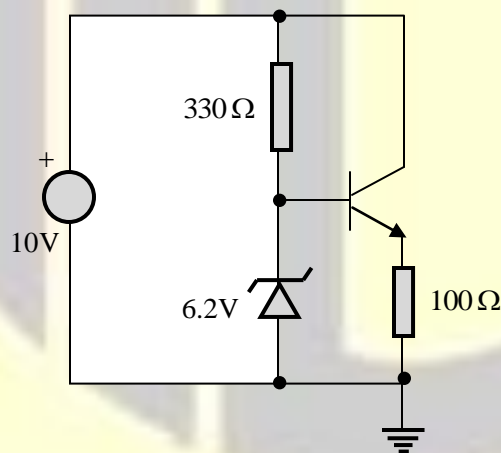
(A) Spherical wave

(B) Plane wave

(C) Cylindrical wave

(D) Conical wave

16. The zener diode shown in following figure is temperature compensated and current gain β of transistor is very high. If current through 100 ohm resistor is 55 mA at 25°C, what is the approximate current through it at 65°C?



(A) 55 mA

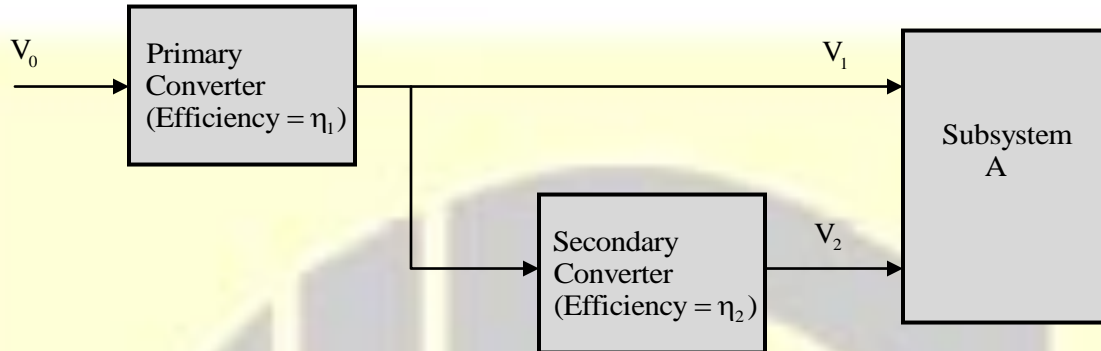
(B) 54 mA

(C) 56 mA

(D) 100 mA

17. We wish to transmit a digital voice at 32 Kbps through a communication channel bandwidth of 3000 Hz. The received signal to noise power ratio is 30 dB. State which of the following statement is true?
- (A) To transmit data error-free through this channel equalizer circuit should be used at the receiver
(B) To transmit data error-free through this channel the voice signal should be compressed by 2
(C) To transmit data error-free through this channel, a channel code with coding gain of 3 dB should be used
(D) It is not possible to transmit data error-free through this channel
-
18. Consider a standard rectangular and a circular waveguide having same dominant mode cut-off frequency determine the ratio of area of circular waveguides to rectangular waveguide
- (A) $\frac{1}{\pi}$ (B) $\frac{6.78}{\pi}$ (C) $\frac{0.69}{\pi}$ (D) π
-
19. What is the lowest level of abstraction in any hardware description language?
- (A) Behavioral (B) Gate level
(C) Structural (D) Register-transfer level
-
20. With the introduction of negative feedback, the gain bandwidth product of an amplifier
- (A) Becomes infinity (B) Increases
(C) Decreases (D) Remains constant
-
21. For a BER of 10^{-5} , which modulation scheme will required minimal power?
- (A) QPSK (B) 8-PSK (C) 16-PSK (D) 16-QAM
-
22. Which one of the following is not synthesizable VHDL statement?
- (A) 'case' (B) 'wait until' (C) 'wait for' (D) generate
-

23. Subsystem A requires two voltage V_1 and V_2 with equal power ratings. Power conversion scheme adapted for the power supply design is shown in the following figure. What is the overall power conversion efficiency?



- (A) $\frac{\eta_1 \times \eta_2}{\eta_1 + \eta_2}$ (B) $\eta_1 \times \eta_2$ (C) $\frac{2\eta_1 \times \eta_2}{1 + \eta_2}$ (D) $\frac{2\eta_1 \times \eta_2}{1 + \eta_1}$

24. Which of the following modulation scheme is most bandwidth efficient?

- (A) AM (B) FM (C) PM (D) SSB-SC

25. A Colpitts oscillator is having tank capacitances of 1 nF and 10 nF, and inductance of 0.1 μ H. The gain required by the circuit to start oscillating is:

- (A) 10 (B) 100 (C) 1 (D) 1000

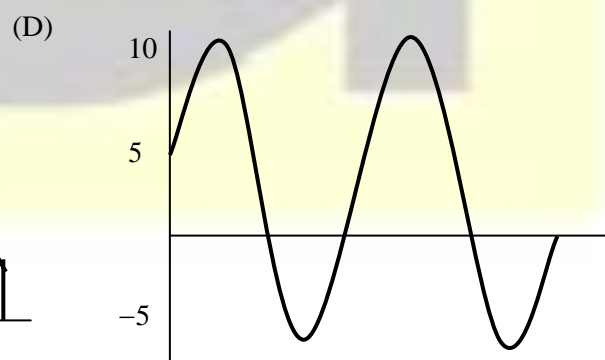
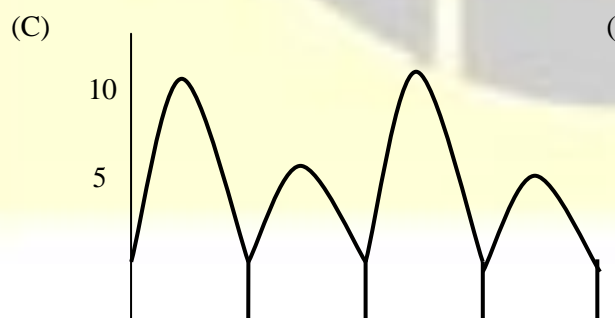
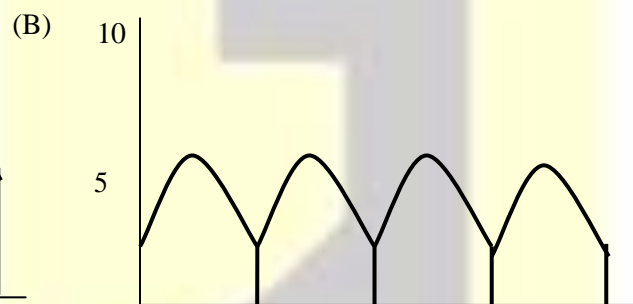
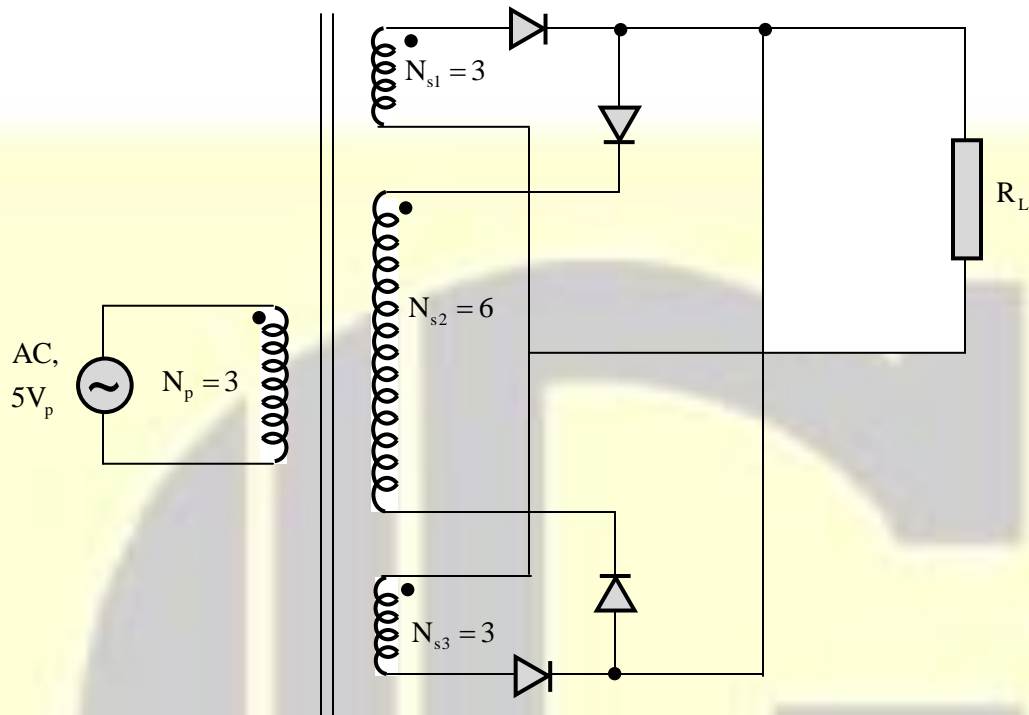
26. A digital CMOS IC operating at 10 MHz clock frequency consumes 100 mW power, the same IC operating at 15 MHz clock frequency consumes 140 mW power. What is the static power consumption of the IC?

- (A) 10 mW (B) 15 mW (C) 20 mW (D) 40 mW

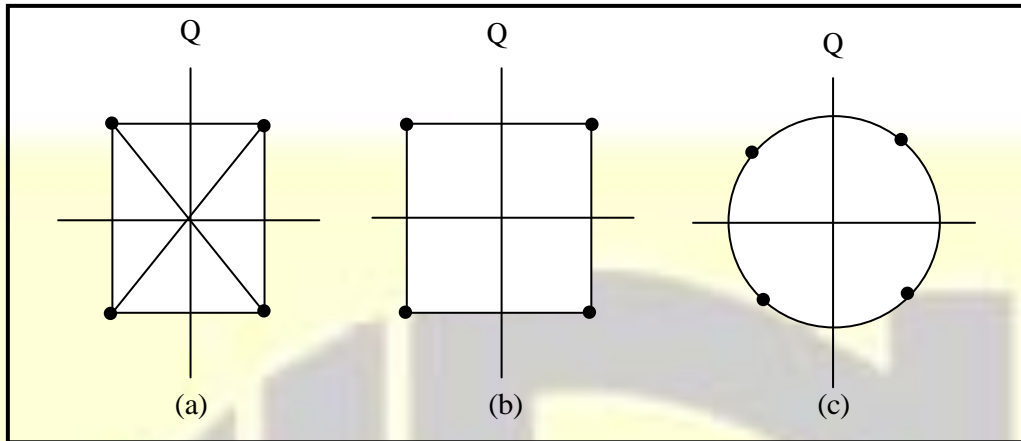
27. An amplifier has a gain of 50 dB, and noise figure of 10 dB. Assuming an ambient temperature of 300K, what will be total equivalent noise temperature at the input of the amplifier?

- (A) 760 K (B) 360 K (C) 2700 K (D) 3000 K

28. Diodes in the following circuit are ideal. What is the correct waveform across R_L ?



29. Identify the modulation schemes for the shown signal constellation diagrams

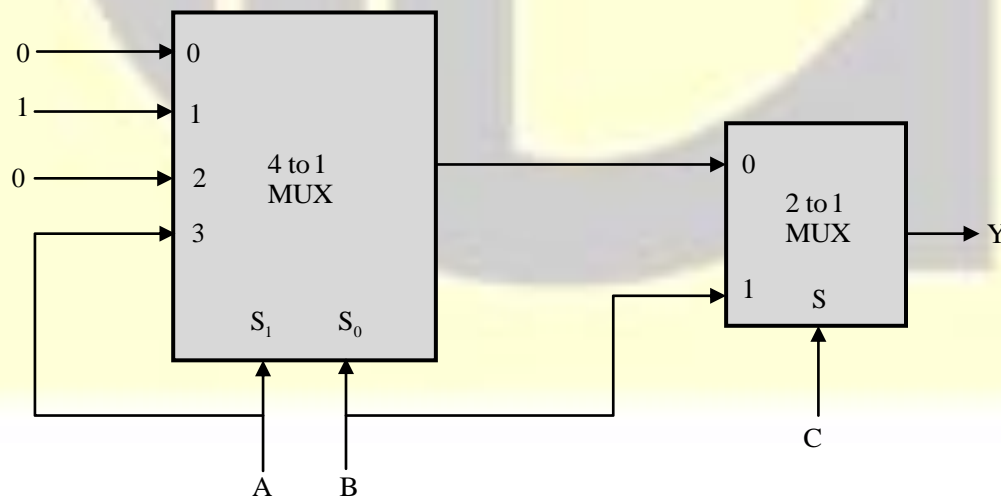


- (A) (a)-QPSK (b)-BPSK (c)-QAM
 (B) (a)-QPSK (b)-OQPSK (c)-MSK
 (C) (a)-OQPSK (b)-QAM (c)-QPSK
 (D) (a)-OQPSK (b)-QPSK (c)-MSK

30. The Fourier Transform of a discrete and aperiodic signal is:

- (A) Continuous and aperiodic
 (B) Continuous and periodic
 (C) Discrete and aperiodic
 (D) Discrete and periodic

31. In the following circuit, Y can be expressed as:



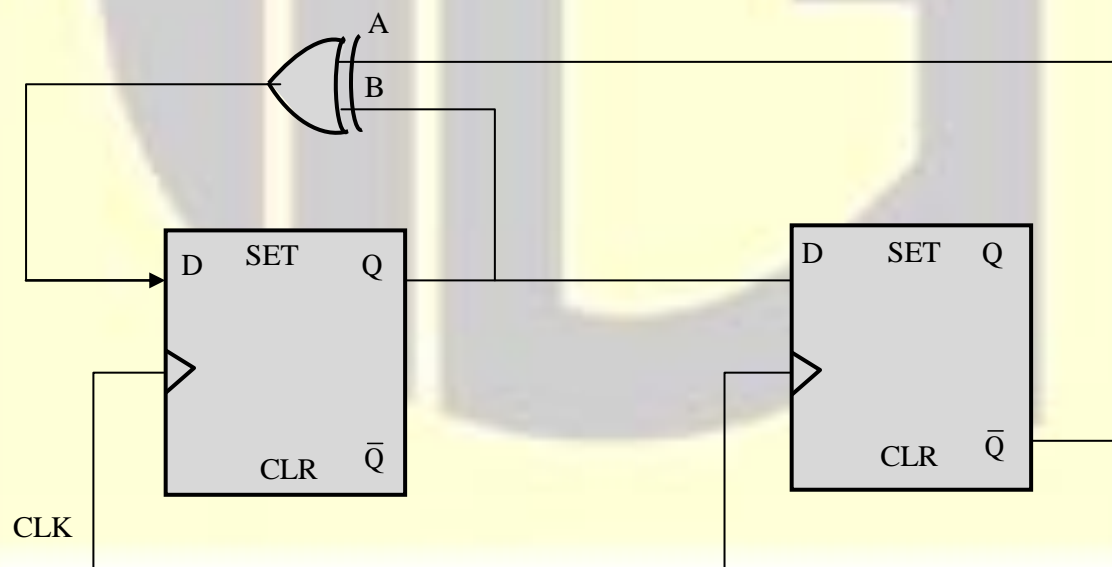
- (A) $Y = BC + A$ (B) $Y = C$ (C) $Y = A\bar{C} + BC$ (D) $Y = B$

32. $s^2 - 0.75s + 0.25$ is the characteristic equation of a second order system. Its response to unit step function will be,
- (A) Over damped (B) Under damped
(C) Critically damped (D) Exponential growth

33. Which modulation scheme would you suggest for high speed data transmission over a fading channel?
- (A) MSK (B) BPSK (C) FSK (D) OFDM

34. For a two port network to be reciprocal, its Scattering parameters must satisfy the following condition, for $i = 1, 2; j = 1, 2$
- (A) $S_{ij} = S_{ji}$ ($i \neq j$) (B) $S_{ij} = S_{ji}$ ($i = j$)
(C) $S_{ij} = 1/S_{ji}$ ($i \neq j$) (D) $S_{ij} = S_{ji}^*$ ($i = j$)

35. In the following circuit, what sequence is followed by A and B on rising edge of CLK after reset is deasserted?



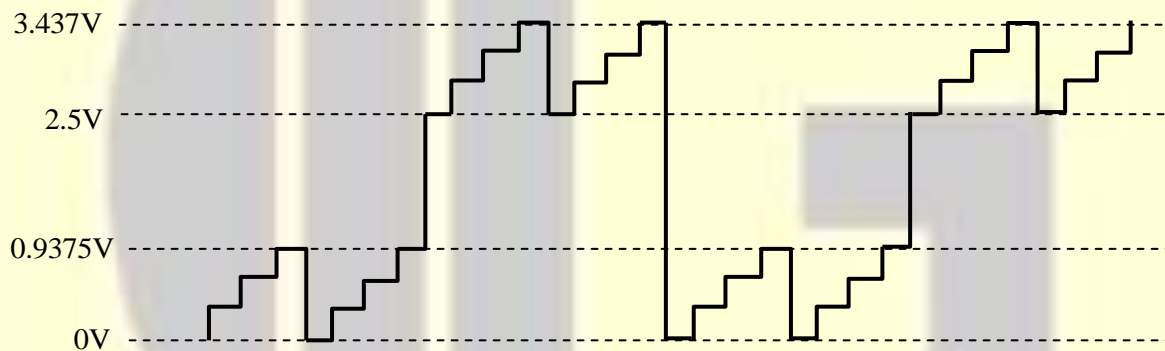
- (A) AB = 10, 11, 00, 10, 11, ... (B) AB = 10, 01, 00, 11, 10, ...
(C) AB = 10, 00, 01, 10, 00, ... (D) AB = 11, 01, 00, 10, 10, ...

36. In an axial mode operation of a helical antenna, maximum field radiated by the antenna is
(A) along the axis of the helical antenna (B) in a plane normal to the helix axis
(C) in both axial and normal planes (D) None of the above
-
37. Which of the following theorem is applicable for both linear and non-linear circuits?
(A) Superposition theorem (B) Thevenin's theorem
(C) Norton's theorem (D) None of the these
-
38. What is the maximum data rate that can be transmitted using a QPSK modulation with a roll-off factor of 0.2 for a 36 MHz transponder?
(A) 7.2 Mbps (B) 30 Mbps (C) 43.2 Mbps (D) 60 Mbps
-
39. Consider a single stage tuned amplifier having 3dB bandwidth of 100 kHz. Determine the bandwidth if two such single stage tuned amplifiers are cascaded
(A) 100 kHz (B) 10 kHz (C) 41.4 kHz (D) 64.3 kHz
-
40. 500 Bytes of data needs to be transmitted from as UART every 100 ms. What should be the minimum transmission baud rate of UART, assuming 1 start bat, 8 data bits and 2 stop bits?
(A) 50000 (B) 55000 (C) 40000 (D) 45000
-
41. What is the value of the major cross-sectional dimension (width) of a rectangular waveguide with dominant TE_{10} mode propagation, if its cut off frequency is 10 GHz?
(A) 15 mm (B) 30 mm (C) 7.5 mm (D) 45 mm
-
42. In a travelling-wave tube, the velocity of electron beam with respect to the axial velocity of RF field is kept
(A) Lower (B) Higher (C) Equal (D) Any of these
-

43. In satellite communication, scrambling is mainly used for
- (A) clock recovery (B) encryption
(C) limiting power spectral density (D) bandwidth efficiency

44. Scattering matrix for a microwave network, which is matched at all the ports, will satisfy the following condition
- (A) All non-diagonal elements will be zero (B) All diagonal elements will be zero
(C) None of the matrix elements will be zero (D) All the matrix elements will be zero.

45. Following waveform shows output of a 4 bit DAC with 5V reference voltage. The 4 bit digital input of DAC is connected to 4 bit up counter, the one bit input of DAC is stuck at '0', which is this bit?



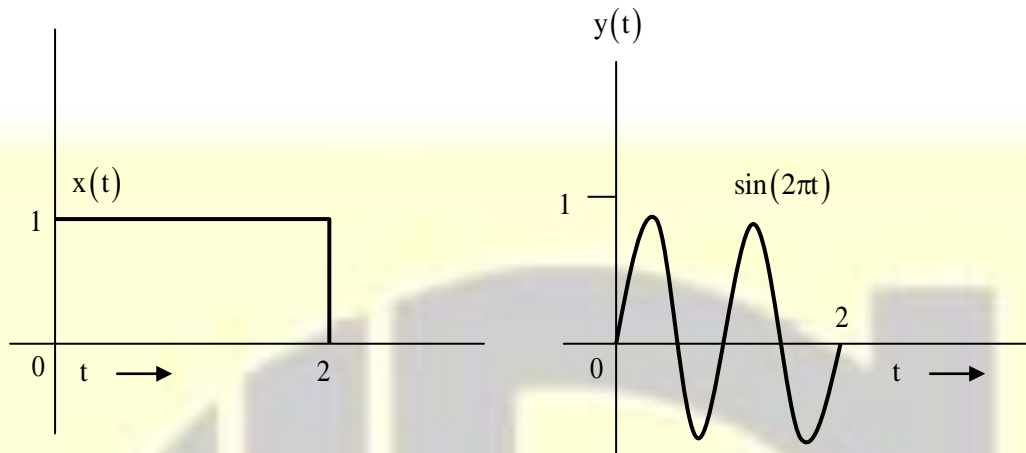
- (A) Bit-0 (LSB) (B) Bit-1
(C) Bit-2 (D) Bit-3 (MSB)

46. Which of the following has the highest skin depth?
- (A) Aluminum (B) Gold (C) Silver (D) Copper

47. A network contains linear resistors and ideal voltage sources. If values of all the resistors are doubled, then voltage across each resistor is
- (A) Halved (B) Doubled
(C) Increases by 4 times (D) Remains the same

48. A coherent QPSK demodulator is required on ground for receiving data from a LEO satellite. What should be optimum order of PLL in the carrier phase tracking loop?
- (A) 1st order (B) 2nd order
(C) 3rd order (D) None of the above
-
49. VSWR of a purely resistive load of normalized value $n + j0$ for $n < 1$ is
- (A) n (B) $1/n$ (C) 1 (D) Infinite
-
50. Two discrete time systems have impulse response $h_1[n] = \delta[n-3]$ and $h_2[n] = \delta[n-5]$. If these two systems are cascaded, then the overall impulse response of the cascaded system is
- (A) $\delta[n-8]$ (B) $\delta[n-3] + \delta[n-5]$
(C) $\delta[n-1] * \delta[n-2]$ (D) $\delta[n-2]$
-
51. Frequency range of Ka-band EM waves is
- (A) 18.0 GHz – 26.5 GHz (B) 26.5 GHz – 40.0 GHz
(C) 12.0 GHz – 18.0 GHz (D) 40.0 GHz – 60.0 GHz
-
52. Following four resistances are connected in parallel; the largest power is dissipated by
- (A) $2.4\Omega, 1W$ (B) $5.1\Omega, 2W$
(C) $10\Omega, 5W$ (D) $22\Omega, 10W$
-
53. Eye diagram gives us an idea of
- (A) Modulation scheme (B) Clock jitter
(C) Signal-to-Noise ratio (D) All of the above
-

54. Determine the correlation coefficient between the pulses $x(t)$ and $y(t)$ shown in the figure below.



- (A) 1 (B) -1 (C) 0 (D) 2π

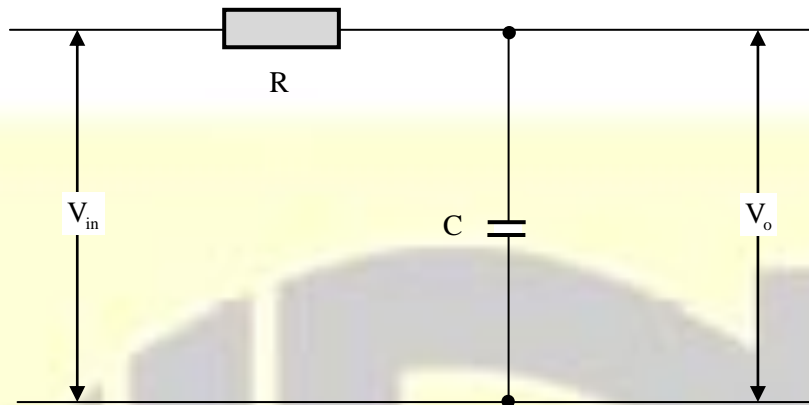
55. What is 4 point discrete Fourier transform of signal $x(n) = (1, 2, 3, 4)$

- (A) $[10, 2j, -2, -2j]$ (B) $[10, -2, -2, -2]$
 (C) $[10, -2 + 2j, -2, -2 - 2j]$ (D) $[10j, -2, -2, -10j]$

56. The value of axial ratio of a 45° linearly polarized EM wave in dB is

- (A) Infinite (B) 0 (C) 1 (D) 2

57. If an input signal with non-zero dc component is applied to a low pass RC network with single resistor R and single capacitor C as shown below, the dc component in the output will be:



- (A) The same as the input
(B) Less than the input
(C) More than the input
(D) Zero

58. The thermal noise spectral density generated in a resistor kept at $t^{\circ}\text{C}$ is given by :

- (A) $k_B(t+273)$
(B) $k_B tB$
(C) $k_B(t+273)B$
(D) $2k_B(t+273)$

59. What are poles and zeros of a system having following transfer function?

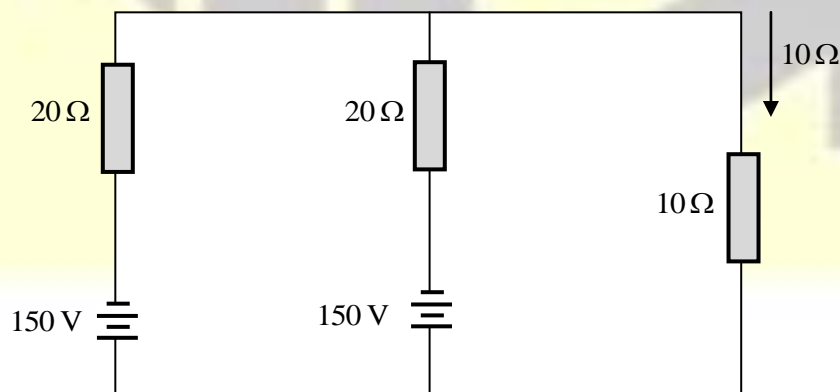
$$H(z) = \frac{(1 - z^{-2})}{(1 + 1.3z^{-1} + 0.36z^{-2})}$$

- (A) Zeros = -1, 1; Poles = -0.4, -0.9
(B) Zeros = -1, 1; Poles = 0.4, 0.9
(C) Zeros = 1; Poles = 0.4, 0.9
(D) Zeros = 1, 1; Poles = 0.4, 0.9

60. The change in phase of an electromagnetic wave normally incident on a perfect conducting wall is?

- (A) 90°
(B) 180°
(C) 0°
(D) 270°

61. What is the turns ratio of transformer needed to match a $1\text{ k}\Omega$ source resistance to a $50\ \Omega$ load?
 (A) 4.47: 1 (B) 400 : 1 (C) 20 : 1 (D) 0.05 : 1
-
62. A satellite communication link has both uplink and downlink C/N_0 of 50 dB Hz. What would be overall link C/N_0 ?
 (A) 25 dB Hz (B) 47 dB Hz (C) 53 dB Hz (D) 100 dB Hz
-
63. Determine polarization loss factor for a circularly polarized signal upon reception by linearly polarized antenna
 (A) $1/\sqrt{2}$ (B) 1/2 (C) 1 (D) 0
-
64. Which instruction of 8051 microcontroller is used for reading data from code memory?
 (A) MOV (B) MOVC (C) MOVX (D) XCH
-
65. If frequency is decreases 4 times, then skin depth of an electromagnetic wave inside a conductor will be:
 (A) halved (B) quadrupled (C) doubled (D) no change
-
66. In the circuit shown below, the current through $10\ \Omega$ resistor is:



- (A) 5A (B) 10A (C) -5A (D) None of these

67. If two tones f_1 and f_2 are amplified by a non-linear amplifier, which frequency components would be present in output?

- (A) f_1, f_2 (B) $f_1, f_2, f_1 + f_2, f_1 - f_2$
(C) $f_1 + f_2, f_1 - f_2$ (D) $nf_1 \pm mf_2$, where n and m are integers

68. When a sinusoidal voltage wave drives a Schmitt trigger, the output is a:

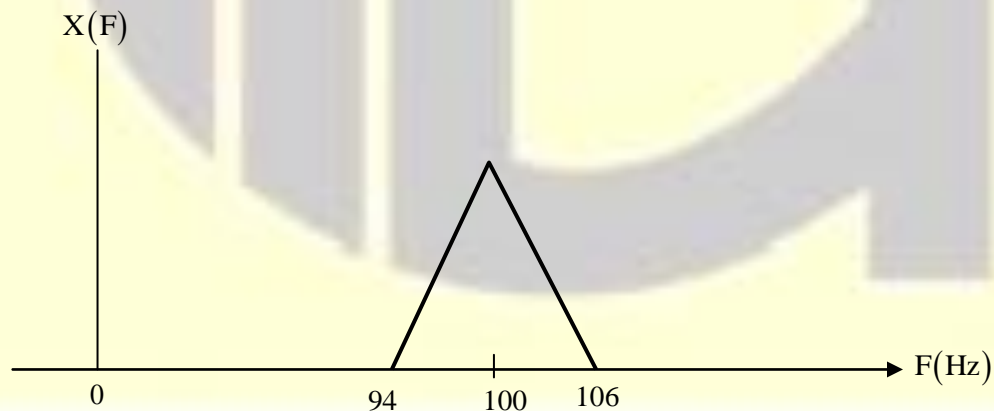
- (A) Triangular wave (B) Rectified sine wave
(C) Rectangular wave (D) Trapezoidal wave

69. What will be content of Stack Pointer if following assembly code of 8051 microcontroller is executed immediately after reset?

```
PUSH 00 H
POP 01 H
POP 02 H
```

- (A) 07 H (B) 06 H (C) 0 AH (D) 31 H

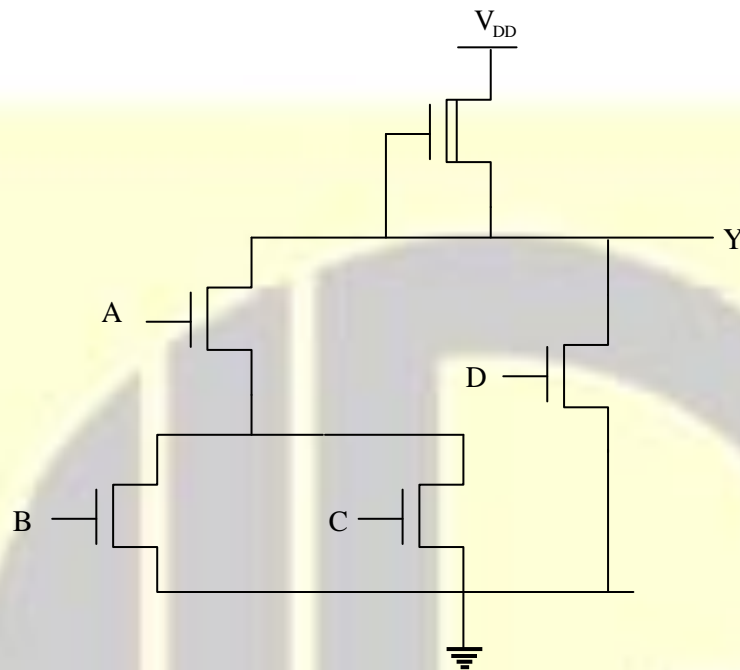
70. Consider the sampling of the band-pass signal, where spectrum is as shown below. What minimum sampling frequency would you use from the options given below so as to avoid aliasing?



- (A) 24 Hz (B) 26.5 Hz (C) 48 Hz (D) 212 Hz

71. A resistor and a capacitor are connected in series with a sine wave generator having frequency such that the resistance and the capacitive reactance are same i.e., voltage across capacitance, V_C is equal to voltage across resistance, V_R . If the frequency of the sine wave generator is doubled, then
- (A) $V_R < V_C$ (B) $V_R = V_C$
(C) $V_R > V_C$ (D) None of the above
-
72. In CMOS designs, why size of PMOS is kept larger than size of NMOS?
- (A) To get higher drive strength (B) To reduce power dissipation
(C) To get balanced rise/fall time (D) All of above
-
73. A plane wave with a frequency of 3 GHz is propagating in an unbounded medium with relative permittivity $\epsilon_r = 6$ and permeability $\mu_r = 1.5$, the phase velocity for this wave in this medium is
- (A) $1 \times 10^8 \text{ ms}^{-1}$ (B) $2 \times 10^8 \text{ ms}^{-1}$
(C) $3 \times 10^8 \text{ ms}^{-1}$ (D) $1.5 \times 10^8 \text{ ms}^{-1}$
-
74. Which of the following statements is NOT true:
- (A) A high PRF pulse Doppler radar has no ambiguities in Doppler frequency
(B) A high PRF pulse Doppler radar has no range ambiguities
(C) A high PRF pulse Doppler radar provides an accurate measurement of target's radial velocity
(D) An MTI radar has many Doppler ambiguities
-

75. The Boolean equation for Y in the following circuit is



(A) $Y = \overline{A(B+C)+D}$

(B) $Y = (A(B+C)+D)$

(C) $Y = (A+BC)D$

(D) $Y = \overline{((A+BC)D)}$

76. A wave is incident from free-space onto a dielectric region of dielectric constant $\epsilon_r = 4$. The wave impedance in the dielectric is:

(A) 55.5Ω

(B) 100.5Ω

(C) 108.6Ω

(D) 188.5Ω

77. Range resolution of a linear frequency modulated pulse compression radar depends on which of the following factors:

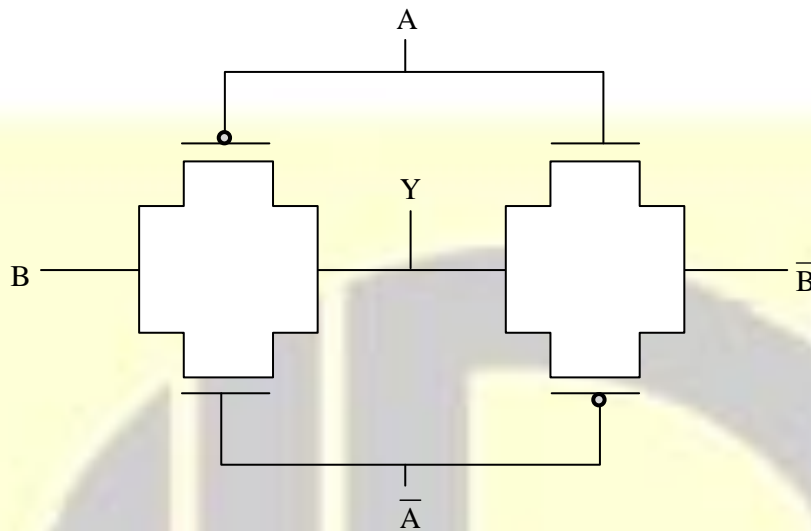
(A) Radiated power

(B) Antenna size

(C) Center frequency of the radar

(D) Bandwidth of the transmitted pulse

78. Which logical function is implemented by following transmission gate based circuit?



(A) $Y = \text{XNOR}(A, B)$

(B) $Y = \text{OR}(A, B)$

(C) $Y = \text{AND}(A, B)$

(D) $Y = \text{XOR}(A, B)$

79. The orbital period of a satellite in circular orbit of radius R from the centre of the earth, is proportional to:

(A) $R^{1/2}$

(B) $R^{3/2}$

(C) R^2

(D) R

80. Which of the following meters is based on the principle of Hall effect?

(A) Ammeter

(B) Gauss meter

(C) Voltmeter

(D) All of the above