PAPER -2

Questions Q1. to Q20. carry one mark each.

Q1. If **A** and **B** are square matrices of order 4×4 such that $\mathbf{A} = 5\mathbf{B}$ and $|\mathbf{A}| = \alpha \cdot |\mathbf{B}|$, then α is

(A) 5
(B) 25
(C) 625
(D) None of these

Q2. The particular integral of the differential equation $(D^3 - D)y = e^x + e^{-x}$, $D \equiv \frac{d}{dx}$ is

(A) $\frac{1}{2}(e^x + e^{-x})$
(B) $\frac{1}{2}x(e^x + e^{-x})$
(C) $\frac{1}{2}x^2(e^x + e^{-x})$
(D) $\frac{1}{2}x^2(e^x - e^{-x})$

Q3. If $x(t) = \frac{d}{dt}\{te^{-t}u(t)\}$, then laplace transform of $x(t)$ is

(A) $\frac{1}{s(s+1)^2}$
(B) $\frac{s}{(s+1)^2}$
(C) $\frac{e^{-s}}{s+1}$
(D) $\frac{e^{-s}}{(s+1)^2}$

Q4. Consider the $x(t)$ as shown in fig. Q4. The FT of $x(t)$ is

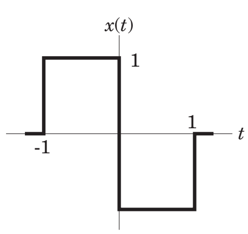


Fig Q4

(A) $\frac{2\sin\omega - 2}{\omega}$
(B) $\frac{2\cos\omega - 2}{j\omega}$
(C) $2j\omega\cos\omega$
(D) $2j\omega\sin\omega$

Q5. If a resistor of 10 Ω is placed in parallel with voltage source in the circuit of fig. Q5, the current i will be

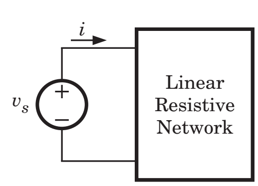


Fig Q5

(A) increased
(B) decreased
(C) unchanged
(D) It is not possible to say

Q6. The current carrying capacity of a 1 W, 4 MΩ resistor used in radio receiver is

(A) 0.5 kA
(B) 2 kA
(C) 2 mA
(D) 0.5 mA

Q7. The equation governing the diffusion of neutral atom is

(A) $\frac{\partial N}{\partial t} = D\frac{\partial^2 N}{\partial x^2}$
(B) $\frac{\partial N}{\partial x} = D\frac{\partial^2 N}{\partial t^2}$
(C) $\frac{\partial^2 N}{\partial t^2} = D\frac{\partial N}{\partial x}$
(D) $\frac{\partial^2 N}{\partial x^2} = D\frac{\partial N}{\partial t}$

Q8. The p-type substrate in a monolithic circuit should be connected to

(A) any dc ground point
(B) the most negative voltage available in the circuit
(C) the most positive voltage available in the circuit
(D) no where, i.e. be floating

Q9. Consider the List I and List II

List I (Oscillator)	List II (Characteristic)
P. Colpitts Oscillator	1. RC Oscillator
Q. Phase shift Oscillator	2. LC Oscillator
R. Tunnel diode Oscillator	3. Negative resistance Oscillator
S. Relaxation Oscillator	4. Sweep Circuits

The correct match is

	P	Q	R	S
(A)	1	2	3	4
(B)	2	1	3	4
(C)	1	2	4	3
(D)	2	1	4	3

Q10. For the circuit shown in fig. Q10, $V_{CB} = 0.5$ V and $\beta = 100$. The value of I_Q is

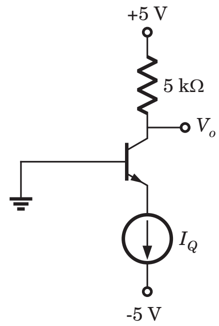


Fig Q10

(A) 1.68 mA

(B) 0.909 mA

(C) 0.134 mA

(D) None of the above

Q11. A four-variable switching function has minterms m_6 and m_9. If the literals in these minterms are complemented, the corresponding minterm numbers are

(A) m_3 and m_0

(B) m_9 and m_6

(C) m_2 and m_0

(D) m_6 and m_9

Q12. The diode logic circuit of fig. Q12 is a

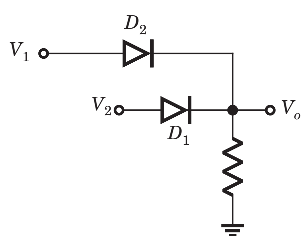


Fig Q12

(A) AND

(B) OR

(C) NAND

(D) NOR

Q13. The even part of a function $x[n] = u[n] - u[n-4]$ is

(A) $\frac{1}{2}\{1 + \delta[n] - u[n-4] - u[-n-4]\}$

(B) $\frac{1}{2}\{u[n+3] - u[n-4] + \delta[n]\}$

(C) $\frac{1}{2}\{u[n] + u[-n] - u[n-4] - u[-n-4]\}$

(D) Above all

Q14. The trigonometric Fourier series for the waveform shown in fig Q14 will be

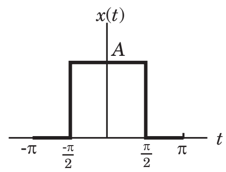


Fig Q14

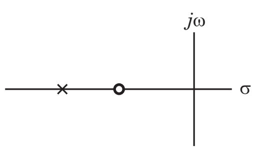
(A) $\frac{A}{2}+\frac{2A}{\pi}(\sin t-\frac{1}{3}\sin 3t+\frac{1}{5}\sin 5t....)$

(B) $\frac{A}{2}+\frac{2A}{\pi}(\cos t-\frac{1}{2}\cos 2t+\frac{1}{3}\cos 3t....)$

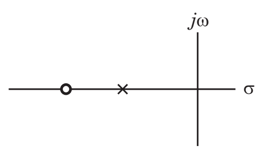
(C) $\frac{A}{2}+\frac{2A}{\pi}(\cos t-\frac{1}{3}\cos 3t+\frac{1}{5}\cos 5t....)$

(D) $\frac{A}{2}+\frac{2A}{\pi}(\sin t+\cos t+\frac{1}{3}\sin 3t+\frac{1}{3}\cos 3t....)$

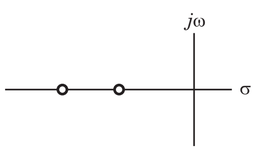
Q15. The poll–zero configuration of a phase–lead compensator is given by



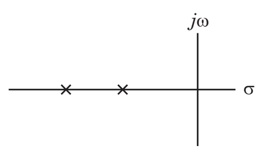
(A)



(B)



(C)



(D)

Q16. While designing controller, the advantage of pole– zero cancellation is

(A) The system order is increased
(B) The system order is reduced
(C) The cost of controller becomes low
(D) System's error reduced to optimum levels

Q17. **Assertion (A):** PSK is inferior to FSK.

Reason (R): PSK require less bandwidth than FSK.

Choose correct option:

(A) Both **A** and **R** individually true and **R** is the correct explanation of **A**.

(B) Both **A** and **R** individually true and but **R** is not the correct explanation of **A**.

(C) **A** is true but **R** is false

(D) **A** is false

Q18. In a certain telemetry system, the measured values are converted to digital form. The digital values can then be transmitted via FSK (binary or quaternary) , or BPSK or QPSK systems. Out of these the best noise immunity can be obtained with

(A) binary FSK (B) quaternary FSK

(C) BPSK (D) QPSK

Q19. An antenna, when radiating, has a highly directional radiation pattern. When the antenna is receiving, its radiation pattern

(A) is more directive (B) is less directive

(C) is the same (D) exhibits no directivity at all

Q20. The beamwidth between first null of uniform linear array of N equally spaced (element spacing $= d$) equally excited antenna is determined by

(A) N alone and not by d (B) d alone and not by N

(C) the ratio N/d (D) the product Nd

Questions Q21. to Q75. carry two marks each.

Q21. If $\mathbf{A} = \begin{bmatrix} 0 & -\tan\frac{\alpha}{2} \\ \tan\frac{\alpha}{2} & 0 \end{bmatrix}$ then $(\mathbf{I}-\mathbf{A})\cdot\begin{bmatrix} \cos\alpha & -\sin\frac{\alpha}{2} \\ \sin\alpha & \cos\alpha \end{bmatrix}$ is equal to

(A) $\mathbf{I}+\mathbf{A}$

(B) $\mathbf{I}-\mathbf{A}$

(C) $\mathbf{I}+2\mathbf{A}$

(D) $\mathbf{I}-2\mathbf{A}$

Q22. For what value of $x\left(0 \le x \le \frac{\pi}{2}\right)$, the function $y = \frac{x}{(1+\tan x)}$ has a maxima ?

(A) $\tan x$

(B) 0

(C) $\cot x$

(D) $\cos x$

Q23. The value of $\int_0^{2a} \frac{f(x)}{f(x)+f(2a-x)}\,dx$ is

(A) 0

(B) 1

(C) a

(D) $2a$

Q24. The integrating factor for the differential equation $(x^3+xy^4)dx+2y^3dy=0$ is given by

(A) e^{-x}

(B) e^{x^2}

(C) e^{x}

(D) e^{-x^2}

Q25. $\int_c \frac{\cos\pi z}{z-1}\,dz = ?$ where c is the circle $|z|=3$

(A) $i2\pi$

(B) $-i2\pi$

(C) $i6\pi^2$

(D) $-i6\pi^2$

Q26. If 3 is the mean and $\frac{3}{2}$ is the standard deviation of a binomial distribution, then the distribution is

(A) $\left(\frac{3}{4}+\frac{1}{4}\right)^{12}$

(B) $\left(\frac{1}{2}+\frac{3}{2}\right)^{12}$

(C) $\left(\frac{4}{5}+\frac{1}{5}\right)^{60}$

(D) $\left(\frac{1}{5}+\frac{4}{5}\right)^{5}$

Q27. For the differential equation $dy/dx = x - y^2$ given that

x:	0	0.2	0.4	0.6
y:	0	0.02	0.0795	0.1762

Using Milne predictor–correction method, the y at next value of x is

(A) 0.2498 (B) 0.3046

(C) 0.4648 (D) 0.5114

Q28. The inverse Fourier transform of $X(j\omega) = \frac{d}{d\omega}\left(\frac{4\sin 4\omega \sin 2\omega}{\omega}\right)$ is

(A) $t^2 - 2e^{-t}\text{rect}\,\{2(t-4)\}$

(B) $t^2 + 2e^{-t}\text{rect}\,(2(t+4))$

(C) $-t\{\text{rect}\,(2t+8) + \text{rect}\,(2t-8)\}$

(D) $t\{\text{rect}\,(2t+4) - \text{rect}\,(2t-8)\}$

Q29. The time signal $x(t)$ corresponding to $X(s) = s\frac{d^2}{ds^2}\left(\frac{1}{s^2+9}\right) + \frac{1}{s+3}$ is

(A) $\left(e^{-3t} + \frac{2t}{3}\sin 3t + \frac{t^2}{9}\cos 3t\right)u(t)$

(B) $(e^{-3t} + 2t\sin 3t + t^2\cos 3t)u(t)$

(C) $\left(e^{-3t} + \frac{2t}{3}\sin 3t + t^2\cos 3t\right)u(t)$

(D) $(e^{-3t} + t^2\sin 3t + 2t\cos 3t)u(t)$

Q30. The incidence matrix of a graph is as given below

$$\mathbf{A} = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & -1 & 1 & -1 \\ 0 & 0 & 0 & 1 & 0 & 0 & -1 & 0 \end{bmatrix}$$

The number of possible tree are

(A) 40 (B) 70

(C) 50 (D) 240

Q31. In the fig Q31 the value of v_1 is

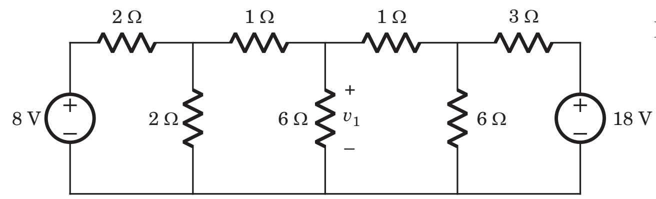


Fig Q31

(A) 6 V

(B) 7 V

(C) 8 V

(D) 10 V

Q32. In the circuit of fig. Q32 the 30 V source has been applied for a long time. The switch is opened at $t = 1$ ms. At $t = 4$ ms the $v_C(4\,\text{ms})$ is

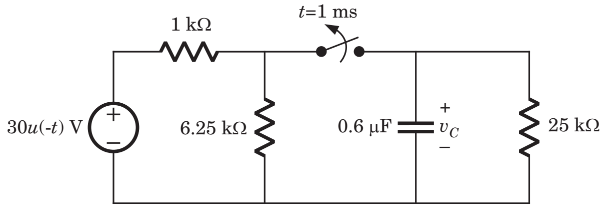


Fig Q32

(A) 8.39 mV

(B) 2.59 V

(C) 1.13 mV

(D) 2.77 V

Q33. For a *RLC* series circuit $R = 20\,\Omega$, $L = 0.6\,\text{H}$, the value of C will be

[CD =critically damped, OD =over damped, UD =under damped].

	CD	OD	UD
(A)	$C = 6$ mF	$C > 6$ mF	$C < 6$ mF
(B)	$C = 6$ mF	$C < 6$ mF	$C > 6$ mF
(C)	$C > 6$ mF	$C = 6$ mF	$C < 6$ mF
(D)	$C < 6$ mF	$C = 6$ mF	$C > 6$ mF

Q34. In the circuit shown in Fig. Q34 $v(0^-) = 8$ V and $i_{in}(t) = 4\delta(t)$. The $v_C(t)$ for $t \geq 0$ is

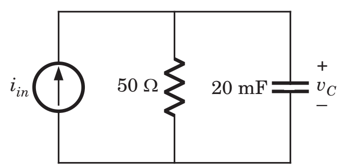


Fig Q34

(A) $164e^{-t}$ V

(B) $208e^{-t}$ V

(C) $208(1 - e^{-3t})$ V

(D) $164e^{-3t}$ V

Q35. In the circuit shown in fig. Q35, when the voltage V_1 is 10 V, the current I is 1 A. If the applied voltage at port-2 is 100 V, the short circuit current flowing through at port 1 will be

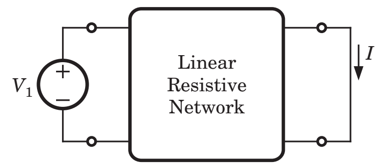


Fig Q35

(A) 0.1 A (B) 1 A

(C) 10 A (D) 100 A

Q36. The network function of circuit shown in fig.Q36 is $H(\omega)=\frac{V_o}{V_1}=\frac{4}{1+j0.01\omega}$

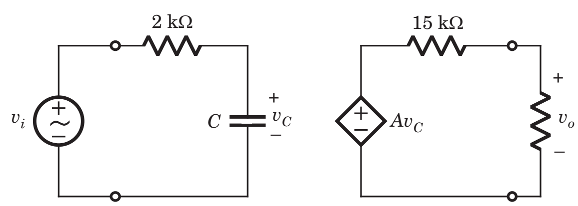


Fig Q36

The value of the C and A is

(A) 10 μF, 6 (B) 5 μF, 10

(C) 5 μF, 6 (D) 10 μF, 10

Q37. In germanium($n_i = 2.4\times10^{13}$ cm^{-3}) semiconductor at $T = 300$ K, the acceptor concentrations is $N_a = 10^{13}$ cm^{-3} and donor concentration is $N_d = 0$. The thermal equilibrium concentration p_0 is

(A) 2.97×10^{9} cm^{-3}

(B) 2.68×10^{12} cm^{-3}

(C) 2.95×10^{13} cm^{-3}

(D) 2.4 cm^{-3}

Q38. A silicon ($n_i = 1.5\times10^{10}$ cm^{-3}) pn junction at $T = 300$ K has $N_d = 10^{14}$ cm^{-3} and $N_a = 10^{17}$ cm^{-3}. The built-in voltage is

(A) 0.63 V (B) 0.93 V

(C) 0.026 V (D) 0.038 V

Q39. The maximum electric field in reverse-biased silicon pn junction is $|E_{max}| = 3\times10^{5}$ V/cm. The doping concentration are $N_d = 4\times10^{16}$ cm^{-3} and $N_a = 4\times10^{17}$ cm^{-3}. The magnitude of the reverse bias voltage is

(A) 3.6 V (B) 9.8 V

(C) 7.2 V (D) 12.3 V

Q40. A ideal n-channel MOSFET has parameters $\mu_n = 525\ \text{cm}^2/\text{V}-\text{s}$, $V_{TN} = 0.75$ V, $t_{ox} = 400\ \text{A}^\circ$. When MOSFET is biased in the saturation region at $V_{GS} = 5$ V, the required rated current is $I_{D(sat)} = 6$ mA. The required ratio W/L is

(A) 14.7 (B) 11.2

(C) 9.61 (D) 7.2

Q41. For a n −channel enhancement-mode MOSFET the parameters are $V_{TN} = 0.8$ V, $k'_n = 8\ \mu\text{A}/\text{V}^2$ and $W/L = 5$. If the transistor is biased in saturation region with $I_D = 0.5$ mA, then required v_{GS} is

(A) 1.68 V

(B) 2.38 V

(C) 4.56 V

(D) 3.14 V

Q42. The cutin voltage for each diode in fig. Q42 is $V_\gamma = 0.6$ V. Each diode current is 0.5 mA. The value of R_1, R_2 and R_3 will be respectively

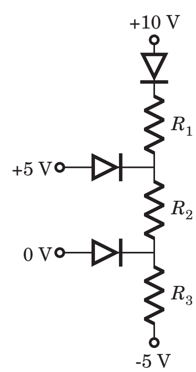


Fig Q42

(A) 10 kΩ, 5 kΩ, 2.93 kΩ (B) 6 kΩ, 3 kΩ, 3.43 kΩ

(C) 5 kΩ, 6 kΩ, 4.933 kΩ (D) 6 kΩ, 8 kΩ, 6.43 kΩ

Q43. In the circuit of fig. Q43 Zener voltage is $V_Z = 5$ V and $\beta = 100$. The value of I_{CQ} and V_{CEQ} are

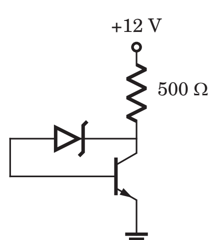


Fig Q43

(A) 12.47 mA, 4.3 V (B) 12.47 mA, 5.7 V

(C) 10.43 A, 5.7 V (D) 10.43 A, 4.3 V

Q44. The transistors in the circuit of fig. Q44 have parameter $V_{TN} = 0.8\text{ V}$, $k_n' = 40\,\mu\text{A}/\text{V}^2$ and $\lambda = 0$. The width-to-length ratio of M_2 is $\left(\frac{W}{L}\right)_2 = 1$. If $V_o = 0.10\text{ V}$ when $V_i = 5\text{ V}$, then $\left(\frac{W}{L}\right)_1$ for M_1 is

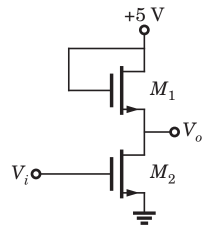


Fig Q44

(A) 47.5

(B) 28.4

(C) 40.5

(D) 20.3

Q45. In the circuit of fig. Q45 the CMRR of the op-amp is 60 dB. The magnitude of the v_o is

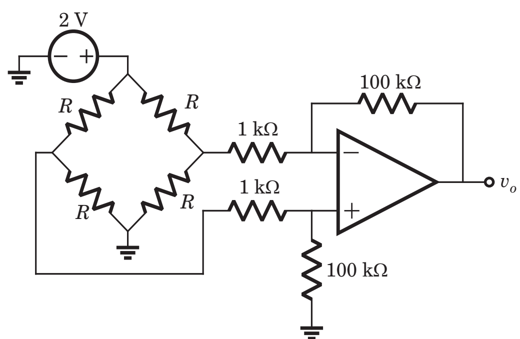


Fig Q45

(A) 1 mV

(B) 100 mV

(C) 200 mV

(D) 2 mV

Q46. If the X and Y logic inputs are available and their complements $\overline{X}$ and $\overline{Y}$ are not available, the minimum number of two-input NAND required to implement $X \oplus Y$ is

(A) 4

(B) 5

(C) 6

(D) 7

Q47. There are four Boolean variables x_1, x_2, x_3 and x_4. The following function are defined on sets of them

$$f(x_3, x_2, x_1) = \Sigma m(3,4,5)$$
$$g(x_4, x_3, x_2) = \Sigma m(1,6,7)$$
$$h(x_4, x_3, x_2, x_1) = fg$$

Then $h(x_4, x_3, x_2, x_1)$ is

(A) $\Sigma m(3, 12, 13)$

(B) $\Sigma m(3, 6)$

(C) $\Sigma m(3, 12)$

(D) 0

Q48. The ideal inverter in fig. Q48 has a reference voltage of 2.5 V. The forward voltage of the diode is 0.75 V. The maximum number of diode logic circuit, that may be cascaded ahead of the inverter without producing logic error, is

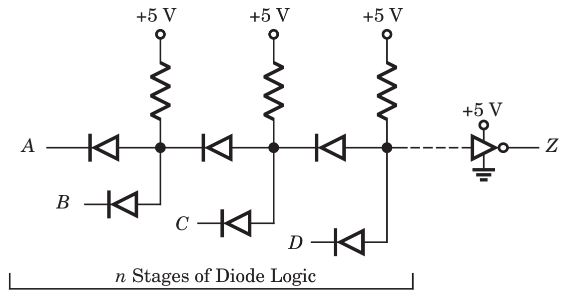


Fig Q48

(A) 3
(B) 4
(C) 5
(D) 9

Q49. Consider the following set of 8085 μP instruction

```
MVI    A, BYTE1
RLC
MOV    B, A
RLC
RLC
ADD    B
```

If BYTE1 = 07H, then content of accumulator, after the execution of program will be

(A) 46H
(B) 70H
(C) 38H
(D) 68H

Q50. Consider the execution of the following instruction by 8085 μp

```
MVI    H, 01FFH
SHLD   2050H
```

After execution the contents of memory location 2050H, 2051H and registers H, L will be respectively

(A) 01H, FFH, FFH, 01H

(B) FFH, 01H, FFH, 01H

(C) FFH, 01H, 01H, FFH

(D) 01H, FFH, 01H, FFH

Q51. The system shown in fig. Q51 is

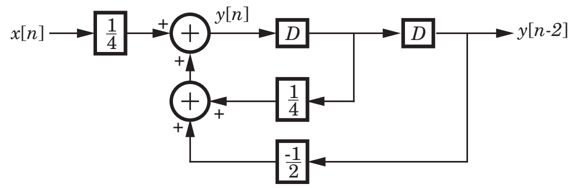


Fig Q51

(A) Stable and causal

(B) Stable but not causal

(C) Causal but unstable

(D) unstable and not causal

Q52. The transfer function of a system is given as

$$H(z)=\frac{2\left(z+\frac{1}{2}\right)}{\left(z-\frac{1}{2}\right)\left(z-\frac{1}{3}\right)}.$$

Consider the two statements

Statement(i) : System is causal and stable.

Statement(ii) : Inverse system is causal and stable.

The correct option is

(A) (i) is true

(B) (ii) is true

(C) Both (i) and (ii) are true

(D) Both are false

Q53. A causal LTI filter has the frequency response $H(j\omega)$ shown in fig. Q53. For the input signal $x(t)=e^{-jt}$, output will be

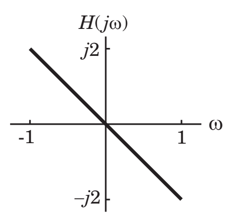


Fig Q53

(A) $-2je^{-jt}$

(B) $2je^{-jt}$

(C) $4\pi je^{-jt}$

(D) $-4\pi je^{-jt}$

Q54. The numeric value of $a = \sum_{n=0}^{\infty} n\left(\frac{1}{4}\right)^n$ will be

(A) $\frac{16}{9}$

(B) $\frac{9}{4}$

(C) $\frac{4}{9}$

(D) $\frac{9}{16}$

Q55. Each of two sequence $x[n]$ and $y[n]$ has a period $N = 4$. The FS coefficient are

$$X[0] = X[3] = \frac{1}{2} X[1] = \frac{1}{2} X[2] = 1 \text{ And } Y[0], Y[1], Y[2], Y[3] = 1$$

The FS coefficient $Z[k]$ for the signal $z[n] = x[n]y[n]$ will be

(A) 6

(B) $6|k|$

(C) $6^{|k|}$

(D) $e^{j\frac{\pi}{2}k}$

Q56. A Routh table is shown below. The location of pole on RHP, LHP and imaginary axis are

s^7	1	2	–1	–2
s^5	1	2	–1	–2
s^5	3	4	–1	
s^4	1	–1	–8	
s^3	7	8		
s^2	–18	–21		
s^1	–9			
s^0	–21			

(A) 1, 2, 4

(B) 1, 6, 0

(C) 1, 0, 6

(D) None of the above

Q57. The open-loop transfer function of a *ufb* control system is

$$G(s) = \frac{K(1+2s)(1+4s)}{s^2(s^2+2s+8)}$$

The position, velocity and acceleration error constants are respectively

(A) 0, 0, $4K$

(B) 0, $4K$, ∞

(C) ∞, $\frac{K}{8}$, 0

(D) ∞, ∞, $\frac{K}{8}$

Q58. The forward-path transfer function of a *ufb* system is

$$G(s) = \frac{K(s+1)(s+2)}{(s+5)(s+6)}$$

The break points are

	Break-in	Breakaway
(A)	–1.563	–5.437
(B)	–5.437	–1.563
(C)	–1.216	–5.743
(D)	–5.743	–1.216

Q59. The Nyquist plot of a system is shown in fig. Q59. The open-loop transfer function is

$$G(s)H(s) = \frac{4s+1}{s^2(s+1)(2s+1)}$$

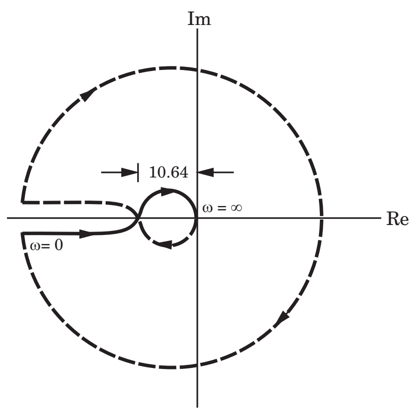


Fig Q59

The no. of poles of closed loop system in RHP are

(A) 0

(B) 1

(C) 2

D) 4

Q60. For the network shown in fig. Q60. The output is $i_R\ (t)$. The state space representation is

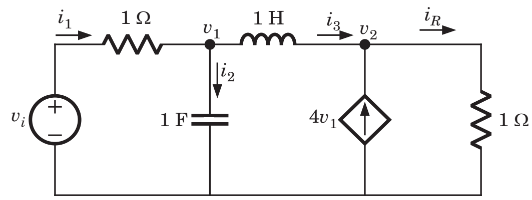


Fig Q60

(A) $\begin{bmatrix} \dot{v}_1 \\ \dot{i}_3 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ -3 & 1 \end{bmatrix} \begin{bmatrix} v_1 \\ i_1 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} v_i,\ i_R = [4 \quad 1] \begin{bmatrix} v_1 \\ i_3 \end{bmatrix}$

(B) $\begin{bmatrix} \dot{v}_1 \\ \dot{i}_3 \end{bmatrix} = \begin{bmatrix} -1 & -1 \\ -3 & -1 \end{bmatrix} \begin{bmatrix} v_1 \\ i_3 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} v_i,\ i_R = [4 \quad 1] \begin{bmatrix} v_1 \\ i_3 \end{bmatrix}$

(C) $\begin{bmatrix} \dot{v}_1 \\ \dot{v}_2 \end{bmatrix} = \begin{bmatrix} 1 & -3 \\ 1 & 6 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} + \begin{bmatrix} 1 \\ -1 \end{bmatrix} v_i,\ i_R = [1 \quad 4] \begin{bmatrix} v_1 \\ v_2 \end{bmatrix}$

(D) $\begin{bmatrix} \dot{v}_1 \\ \dot{v}_2 \end{bmatrix} = \begin{bmatrix} 1 & 3 \\ -1 & 6 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} + \begin{bmatrix} 1 \\ -1 \end{bmatrix} v_i,\ i_R = [1 \quad 4] \begin{bmatrix} v_1 \\ v_2 \end{bmatrix}$

Q61. The power spectral density of a bandpass white noise $n(t)$ is N/2 as shown in fig. Q61. The value of $\overline{n^2}$ is

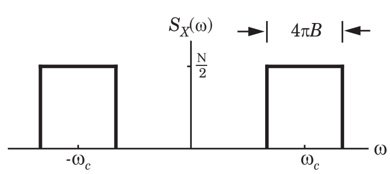


Fig Q61

(A) NB

(B) 2NB

(C) 2πNB

(D) $\frac{NB}{\pi}$

Q62. In a receiver the input signal is 100 μV, while the internal noise at the input is 10 μV. With amplification the output signal is 2 V, while the output noise is 0.4 V. The noise figure of receiver is

(A) 2

(B) 0.5

(C) 0.2

(D) None of the above

Q63. 12 signals each band-limited to 5 kHz are to be transmitted over a single channel by frequency division multiplexing . If AM-SSB modulation guard band of 1 kHz is used, then the band width of the multiplexed signal will be

(A) 131 kHz

(B) 81 kHz

(C) 121 kHz

(D) 71 kHz

Q64. A carrier wave of 1 GHz and amplitude 3 V is frequency modulated by a sinusoidal modulating signal frequency of 500 Hz and of peak amplitude of 1 V. The frequency deviation is 1 kHz. The peak level of the modulating wave form is changed to 5 V and the modulating frequency is changed to 2 kHz. The expression for the new modulated wave form is

(A) $\cos[2\pi \times 10^6 t + 2.5\cos(4\pi \times 10^3 t)]$

(B) $\cos[2\pi \times 10^6 t + 5\cos(4\pi \times 10^3 t)]$

(C) $3\cos[2\pi \times 10^6 t + 2.5\cos(4\pi \times 10^3 t)]$

(D) $3\cos[2\pi \times 10^6 t + 5\cos(4\pi \times 10^3 t)]$

Q65. Let message signal $m(t) = \cos(4\pi 10^3 t)$ and carrier signal $c(t) = 5\cos(2\pi 10^6 t)$ are used to generate a FM signal. It the peak frequency deviation of the generated FM signal is three times the transmission bandwidth of the AM signal, then the coefficient of the term $\cos(2\pi(1008 \times 10^3) t)$ in the FM signal would be

(A) $5J_4(3)$

(B) $\frac{5}{2}J_8(3)$

(C) $\frac{5}{2}J_8(4)$

(D) $5J_4(6)$

Q66. The curl of vector field $\mathbf{A} = \rho z \sin\phi \, \mathbf{u}_\rho + 3\rho z^2 \cos\phi \, \mathbf{u}_\rho$ at point (5, 90°, 1) is

(A) 0

(B) $12\mathbf{u}_\theta$

(C) $6\mathbf{u}_r$

(D) $5\mathbf{u}_\phi$

Q67. A 150 MHz uniform plane wave is normally incident from air onto a material. Measurements yield a SWR of 3 and the appearance of an electric field minimum at 0.3λ in front of the interface. The impedance of material is

(A) $502 - j641\,\Omega$

(B) $641 - j502\,\Omega$

(C) $641 + j502\,\Omega$

(D) $502 + j641\,\Omega$

Q68. The quarter-wave lossless $100\,\Omega$ line is terminated by load $Z_L = 210\,\Omega$. If the voltage at the receiving end is 60 V, the voltage at the sending end is

(A) 126 V

(B) 28.6 V

(C) 21.3 V

(D) 169 V

Q69. An antenna can be modeled as an electric dipole of length 4 m at 3 MHz. If current is uniform over its length, then radiation resistance of the antenna is

(A) $1.974\,\Omega$

(B) $1.263\,\Omega$

(C) $2.186\,\Omega$

(D) $2.693\,\Omega$

Q70. An array comprises two dipoles that are separated by half wavelength. If the dipoles are fed by currents, that are 180° out of phase with each other, then array factor is

(A) $\sin\left(\frac{\pi}{4}\cos\theta + \frac{\pi}{4}\right)$

(B) $\cos\left(\frac{\pi}{4}\cos\theta + \frac{\pi}{2}\right)$

(C) $\cos\left(\frac{\pi}{2}\cos\theta + \frac{\pi}{2}\right)$

(D) $\sin\left(\frac{\pi}{2}\cos\theta + \frac{\pi}{2}\right)$

Common Data Questions

Common Data for Questions Q.71-73:

For the circuit shown in fig. Q71-73 transistor parameters are $V_{TN} = 2$ V, $K_n = 0.5\,\text{mA}/\text{V}^2$ and $\lambda = 0$. The transistor is in saturation.

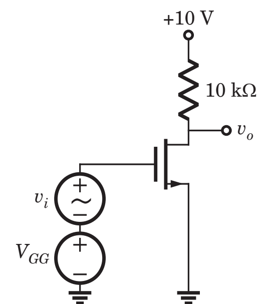


Fig Q71-73

Q71. If I_{DQ} is to be 0.4 mA, the value of V_{GSQ} is

(A) 5.14 V

(B) 4.36 V

(C) 2.89 V

(D) 1.83 V

Q72. The values of g_m and r_o are

(A) 0.89 mS, ∞

(B) 0.89 mS, 0

(C) 1.48 mS, 0

(D) 1.48 mS, ∞

Q73. The small signal voltage gain A_v is

(A) 14.3

(B) –14.3

(C) –8.9

(D) 8.9

Common Data for Questions Q74-75:

Consider three continuous-time periodic signals whose Fourier series representation are as follows.

$$x_1(t) = \sum_{k=0}^{100} \left(\frac{1}{3}\right)^k e^{-jk\frac{2\pi}{50}t}, \qquad x_2(t) = \sum_{k=-100}^{100} \cos k\pi \, e^{-jk\frac{2\pi}{50}t}, \qquad x_3(t) = \sum_{k=-100}^{100} j\sin\left(\frac{k\pi}{2}\right) e^{-jk\frac{2\pi}{50}t}$$

Q74. The even signals are

(A) $x_2(t)$ only
(B) $x_2(t)$ and $x_3(t)$
(C) $x_1(t)$ and $x_3(t)$
(D) $x_1(t)$ only

Q75. The real valued signals are

(A) $x_1(t)$ and $x_2(t)$
(B) $x_2(t)$ and $x_3(t)$
(C) $x_3(t)$ and $x_1(t)$
(D) $x_1(t)$ and $x_3(t)$

Linked Answer Questions: Q76. to Q85. carry two marks each.

Statement for Linked Answer Questions: Q76. and Q77:

The parameters of an $n-$channel enhancement-mode MOSFET are $V_{TN} = 0.8$ V, $W = 64\,\mu$m, $L = 4\,\mu$m, $t_{ox} = 450$ A°, $\mu_n = 650\,\text{cm}^2/\text{V}-\text{s}$.

Q76. The conduction parameter K_n is

(A) $0.8\ \text{mA}/\text{V}^2$
(B) $0.8\ \mu\text{A}/\text{V}^2$
(C) $0.4\ \text{mA}/\text{V}^2$
(D) $0.4\ \mu\text{A}/\text{V}^2$

Q77. If $V_{GS} = V_{DS} = 3$ V, then current I_D is

(A) 1.94 mA
(B) 2.87 mA
(C) 5.68 mA
(D) 3.84 mA

Statement for Linked Answer Questions: Q78 and Q79:

The 8-bit left shift register and D-flip-flop shown in fig. Q78-79 is synchronized with same clock. The D flip-flop is initially cleared.

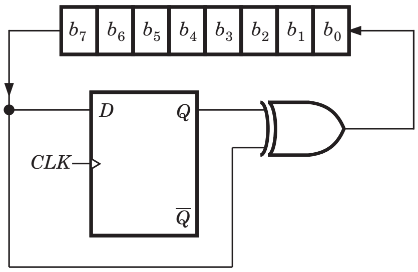


Fig Q78-79

Q78. The circuit act as

(A) Binary to 2's complement converter

(B) Binary to Gray code converter

(C) Binary to 1's complement converter

(D) Binary to Excess–3 code converter

Q79. If initially register contains byte B7, then after 4 clock pulse contents of register will be

(A) 73 (B) 72

(C) 7E (D) 74

Statement for Linked Answer Questions: Q80 and Q81:

A block diagram is shown in fig. Q80-81.

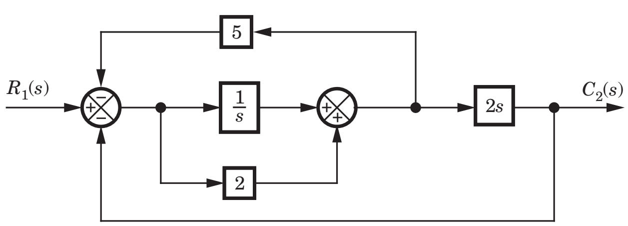


Fig Q80-81

Q80. The transfer function for this system is

(A) $\dfrac{2s(2s+1)}{2s^2+3s+5}$ (B) $\dfrac{2s(2s+1)}{2s^2+13s+5}$

(C) $\dfrac{2s(2s+1)}{4s^2+13s+5}$ (D) $\dfrac{2s(2s+1)}{4s^2+3s+5}$

Q81. The pole of this system are

(A) $-0.75 \pm j1.39$ (B) $-0.41, -6.09$

(C) $-0.5, \quad -1.67$ (D) $-0.25 \pm j0.88$

Statement for Linked Answer Questions: Q82 and Q83:

Ten telemetry signals, each of bandwidth 2 kHz, are to be transmitted simultaneously by binary PCM. The maximum tolerable error in sample amplitudes is 0.2% of the peak signal amplitude. The signals must be sampled at least 20% above the Nyquist rate. Framing and synchronizing requires an additional 1% extra bits.

Q82. The minimum possible data rate must be

(A) 272.64 kbits/sec (B) 436.32 kbits/sec

(C) 936.64 kbits/sec (D)None of the above

Q83. The minimum transmission bandwidth is

(A) 218.16 kHz (B) 468.32 kHz

(C) 136.32 kHz (D) None of the above

Statement for Linked Answer Questions: Q84 and Q85:

In an air-filled waveguide, a TE mode operating at 6 GHz has

$$E_y = 15\sin\left(\frac{2\pi x}{a}\right)\cos\left(\frac{\pi y}{b}\right)\sin(\omega t - 12z)\ \text{V/m}$$

Q84. The cutoff frequency is

(A) 4.189 GHz (B) 5.973 GHz

(C) 8.438 GHz (D) 7.946 GHz

Q85. The intrinsic impedance is

(A) 35.72 Ω (B) 3978 Ω

(C) 1989 Ω (D) 71.44 Ω

Answers Paper-2

1.	(C)	2.	(B)	3.	(B)	4.	(B)	5.	(C)
6.	(A)	7.	(A)	8.	(B)	9.	(B)	10.	(B)
11.	(B)	12.	(B)	13.	(D)	14.	(C)	15.	(A)
16.	(B)	17.	(C)	18.	(B)	19.	(C)	20.	(D)
21.	(A)	22.	(D)	23.	(C)	24.	(B)	25.	(B)
26.	(A)	27.	(B)	28.	(C)	29.	(C)	30.	(A)
31.	(A)	32.	(D)	33.	(A)	34.	(B)	35.	(C)
36.	(C)	37.	(C)	38.	(A)	39.	(C)	40.	(A)
41.	(B)	42.	(A)	43.	(B)	44.	(D)	45.	(B)
46.	(A)	47.	(A)	48.	(A)	49.	(A)	50.	(C)
51.	(A)	52.	(C)	53.	(B)	54.	(C)	55.	(A)
56.	(A)	57.	(D)	58.	(A)	59.	(C)	60.	(B)
61.	(B)	62.	(A)	63.	(D)	64.	(C)	65.	(D)
66.	(D)	67.	(C)	68.	(A)	69.	(B)	70.	(B)
71.	(C)	72.	(A)	73.	(C)	74.	(A)	75.	(B)
76.	(C)	77.	(A)	78.	(B)	79.	(C)	80.	(C)
81.	(C)	82.	(B)	83.	(A)	84.	(B)	85.	(B)