



ISRO Previous Year Papers Electronics & Telecommunications

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1. 1 cm^3 of pure Germanium at 20°C contains about 4.2×10^{22} atoms, 2.5×10^{13} free electrons and 2.5×10^{13} holes. 0.001% of Arsenic doping donates an extra 10^{17} free electrons in the same volume. The approximate number of holes in one cm^3 in the doped semiconductor under equilibrium condition is:
- (A) 6.25×10^9 (B) 2.5×10^9 (C) 10.5×10^9 (D) 10^{17}
-
2. Measurement of Hall coefficient enables the determination of:
- (A) Temperature coefficient and thermal conductivity
(B) Mobility and concentration of charge carriers
(C) Fermi level and forbidden energy gap
(D) None of the above
-
3. Silicon is not suitable for fabrication of light emitting diodes because it is:
- (A) An indirect band gap semiconductor
(B) A direct band gap semiconductor
(C) A wide band gap semiconductor
(D) A narrow band gap semiconductor
-
4. The band gap of elements arranged in ascending order is:
- (A) Diamond, Ge, Si (B) Si, Ge, Diamond
(C) Ge, Si, Diamond (D) Diamond, Si, Ge
-
5. The following statements are made for NMOS & PMOS
1. The carrier mobility in NMOS is higher
 2. PMOS require less area than NMOS
 3. NMOS circuits are smaller than PMOS
 4. PMOS are faster in switching
- Of these, the true statements are:
- (A) 2 and 4 only (B) 2 and 3 only (C) 1 and 3 only (D) 1, 2 and 3 only
-

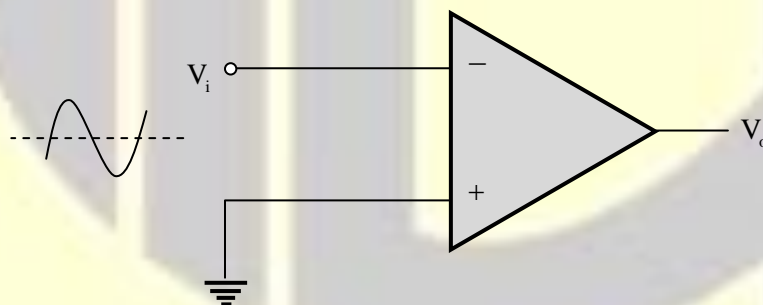
6. The following statements are made for FETs
1. In n-channel depletion mode MOS in the active region, the control voltage V_{GS} is negative.
 2. NMOS in depletion mode is cut off for $V_{GS} = 0$
 3. NMOS in enhance mode is cut off for $V_{GS} = 0$
 4. There is no path between source and drain in the enhancement mode

Of these, the true statements are:

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

7. Special handling precautions should be taken when working with MOS devices. The statement which is not true is:
- (A) All test equipment should be grounded
 - (B) MOS devices should have their all leads shorted together during shipment and storage
 - (C) Never remove or insert MOS devices with the power on
 - (D) MOS devices do not required grounding straps used for CMOS

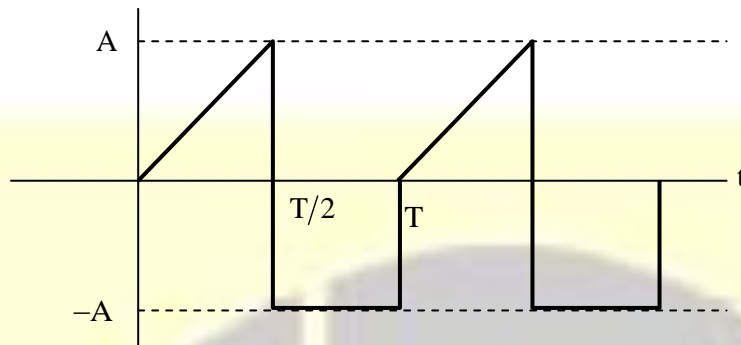
8. If the input to the circuit of Figure is a sine wave, then the output will be:



- (A) Half wave rectified sine wave (B) A full wave rectified sine wave
(C) A square wave (D) A triangular wave

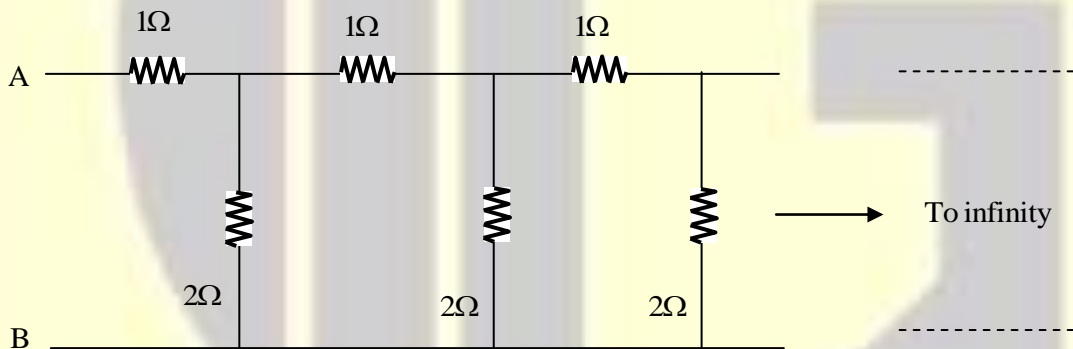
9. A high gain OpAmp has $R_f = 10^5 \Omega$ & $R_i = 10^3 \Omega$. The correct statement is:
- (A) The non-inverting gain & inverting gain are nearly same
 - (B) The inverting gain is very much higher than non-inverting gain
 - (C) The non-inverting gain is very much higher than inverting gain
 - (D) The inverting & non-inverting gains are unrelated
-
10. For various types of oscillators, the correct statement is:
- (A) LC oscillators are more stable than crystal oscillators
 - (B) Crystal oscillators have higher Q
 - (C) Phase-shift oscillators have the widest range of frequency
 - (D) Wien bridge oscillator is used where a single frequency oscillator is required
-
11. For Butterworth & Chebyshev filters, the correct statement is:
- (A) Butterworth response has a sharp cut-off
 - (B) Chebyshev response has a flat response in the pass band
 - (C) Butterworth response has ripples in the pass band
 - (D) Chebyshev response has ripples in the pass band
-
12. In a feedback series regulator circuit, the output voltage is regulated by controlling the
- (A) Magnitude of the I/P voltage
 - (B) Gain of the feedback transistor
 - (C) Voltage drop across the series pass transistor
 - (D) Reference voltage
-
13. In a fullwave rectifier circuit with centre tap transformer, if voltage between one end of secondary winding and centre tap is 300V peak, then PIV (peak inverse voltage) is
- (A) 300V (B) 150V (C) 600V (D) 900V
-

14. The rms value of the periodic waveform as shown in figure is



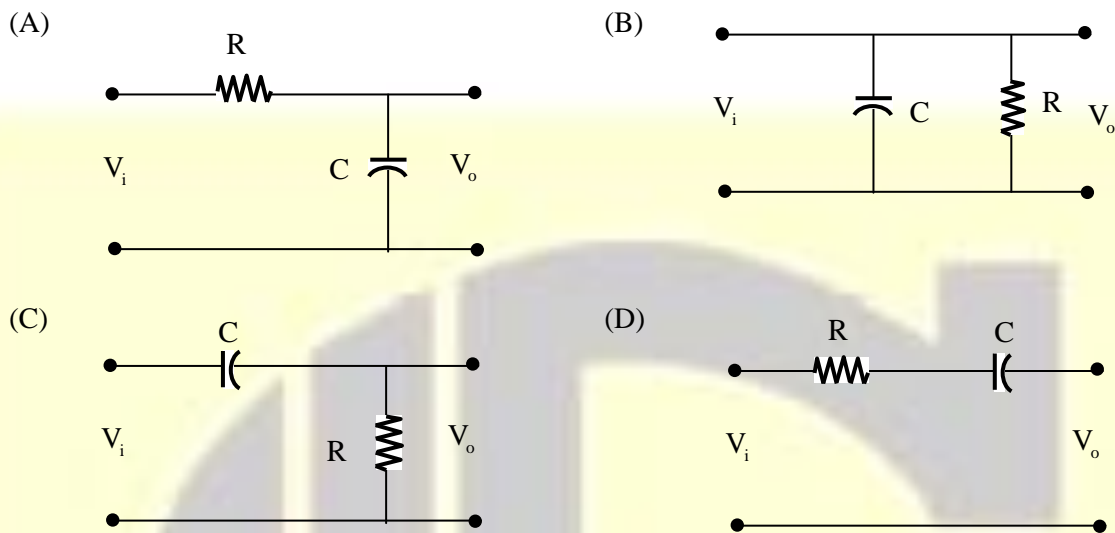
- (A) $\sqrt{3}/2A$ (B) $\sqrt{2}/3A$ (C) $\sqrt{1}/3A$ (D) $\sqrt{2}A$

15. The approximate equivalent resistance between terminals A and B for the following infinite ladder network comprising of 1Ω & 2Ω resistors is:

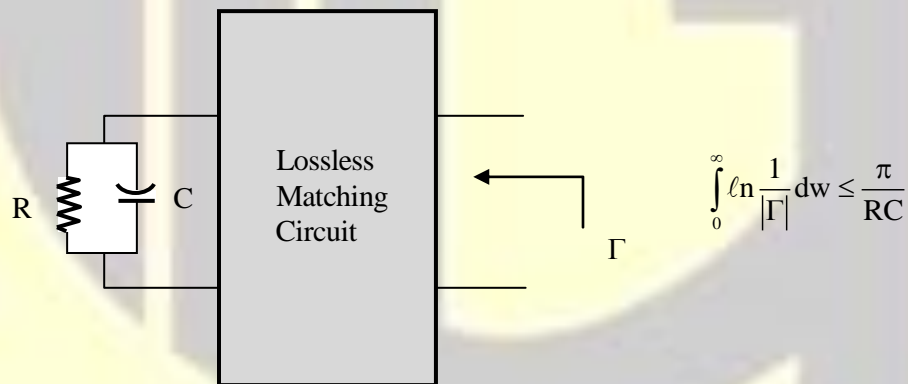


- (A) 1Ω (B) 2Ω (C) 4Ω (D) 0.5Ω

16. If the step response to the input step amplitude of 1V is given by $V_o(t) = (1 - e^{-t/RC})$, the network can be represented by:



17. For a parallel RC circuit as shown in figure, $R = 20\Omega$ & $C = 0.9\text{pF}$, which is to be matched to 50Ω over a bandwidth



The circuit has to be matched over 6 GHz to 18 GHz. What is the very best Γ that can be achieved

- (A) 0 (B) 0.05 (C) 0.1 (D) 1

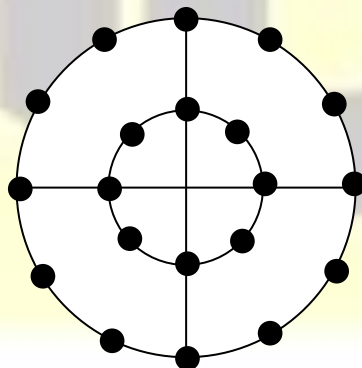
22. A signal $m(t) = 3\cos(6000\pi t) + 4\cos(7000\pi t) + 5\cos(10000\pi t)$ to be sampled. What is the minimum sampling rate for band pass sampling for truth full representation
- (A) 2000 Hz (B) 3000 Hz (C) 5000 Hz (D) 10000 Hz

23. Minimum number of bits required to represent maximum value of given analogues signal with 0.1% accuracy is:
- (A) 8 bits (B) 9 bits (C) 10 bits (D) 12 bits

24. An ideal power limited communication channel with additive white Gaussian noise is having 4 KHz band width and Signal to Noise ratio of 255. The channel capacity is:
- (A) 8 kilo bits/sec (B) 9.63kilo bits/sec
(C) 16 kilo bits/sec (D) 32 kilo bits/sec

25. An ideal power limited communication channel with additive white Gaussian noise with 1 MHz band width and Signal to Noise ratio of 15 is transmitting the information at theoretical maximum rate. If the signal to Noise ratio is reduced to 7, how much bandwidth is required to maintain same rate:
- (A) 15/7 MHz (B) 4/3 MHz (C) 2 MHz (D) None of these

26. Following constellation diagram represents:



- (A) 16 PSK (B) 16 QAM (C) 16 APSK (D) All of above

27. The information rate to be transmitted is 9000 bits/sec, FEC is $\frac{3}{4}$, the symbol rate for QPSK modulation scheme is:

- (A) 225 symbols/sec (B) 450 symbols/sec
(C) 600 symbols/sec (D) 675 symbols/sec

28. Electric displacement density D at any point on spherical surface of radius R with a charge Q at the centre in a medium with dielectric constant ϵ is:

- (A) $\frac{Q}{(4\pi\epsilon R^2)}$ (B) $\frac{Q}{(4\pi R^2)}$ (C) $\left(\frac{Q}{4\pi\epsilon R}\right)^2$ (D) $\frac{Q}{(4\pi R)^2}$

29. Which of the following does not represent Maxwell's equation:

- (A) $\oint E \cdot ds = -\int \frac{\partial B}{\partial t} \cdot d\alpha$ (B) $\oint D \cdot da = -\int \rho \cdot dV$
(C) $\nabla \times H = B + J$ (D) $\oint B \cdot da = 0$

30. For a homogeneous and isotropic medium with a charge density ρ and dielectric constant E, the Poisson's equation for electrical potential V is:

- (A) $\nabla^2 V = \frac{\rho}{\epsilon}$ (B) $\nabla^2 V = -\frac{\rho}{\epsilon}$ (C) $\nabla \cdot V = \frac{\rho}{\epsilon}$ (D) $\nabla \cdot V = -\frac{\rho}{\epsilon}$

31. For a plane travelling EM wave, the correct equation for characteristic impedance Z for the medium with permittivity of ϵ and permeability of μ is:

- (A) $Z = \sqrt{\frac{\mu}{\epsilon}}$ (B) $Z = \sqrt{\frac{\epsilon}{\mu}}$ (C) $Z = \sqrt{(\mu * \epsilon)}$ (D) $Z = \frac{1}{\sqrt{\mu * \epsilon}}$

32. A plane wave propagating in the dielectric medium has an electric field given as $E_x = E_0 \cos(2.6 \times 10^{10} t - 100z)$. The phase velocity of plane wave is:
- (A) 10^6 m/sec (B) 2.6×10^8 m/sec (C) 3.0×10^8 m/sec (D) 4.0×10^8 m/sec
-
33. A plane wave propagating in the dielectric medium has an electric field given as $E_x = E_0 \cos(3 \times 10^{10} t - 100z)$. The dielectric constant of the medium is:
- (A) 1.33 (B) 1.00 (C) 1.01 (D) 2.15
-
34. A transmission line of 50Ω characteristic impedance terminated by a load impedance of $50-j50$. The magnitude of reflection coefficient at the load is:
- (A) $\frac{\sqrt{5}}{3}$ (B) $\frac{\sqrt{3}}{5}$ (C) $3\sqrt{5}$ (D) None of these
-
35. The outer conductor diameter and the inner conductor diameter dimensions of a coaxial cable are made twice to its original value. (Coaxial line is filled with dielectric material having dielectric constant $\epsilon_r = 4.0$). The correct statement is:
- (A) Impedance remain same to its original value
(B) Impedance reduces to half of its original value
(C) Impedance increase & becomes twice of original value
(D) None of the above
-
36. A non dispersive media has:
- (A) Group velocity > phase velocity (B) Group velocity < phase velocity
(C) Group velocity = phase velocity (D) None of the above
-

37. A plane wave is characterized by:

$$\vec{E} = (0.5\hat{x} + \hat{y}e^{j\pi/2})e^{j\omega t - jkz}$$

The wave is

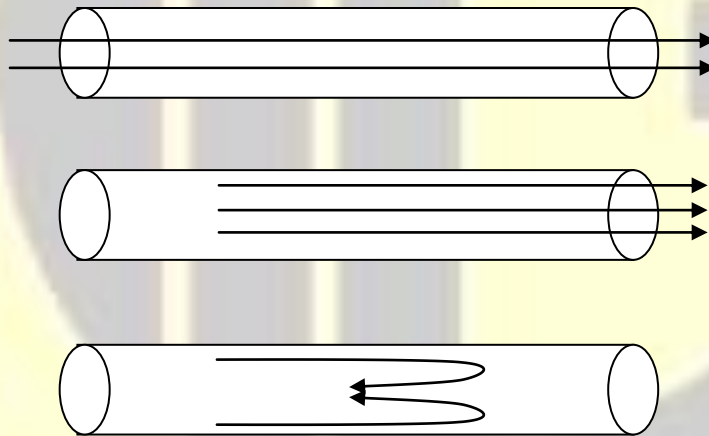
- (A) Linearly polarized (B) Circularly polarized
(C) Unpolarized (D) Elliptically polarized

38. If a right hand circularly polarized wave is incident on a perfect conductor.

The reflected wave is:

- (A) Right circularly polarized wave (B) Left circularly polarized wave
(C) Linear polarized wave (D) None of the above

39. In which of the following cases the divergence of electric field is zero

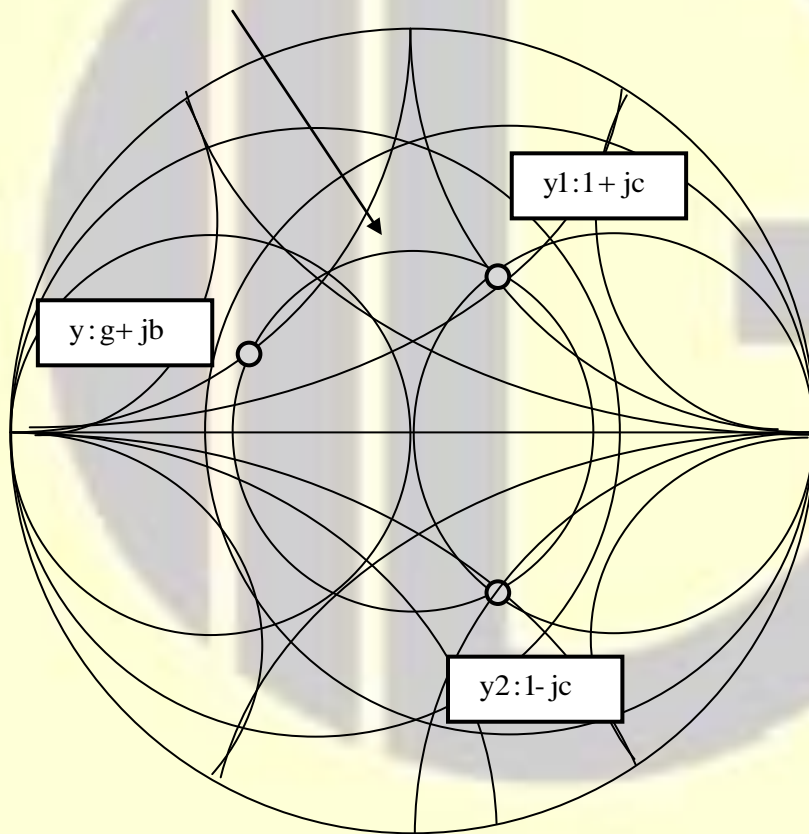


- (A) When electric field flows uniform through open tubes
(B) When electric field is released from the tube
(C) When electric field is within the closed tube
(D) None of the above

40. Skin depth at 2 GHz for a gold conductor with $\sigma = 4.55 \times 10^7$ S/m is $1.5 \mu\text{m}$. Skin depth (in μm) at 8 GHz & 18 GHz is:
 (A) 3.00, 4.50 (B) 0.75, 0.50 (C) 0.375, 0.055 (D) 1.50, 1.00

41. The S matrix of a lossless line having length $\lambda/4$ is
 (A) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ (C) $\begin{bmatrix} 0 & j \\ j & 0 \end{bmatrix}$ (D) None of the above

42. In the following Smith Chart, Constant VSWR circle



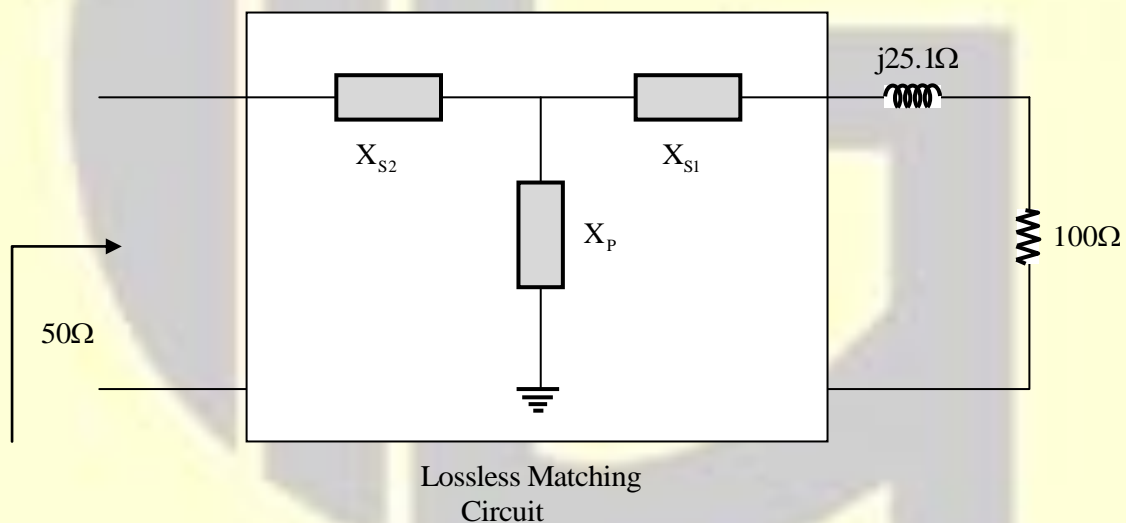
the movement from y along a constant VSWR circle to y1 needs addition of

- (A) Capacitance in series with y (B) Capacitance in shunt with y
 (C) TRL in series with y (D) Stub with y

43. If the RF transmission is terminated in its Characteristic impedance Z_c , which of the following statements is wrong:
- (A) The input impedance of transmission line becomes Z_c
 - (B) The transmission line acts as an infinite long transmission line
 - (C) The VSWR becomes one
 - (D) The VSWR becomes infinite

44. The loss-less, quarter wavelength long, RF transmission of characteristic impedance 50Ω is terminated in pure resistive load impedance 100Ω , the input impedance is:
- (A) 5Ω
 - (B) 10Ω
 - (C) 25Ω
 - (D) 500Ω

45. A lossless matching circuit is shown in the figure

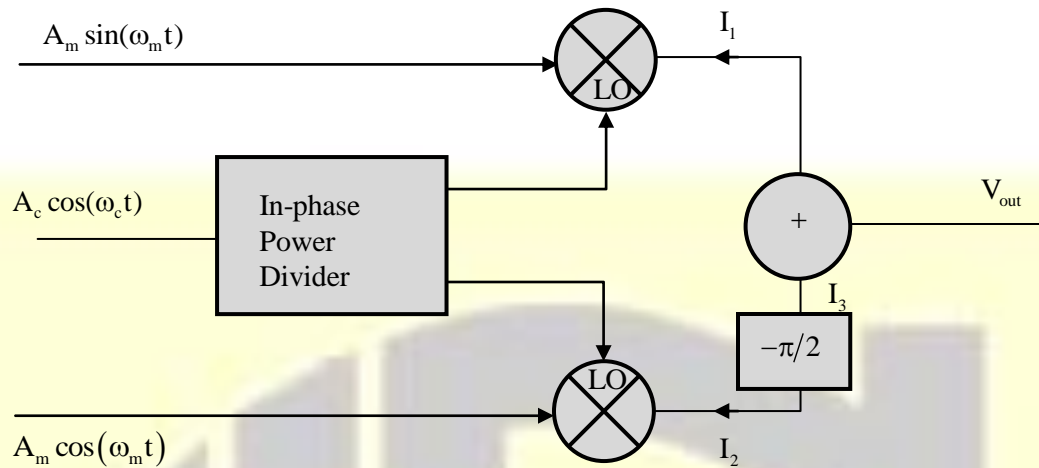


The value satisfying the matching conditions are:

- (A) $X_{S1} = -j25.1, X_P = +j100, X_{S2} = -j50$
- (B) $X_{S1} = +j25.1, X_P = -j100, X_{S2} = -j50$
- (C) $X_{S1} = -j25.1, X_P = -j100, X_{S2} = -j50$
- (D) $X_{S1} = +j25.1, X_P = +j100, X_{S2} = +100$

46. The true statement for wave propagation in rectangular wave guides filled with air is:
- (A) The phase velocity is equal to velocity of light in air
 - (B) The phase velocity is always more than the velocity of light in air
 - (C) The phase velocity is always less than the velocity of light in air
 - (D) The phase velocity is un-defined
-
47. As the wave frequency approaches to cut-off frequency of wave guide, the correct statement is:
- (A) The phase velocity of waves tends to zero
 - (B) The phase velocity of waves tends to velocity of light
 - (C) The phase velocity of waves tends to infinite
 - (D) None of these
-
48. The EM wave which does not propagate through a rectangular waveguide with $a = 30 \text{ mm}$ & $b = 15 \text{ mm}$ is:
- (A) EM wave of frequency 4.5 GHz
 - (B) EM wave of frequency 5.5 GHz
 - (C) EM wave of frequency 50 GHz
 - (D) EM wave of frequency 300 GHz
-
49. The minimum input signal that gives output signal to noise ratio of 10 dB in a system that has an input impedance equal to 50Ω , a noise figure of 4 dB and bandwidth of 100 kHz is:
[$10 \cdot \log(kT_0) = -174 \text{ dBm}$]
- (A) $0.32 \mu\text{V}$
 - (B) $1.41 \mu\text{V}$
 - (C) $0.245 \mu\text{V}$
 - (D) None of these
-

50.



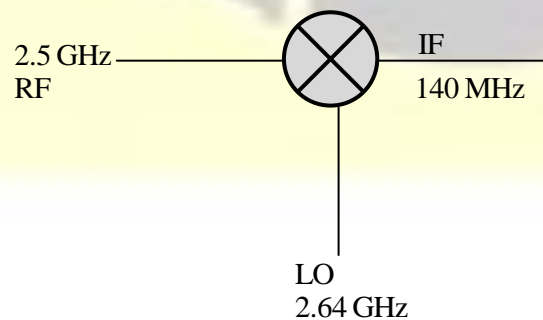
In this, circuit, V_{out} is:

- (A) Upper sideband ($\omega_L + \omega_m$) (B) Lower sideband ($\omega_L - \omega_m$)
 (C) Both upper and lower sideband ($\omega_L + \omega_m$) (D) None of above

51. The RF amplifier A is having 3 dB NF & 5 dB of gain, amplifier B is having 3.5 dB NF & 15 dB. For overall noise figure of the cascaded system, the correct statement is:

- (A) A as first stage & B as second stage offers minimum over all NF
 (B) B as first stage & A as second stage minimum over all NF
 (C) Both the combination will offer same overall NF
 (D) Over all NF will be less than 3 dB.

52. For this RF circuit, the correct statement is:



- (A) IF Spectrum is inverted and image is at 2.780 GHz
 - (B) IF Spectrum is not inverted and image is at 2.780 GHz
 - (C) IF Spectrum is inverted and image is at 2.360 GHz
 - (D) IF Spectrum is not inverted and image is 2.220 GHz
-

53. The gain of a parabolic dish antenna of 1m diameter and 80% efficiency at 9.5 GHz is:

- (A) 39 dB
 - (B) 78 dB
 - (C) 40 dB
 - (D) 45 dB
-

54. In a uniform linear array, four isotropic radiating elements are spaced $\lambda/4$ apart. The progressive phase shift between the elements required for forming the main beam at 60° of the end fire is:

- (A) $-\pi$
 - (B) $-\pi/2$
 - (C) $-\pi/4$
 - (D) $-\pi/8$
-

55. The radiation resistance of a thin line centre fed $\lambda/2$ antenna with sinusoid current distribution is:

- (A) 73Ω
 - (B) $73 + j42.5\Omega$
 - (C) 50Ω
 - (D) 75Ω
-

56. To increase gain of a parabolic reflector antenna by 6dBi, the correct statement is:

- (A) Diameter is to be increased to 6 folds
 - (B) Diameter is to be increased to 4 folds
 - (C) Diameter is to be increased to 2 folds
 - (D) None of above
-

57. The waveguide Magic Tee can be used as:

- (A) An Isolator
 - (B) T/R switch in trans-receiver
 - (C) Adjustable Phase Shifter
 - (D) All of these
-

58. The microwave device working on the principal of Faraday rotation is called as:
 (A) Rotary joint (B) Circulator (C) Isolator (D) None of these

59. The phase difference between adjacent anode poles of Magnetron is generally:
 (A) Zero radians (B) $\pi/4$ radians (C) $\pi/2$ radians (D) π radians

60. Which of the following devices cannot be used as microwave oscillator:
 (A) IMPATT diode (B) PN Junction diode
 (C) TRPAT diode (D) BARRITT diode

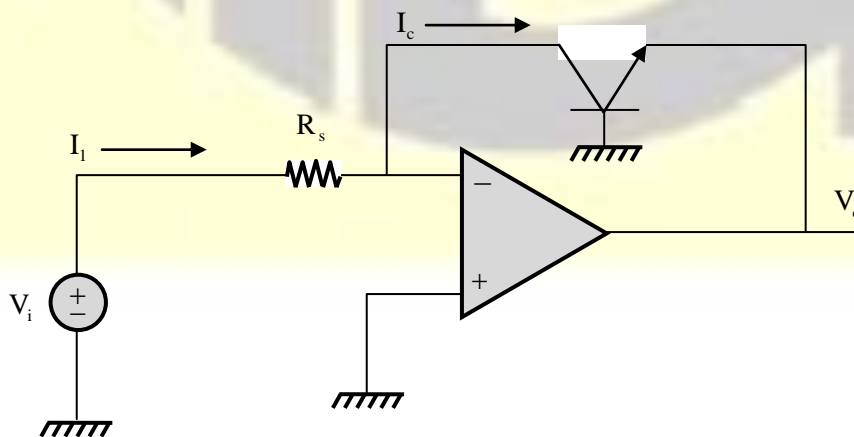
61. For a phase Locked Loop system, the open loop transfer function is

$$G(s) = \frac{1000}{s \left(\frac{s}{1192} + 1 \right)}$$

The phase margin is 50° and the crossover frequency is approximately 1000 rad/s. A time delay is introduced in the phase detector reducing the phase margin to 40° . The maximum permissible time delay (in seconds) is:

- (A) 10^{-4} (B) 0.174 (C) 1.192×10^{-3} (D) 0.174×10^{-3}

62. In this circuit, the relation between V_i & V_o is:

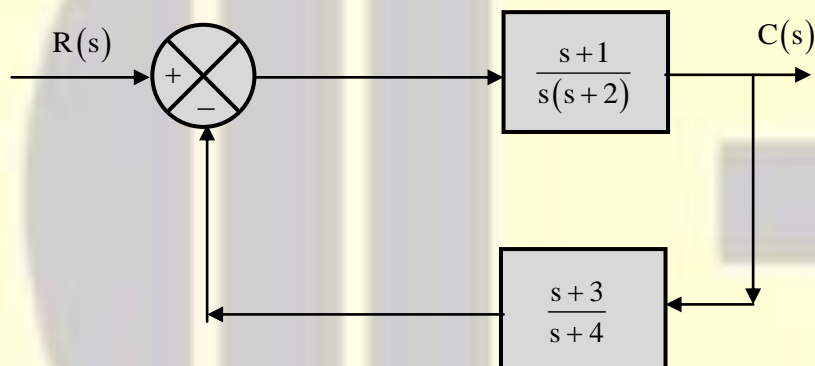


- (A) $V_o = V_i e^{V_o/V_T}$ (B) $V_o = V_T \ln \frac{V_i}{R_s I_s}$
 (C) $V_o = V_i - I_C R_s$ (D) None of these

63. Output impedance of a source follower is:

- (A) $1/g_m + r_d$ (B) $r_d / (1 + g_m r_d)$
 (C) r_d (D) None

64. For a negative feedback system shown in Figure,



The equivalent transfer function is:

- (A) $\frac{s^3 + 5s^2 + 6s}{s^3 + 7s^2 + 12s + 3}$ (B) $\frac{s^3 + 5s^2 + 6s}{s^3 + 5s^2 + 4s - 3}$
 (C) $\frac{s^2 + 5s + 4}{s^3 + 7s^2 + 12s + 3}$ (D) $\frac{s^2 + 5s + 4}{s^3 + 5s^2 + 4s - 3}$

65. If $(146)_x + (313)_{x-2} = (246)_8$, then the value of base x is:

- (A) 5 (B) 6 (C) 7 (D) 9

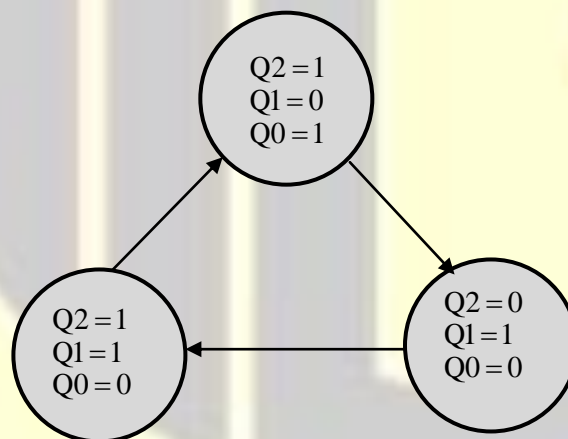
66. The truth table for implementing a Boolean variable F is given by

C	B	A	F
0	0	0	d
0	0	1	1
0	1	0	1
0	1	1	d
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

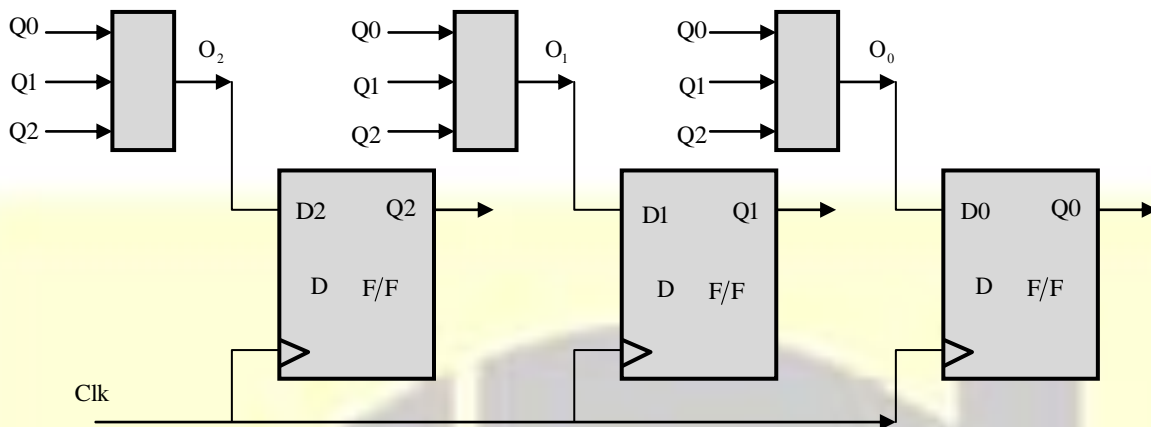
Where d represents don't care states. The minimized expression for F is

- (A) $B\bar{C} + A\bar{C} + A.B$ (B) $A.B + \bar{C}$
 (C) $\bar{A}.B.\bar{C} + A.\bar{B}.\bar{C} + A.B.C$ (D) None of above

67. The state transition diagram for a sequence generator is shown in figure



It is designed using D F/Fs and combination logic blocks L_1, L_2 & L_3 and is initialized at $(Q_2 = 1, Q_1 = 0, Q_0 = 1)$



The minimized expression for O_0 , O_1 & O_2 are:

- (A) $O_2 = Q_2$ $O_1 = Q_1$ $O_0 = Q_0$
 (B) $O_2 = Q_1 \cdot \bar{Q}_0$ $O_1 = \bar{Q}_0 \cdot Q_1 \cdot \bar{Q}_2 + Q_0 \cdot \bar{Q}_1 \cdot Q_2$ $O_0 = \bar{Q}_0 Q_1 Q_2$
 (C) $O_2 = Q_1$ $O_1 = Q_0 + \bar{Q}_2$ $O_0 = Q_1 \cdot Q_2$
 (D) None of the above

68. The number of comparators needed in a 8-bit flash type A to D converter is
 (A) 8 (B) 16 (C) 255 (D) 256

69. The register in the 8085A that is used to keep track of the memory address of the next op-code to be run in the program is the:
 (A) stack pointer (B) program counter
 (C) accumulator (D) None of above

70. The Complement Accumulator (CMA) instruction of 8085 processor on execution affects
 (A) Zero flag (B) Sign Flag (C) Carry Flag (D) None of the flags

71. “Cycle Stealing” in microprocessor parlance refers to
- (A) Special type of DMA access by an external device
 - (B) RESET operation at power ON by microprocessor
 - (C) Interrupt Acknowledge cycle
 - (D) None of above
-
72. Principle of “locality” is used in context of
- (A) Addressing lowest memory address by microprocessor
 - (B) Addressing Highest Memory address by microprocessor
 - (C) Accessing Cache memory locations
 - (D) None of above
-
73. If A, B & C are vectors and $A = 1.u_x + 2.u_y + 3.u_z$, $B = 1.u_x + 1.u_y + 1.u_z$ and $C = 3.u_x + 2.u_y + 1.u_z$, then $(A \times B) \cdot C$ is:
- (A) 2
 - (B) 1
 - (C) 0
 - (D) -1
-
74. The system of equation $x + y + z = 6$, $2x + y + z = 7$, $x + 2y + z = 8$ has
- (A) A unique solution
 - (B) No solution
 - (C) An infinite number of solutions
 - (D) None of these
-
75. If
- $$X = e^{y + e^{y + e^{y + \dots}}}$$
- then $\frac{dy}{dx}$ is
- (A) $(1-x)$
 - (B) $(1-x)/x$
 - (C) $1/x$
 - (D) $x/(1-x)$
-

76. The area bounded by the curves $y^2 = x$, $y = x$ is given by

- (A) $2/3$ (B) $1/2$ (C) $1/6$ (D) $1/3$
-

77. The eigen values of the matrix are

$$\begin{bmatrix} \cos \alpha & \sin \alpha \\ \sin \alpha & \cos \alpha \end{bmatrix}$$

- (A) $\pm \cos \alpha$ (B) $\pm \sin \alpha$ (C) $\tan \alpha$ & $\cot \alpha$ (D) $\cos \alpha \pm \sin \alpha$
-

78. The Laplace transform of $x(t)$ formed by convolution operator is:

$$x(t) = \{t.u(t)\} \otimes \{\cos 2\pi t.u(t)\}$$

- (A) $1/[s(s^2 + 4\pi^2)]$ (B) $2\pi/[s(s^2 + 4\pi^2)]$
(C) $1/[s^2(s^2 + 4\pi^2)]$ (D) $s^3/(s^2 + 4\pi^2)$
-

79. A random variable X has $\bar{X} = 0$ & $\sigma_x^2 = 1$. Form a new random variable $Y = 2X + 1$. The values of \bar{Y} & σ_y^2 are:

- (A) 0 & 1 (B) 1 & 2 (C) 1 & 4 (D) None of these
-

80. Person X can solve 80% of the ISRO question paper and Person Y can solve 60%. The probability that at least one of them will solve a problem from the question paper, selected at random is:

- (A) 0.48 (B) 0.70 (C) 0.88 (D) 0.92
-