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ESE 2020 : Prelims Exam
CLASSROOM TEST SERIES

E & T ENGINEERING

Test 8

Section A : Analog and Digital Communication Systems

Section B : Electronic Devices & Circuits-1 + Advanced Communication Topics-1

Section C : Control Systems-2 + Microprocessors and Microcontroller-2

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2.	(b)	17.	(b)	32.	(c)	47.	(a)	62.	(d)
3.	(c)	18.	(b)	33.	(d)	48.	(a)	63.	(b)
4.	(a)	19.	(a)	34.	(c)	49.	(b)	64.	(b)
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6.	(a)	21.	(a)	36.	(b)	51.	(c)	66.	(c)
7.	(a)	22.	(b)	37.	(a)	52.	(c)	67.	(d)
8.	(a)	23.	(c)	38.	(d)	53.	(d)	68.	(a)
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12.	(a)	27.	(d)	42.	(a)	57.	(d)	72.	(a)
13.	(d)	28.	(b)	43.	(a)	58.	(a)	73.	(c)
14.	(d)	29.	(d)	44.	(d)	59.	(b)	74.	(c)
15.	(d)	30.	(b)	45.	(d)	60.	(d)	75.	(c)

Detailed Explanation
Section A : Analog and Digital Communication Systems

1. (d)

The maximum and minimum values of the envelope of an AM modulated signal can be given as,

$$E_{max} = A_c(1 + \mu)$$
$$E_{min} = A_c(1 - \mu)$$

Given that, $A_c = 10$ V and $\mu = 0.4$

So, $E_{max} = 10(1 + 0.4)$ V $= 14$ V

$E_{min} = 10(1 - 0.4)$ V $= 6$ V

2. (b)

Given that, $m(t) = \text{sinc}(1000t)$

The bandwidth of an AM signal can be given as,

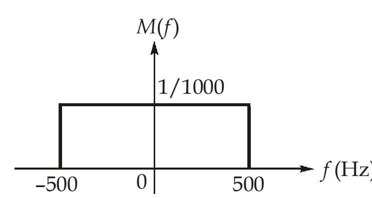
$$(\text{BW})_{AM} = 2f_{m\,(max)}$$

Here, $f_{m\,(max)}$ = bandwidth of $m(t)$

By taking Fourier transform of $m(t)$, we get,

$$\text{sinc}(t) \xleftrightarrow{\text{CTFT}} \text{rect}(f)$$

$$m(t) = \text{sinc}(1000t) \xleftrightarrow{\text{CTFT}} M(f) = \left(\frac{1}{1000}\right)\text{rect}\left(\frac{f}{1000}\right)$$



From the plot of $M(f)$, we get,

$f_{m\,(max)} = 500$ Hz

So, $(\text{BW})_{AM} = 1000$ Hz

3. (c)

$$P_t = P_c\left(1 + \frac{\mu^2}{2}\right)$$

With first sinusoid alone, $10.125 = 9\left(1 + \frac{\mu_1^2}{2}\right)$

With second sinusoid alone, $\mu_2 = 0.4$

To calculate the total radiated power,

$$\mu^2 = \mu_1^2 + \mu_2^2$$

$$P_t = 9\left(1 + \frac{\mu_1^2}{2} + \frac{\mu_2^2}{2}\right) = 10.125 + \frac{9\mu_2^2}{2}\ \text{kW}$$

$$= 10.125 + (9 \times 0.08) = 10.125 + 0.72 = 10.845\ \text{kW}$$

4. (a)

$$s(t) = [2 + A_m\cos(\omega_m t)]\cos(\omega_c t)\ \text{V}$$

$$= 2\left[1 + \frac{A_m}{2}\cos(\omega_m t)\right]\cos(\omega_c t)\ \text{V}$$

Given that, RMS value of $m(t)$ $= \frac{A_m}{\sqrt{2}} = 1 \Rightarrow A_m = \sqrt{2}$

Modulation index, $\mu = \frac{A_m}{2} = \frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$

Transmission efficiency, $\eta = \frac{\mu^2}{2+\mu^2} \times 100\% = \frac{0.50}{2.50} \times 100 = 20\%$

5. **(b)**

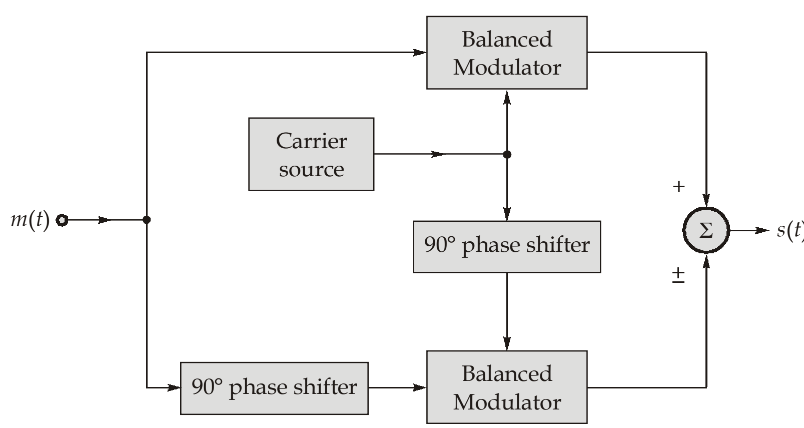
6. **(a)**

Speech-processing circuits in AM transmitters are used for,

- Prevention of overmodulation.
- Prevention of excessive signal bandwidth.
- Increasing the average transmitted power.

7. **(a)**

The block diagram representation of generation of SSB signal using phase shift method is given below.



8. **(a)**

$$(BW)_{FM} = \left(1 + \frac{\Delta f}{f_m}\right)(2f_m) = \left(1 + \frac{A_m k_f}{f_m}\right)(2f_m)$$

$$(BW)_{PM} = (1 + A_m k_p)\,(2f_m)$$

When only f_m is increased, $(BW)_{PM}$ will be increased by higher factor than that of $(BW)_{FM}$.

9. **(c)**

$$(\Delta f)_{new} = \frac{4.8}{2.4} \times 10 = 20 \text{ kHz}$$

$$\beta_{new} = \frac{(\Delta f)_{new}}{f_{m\,(new)}} = \frac{20000}{200} = 100$$

10. (b)

Modulation index, $$\beta = \frac{(\Delta f)_{\max}}{f_m} = 5$$

$$(\Delta f)_{\max} = 5f_m = \frac{5\times 1250}{2\pi}\text{Hz} = \frac{3125}{\pi} \simeq 994.72\text{ Hz}$$

11. (a)

$$(\text{BW})_1 = (1+\beta_1)2f_{m1} = \left(1+\frac{\Delta f_1}{f_{m1}}\right)2f_{m1}$$

$$= 2(f_{m1} + \Delta f_1) = 150\text{ kHz}$$

Since, only f_m is increased by 5 kHz,

$$(\text{BW})_2 = 2(f_{m2} + \Delta f_1) = 2(5\text{ kHz} + f_{m1} + \Delta f_1)$$

$$= 10\text{ kHz} + 2(f_{m1} + \Delta f_1) = 10\text{ kHz} + (\text{BW})_1 = 160\text{ kHz}$$

12. (a)

Equalization is necessary in Armstrong modulation system.

13. (d)

14. (d)

15. (d)

The purpose of a squelch circuit is to quiet the receiver in the absence of the received signal.

16. (b)

An RC high pass filter can be used as a pre-emphasis circuit.

17. (b)

$$f_i = f_s + 2(\text{IF})$$

To avoid the problem of image frequency,

$$100\text{ MHz} + 2(\text{IF}) \geq 150\text{ MHz}$$

$$2(\text{IF}) \geq 50\text{ MHz}$$

$$(\text{IF}) \geq 25\text{ MHz}$$

$$(\text{IF})_{\min} = 25\text{ MHz}$$

18. (b)

Station frequency, $f_s = 1000$ kHz

Image frequency, $f_i = f_s + 2(IF) = 1900$ kHz

Image frequency rejection ratio,

$$\alpha = \sqrt{1+Q^2\rho^2} \simeq Q\rho \qquad [\because Q\rho >> 1]$$

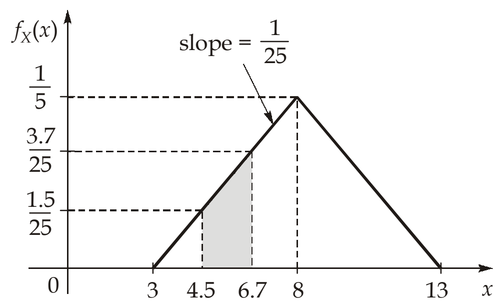
$$\rho = \frac{f_i}{f_s} - \frac{f_s}{f_i} = \frac{1900}{1000} - \frac{1000}{1900}$$

$$= 1.9 - \frac{10}{19} = 1.9 - 0.526 = 1.374$$

$$\alpha \simeq Q\rho = 100 \times 1.374 = 137.4$$

19. (a)

$$P\{4.5 < X \le 6.7\} = \int_{4.5}^{6.7} f_X(x)\,dx$$



$$\begin{aligned} P\{4.5 < X \le 6.7\} &= \text{shaded area} \\ &= \left(\frac{1}{2}\times 3.7\times\frac{3.7}{25}\right)-\left(\frac{1}{2}\times 1.5\times\frac{1.5}{25}\right) \\ &= \frac{1}{50}\left[(3.7)^2-(1.5)^2\right]=\frac{(13.69-2.25)}{50} \\ &= \frac{11.44}{50}=\frac{22.88}{100}=0.2288 \end{aligned}$$

20. (b)

$$Z = X + Y$$

Since X and Y are statistically independent,

$$\begin{aligned} f_Z(z) &= f_X(z) * f_Y(z) \\ &= 5\exp(-5z)u(z) * 2\exp(-2z)u(z) \end{aligned}$$

$$L\{f_Z(z)\} = \left(\frac{5}{s+5}\right)\left(\frac{2}{s+2}\right)=\frac{10}{3}\left[\frac{1}{s+2}-\frac{1}{s+5}\right]$$

So, $$f_Z(z) = \frac{10}{3}\left[\exp(-2z)-\exp(-5z)\right]u(z)$$

21. (a)

$$E[Y(t)] = H(0)E[X(t)]$$

$H(f)$ = frequency response of the high-pass filter (HPF)

$H(0)$ = 0 for an ideal HPF

So, $$E[Y(t)] = (0)E[X(t)] = 0$$

22. (b)

$$F = 1+\frac{R_{eq}}{R_a}=1+\frac{30}{50}=1.6$$

In decilogs, $$\begin{aligned}[F] &= 10\log_{10}(1.6) = 10\log_{10}(16) - 10\log_{10}(10) \text{ dB} \\ &= 10\log_{10}(2^4) - 10 = 4(3.01) - 10 = 2.04 \text{ dB}\end{aligned}$$

23. (c)

$$10\log_{10}(G) = 12.04 \text{ dB} \Rightarrow G = 16$$
$$10\log_{10}(F) = 2.04 \text{ dB} \Rightarrow F = 1.6$$
$$(\text{SNR})_{\text{input}} = \frac{S_{\text{in}}}{N_{\text{in}}} = \frac{1 \text{ W}}{100 \text{ mW}} = 10$$
$$F = \frac{(\text{SNR})_{\text{input}}}{(\text{SNR})_{\text{output}}}$$
$$(\text{SNR})_{\text{output}} = \frac{S_{\text{out}}}{N_{\text{out}}} = \frac{(\text{SNR})_{\text{input}}}{F} = \frac{10}{1.6} = \frac{100}{16}$$
$$S_{\text{out}} = S_{\text{in}}G = (1 \text{ W})(16) = 16 \text{ W}$$
$$N_{\text{out}} = \frac{S_{\text{out}}}{(\text{SNR})_{\text{output}}} = \frac{16}{\left(\frac{100}{16}\right)} = \frac{256}{100} = 2.56 \text{ W}$$

24. (b)

$$[\text{SNR}]_{\text{post-detection}} = [\text{SNR}]_{\text{input}} - [F] + [\text{Improvement factor}]$$
$$= 29 - 4 + 16 = 41 \text{ dB}$$

25. (a)

Entropy, $$H = \frac{1}{4}\log_2(4) + \frac{2}{8}\log_2(8) + \frac{3}{16}\log_2\left(\frac{16}{3}\right) + \frac{5}{16}\log_2\left(\frac{16}{5}\right) \text{ bits/symbol}$$
$$\simeq 2.227 \text{ bits/symbol}$$

26. (c)

Given that, X and Y are independent.

So, $H(X|Y) = H(X)$

$H(Y|X) = H(Y)$

Given that, $H(Y|X) = 2$ bits/symbol

So, $H(Y) = H(Y|X) = 2$ bits/symbol

27. (d)

For a noiseless channel,

$H(X|Y) = H(Y|X) = 0$

and $H(X) = H(Y)$

28. (b)

Source-1 produces 4 equiprobable symbols,

$\log_2(4) = 2$ (Integer) $\Rightarrow$ 100% coding efficiency will be obtained

Source-2 produces 3 equiprobable symbols,

$\log_2(3) \neq$ Integer $\Rightarrow$ 100% coding efficiency will not be obtained

So, option (b) is correct.

29. (d)

$$10\log_{10}(\text{SNR}) = 28 \text{ dB}$$

$$\text{SNR} = 10^{2.8} \simeq 631$$

Channel capacity, $C = B\log_2(1+\text{SNR}) = 4\log_2(1+631) \simeq 37.2 \text{ kbps}$

30. (b)

$$y(t) = x^2(t)$$

$$Y(f) = X(f) * X(f)$$

$$f_{y\,(\max)} = 2f_{x(\max)}$$

$$f_{s(y)} = 2f_{s(x)} = 2 \times 5000 = 10000 \text{ samples/sec}$$

31. (c)

$$f_{m\,(\max)} = 15 \text{ kHz}$$

$$f_s = 30 \text{ kHz}$$

$$R_b = n\,f_s$$

n = number of bits per sample

$$n = \log_2 L = \log_2 256 = 8 \text{ bits/sample}$$

$$R_b = 8 \times 30 \text{ kbps} = 240 \text{ kbps}$$

Minimum channel BW required is,

$$(\text{BW})_{\min} = \frac{R_b}{2}(1+\alpha) = \frac{240}{2}(1.25)\text{kHz} = 150 \text{ kHz}$$

32. (c)

Time duration of one time frame,

$$T_s = \frac{1}{f_s} = \frac{1}{8\times10^3} = 125\,\mu\text{s}$$

In one frame,

total number of pulses = $(24 \times 1) + 1 = 25$ pulses/frame

Time duration utilized by all pulses in a frame = 25 μs

∵ each pulse is of 1 μs duration

frame duration = 125 μs

Time spacing between the successive pulses = $\frac{125-25}{25} = \frac{100}{25} = 4\,\mu\text{s}$

33. (d)

Sampling rate, $f_s = 44.1$ kHz

Bits per sample, $n = 16$

Number of bits for piece of music with a duration of 1 minute is,

$$R = n \times f_s \times (60 \text{ sec}) \qquad [\because 1 \text{ minute} = 60 \text{ seconds}]$$

$$= 16 \times 44.1 \times 10^3 \times 60 \text{ bits}$$

$$= 42.336 \times 10^6 \text{ bits}$$

34. (c)

For a uniform quantizer, the maximum quantization error is $\frac{\Delta}{2}$.

So, $$\frac{\Delta}{2} \leq \frac{0.1}{100}(a) \text{ ; Where, } \Delta = \text{stepsize}$$

$$\Delta \leq \frac{a}{500}$$

$$\Delta = \frac{a-(-a)}{L} = \frac{2a}{2^n}$$

Where, L = Number of quantization levels and n = number of bits per sample.

So, $$\frac{2a}{2^n} \leq \frac{a}{500}$$

$$2^n \geq 1000$$

$$n \geq 10 \qquad [\because n \text{ can be an integer only}]$$

$$n_{\min} = 10$$

35. (c)

For sinusoidal input,

$$[\text{SQNR}] \simeq 6n + 1.8 \text{ dB}$$

For 8-level quantizer, $n = \log_2(8) = 3$ bits/sample

So, $[\text{SQNR}] = 6(3) + 1.8 = 19.8$ dB

36. (b)

Condition for orthogonality in a coherent BFSK system is,

$$(f_1 - f_0) = n\frac{R_b}{2}; n = 1, 2, 3, 4, ...$$

$$R_b = \frac{2(f_1 - f_0)}{n} = \frac{2 \times 20}{n} \text{ kbps}$$

$$R_{b\,(\max)} = \frac{40}{n_{\min}} = \frac{40}{(1)} = 40 \text{ kbps}$$

37. (a)

Minimum BW required to transmit a 16-ary PSK signal with Nyquist baseband pulse shaping is,

$$(\text{BW})_{\min} = \frac{R_b}{\log_2 16} = \frac{10}{4}\text{MHz} = 2.5 \text{ MHz}$$

38. (d)

BER with phase error is,

$$\text{BER} = Q(\gamma\cos\phi)$$

$$\phi = \text{phase error} = 30°$$

so, $$k = \cos 30° = \frac{\sqrt{3}}{2} = 0.866 \approx 0.87$$

39. (d)

For matched filter, $(\text{SNR})_{max} = \dfrac{2E_s}{N_0}$

$$E_s = \text{Energy of the signal } s(t)$$

$$= \int_{-\infty}^{\infty} |s(t)|^2 dt = \int_0^2 (4)^2 dt = 32$$

So, $(\text{SNR})_{max} = \dfrac{2(32)}{N_0} = \dfrac{64}{N_0}$

40. (c)

41. (d)

The amplitude of the carrier frequency component in the spectrum of an FM signal is $A_c J_0(\beta)$, which is a strong function of the modulation index (β).

42. (a)

43. (a)

44. (d)

$$C = B\log_2(1+\text{SNR}) = B\log_2\left(1+\frac{S}{N_0 B}\right)$$

Doubling the bandwidth (B) also reduces the SNR and hence the capacity will not be doubled.

45. (d)

Granular noise cannot be eliminated. It can be only minimized by selecting relatively small step-size.

Section B : Electronic Devices & Circuits-1 + Advanced Communication Topics-1

46. (b)

47. (a)

$$\text{Responsivity } (R) = \frac{I_p}{P_0} = \frac{\eta q}{h\nu}$$

$\therefore$ $$R = \frac{\eta q}{h \times \frac{c}{\lambda}}$$

$$R = \frac{\eta q}{hc} \times \lambda$$

For constant efficiency assumption, $R \propto \lambda$

48. (a)

$$\begin{aligned} x_p &= 0.2\,(x_p + x_n) \\ 0.8\,x_p &= 0.2\,x_n \\ \frac{x_p}{x_n} &= \frac{1}{4} \\ N_a x_p &= N_d x_n \\ \frac{N_d}{N_a} &= \frac{x_p}{x_n} = \frac{1}{4} = 0.25 \end{aligned}$$

49. (b)

$$\begin{aligned} \frac{I_{02}}{I_{01}} &= 2^{\frac{T_2 - T_1}{10}} \\ \frac{I_{02} - I_{01}}{I_{01}} \times 100 &= 300 \quad \Rightarrow \quad \frac{I_{02}}{I_{01}} = 4 \\ \frac{I_{02}}{I_{01}} &= 4 = 2^{\frac{T_2 - T_1}{10}} \\ 2^2 &= 2^{\frac{T_2 - T_1}{10}} \\ T_2 - T_1 &= 20°\text{C} \\ T_2 - 25°\text{C} &= 20°\text{C} \\ T_2 &= 20°\text{C} + 25°\text{C} = 45°\text{C} \end{aligned}$$

50. (b)

$$W = K\sqrt{V_{bi} + V_R}$$

$$\therefore \quad \frac{W_2}{W_1} = \sqrt{\frac{V_{bi} + V_{R2}}{V_{bi} + V_{R1}}}$$

$$\begin{aligned} \frac{W_2}{2\ \mu\text{m}} &= \frac{\sqrt{0.8 + 7.2}}{\sqrt{0.8 + 1.2}} = \frac{\sqrt{8}}{\sqrt{2}} = 2 \\ W_2 &= 4\ \mu\text{m} \end{aligned}$$

51. (c)

Given, $L_n = 20\ \mu$m, $L_p = 10\ \mu$m, $W = 1\ \mu$m, $G = 10^{20}$ cm^{-3} sec^{-1}

For photo diode, the steady state photo current density is,

$$\begin{aligned} J &= q[W + L_n + L_p]G \\ &= 1.6 \times 10^{-19}\,[10^{-4} + 2 \times 10^{-3} + 10^{-3}]10^{20}\ \text{A/cm}^2 \\ J &= 49.60\ \text{mA/cm}^2 \end{aligned}$$

52. (c)

Multi-mode step-index fibers offer highest dispersion among the three, followed by multi-mode graded-index fibers.

Single-mode step-index fibers offer least dispersion among the three.

53. (d)

54. (b)

$$\alpha = 0.5 \text{ dB/km}$$

$$\alpha L_{(\max)} = 10\log_{10}\left(\frac{P_{in}}{P_{out}}\right) = 10\log_{10}\left(\frac{1 \text{ mW}}{50\ \mu\text{W}}\right)$$

$$\alpha L_{(\max)} = 10\log_{10}(20) = 13 \text{ dB}$$

$$L_{(\max)} = \frac{13}{0.5}\text{ km} = 26 \text{ km}$$

55. (a)

A link-layer switch does not change the link-layer (MAC) address in a frame.

56. (b)

Data integrity ensures the prevention of packet modification.

57. (d)

Since 8-bit sequence numbers are used,

Maximum number of segments = 255

Maximum size of each segment = 128 bytes = 128 × 8 bits

$$\text{Maximum data rate/connection} = \frac{255\times128\times8}{30}\text{bps} = 8.5 \times 1024 \text{ bps}$$

$$= 8.5 \times 1.024 \text{ kbps} = 8.704 \text{ kbps}$$

58. (a)

59. (b)

60. (d)

Velocity, $v = \frac{c}{n}$; n = refractive index

$n_{core} > n_{cladding}$ ⇒ statement-II is correct

$v_{core} < v_{cladding}$ ⇒ statement-I is wrong

Section C : Control Systems-2 + Microprocessors and Microcontroller-2

61. (a)

Transfer function, T.F $= C[sI - A]^{-1} B$

$$= \begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}s+4 & 1\\ -3 & s+1\end{bmatrix}^{-1}\begin{bmatrix}1\\1\end{bmatrix}$$

$$= \frac{\begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}s+1 & -1\\ 3 & s+4\end{bmatrix}\begin{bmatrix}1\\1\end{bmatrix}}{(s+1)(s+4)+3} = \frac{\begin{bmatrix}s+1 & -1\end{bmatrix}\begin{bmatrix}1\\1\end{bmatrix}}{s^2+5s+7}$$

$$= \frac{s}{s^2+5s+7}$$

62. (d)

Given, $$G(s) = \frac{100}{(s+1)^4}$$

$$G(j\omega) = \frac{100}{(j\omega+1)^4}$$

At phase cross-over frequency ω_{pc},

$$-4\tan^{-1}(\omega_{pc}) = -180°$$

$$\omega_{pc} = 1 \text{ rad/sec}$$

Gain margin, $$GM = \frac{1}{M|_{\omega=\omega_{pc}}} = \frac{1}{\left|\frac{100}{(j\omega+1)^4}\right|_{\omega=\omega_{pc}}} = \frac{\left[1+(\omega_{pc})^2\right]^2}{100}$$

$$= \frac{[1+1]^2}{100} = \frac{4}{100} = 0.04$$

63. (b)

We can write,

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}-5 & 1\\ -1 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}K\\ 4\end{bmatrix}u$$

For system to be uncontrollable $|Q_C| = 0$

where, $$Q_C = \begin{bmatrix}B & AB\end{bmatrix}$$

$\therefore$ $$Q_C = \begin{bmatrix}K & -5K+4\\ 4 & -K-12\end{bmatrix}$$

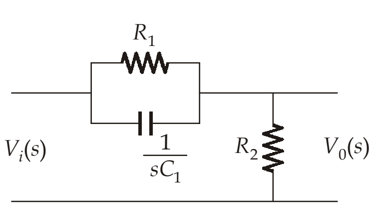
$$|Q_C| = 0 \Rightarrow K(-K-12) - 4(-5K+4) = 0$$

$$K^2 - 8K + 16 = 0$$

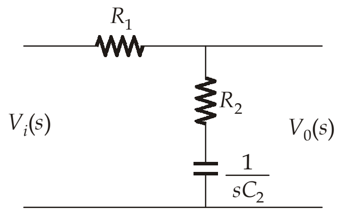
$$(K-4)^2 = 0$$

$\therefore$ $$K = 4$$

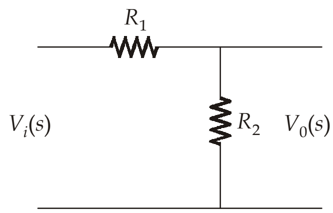
64. (b)

- 

it act as lead compensator (high-pass filler), which improves transient response but steady state performance is not much effected.

- 

it acts a lag compensator (low-pass filter), which reduces the bandwidth.

- 

which is a simple resistive network, and it attenuates the gain i.e., $\frac{V_0(s)}{V_i(s)} = \frac{R_2}{R_1 + R_2}$.

65. (a)

For type-4 system, there are four poles at origin.

For type-n system, the initial slope of Bode magnitude plot is,

$$M = -20n \text{ dB/decade or } -6n \text{ dB/octave}$$

$\therefore$ For type-4 system, the initial slope of bode magnitude plot is

$$M = -80 \text{ dB/decade or } -24 \text{ dB/octave}$$

66. (c)

It is given that, the system is an all pole system.

Since at $\omega \to 0$, the phase angle of transfer function is –90° and magnitude is infinite, there must be 1 pole at origin.

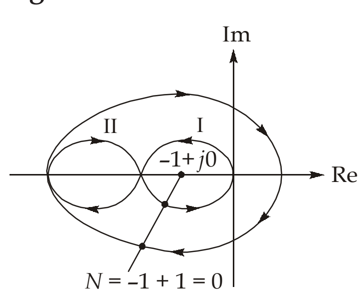
Similarly for $\omega \to \infty$, the phase angle becomes zero or –360° and magnitude becomes zero, then there might be 4 poles in total.

Therefore, the open loop transfer function can be given as,

$$G(s) = \frac{K}{s(1+sT_1)(1+sT_2)(1+sT_3)}$$

67. (d)

When the point (–1 + j0) is in region-I :

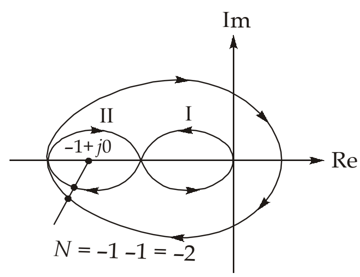


$$N = P - Z$$
N = number of encirclements about "$-1 + j0$"
P = number of open loop poles on RHS of s-plane.
Z = number of closed loop poles on RHS of s-plane.

$N = 0$;
$P = 0 \Rightarrow$ as it is given in the problem

$$N = P - Z$$
$$0 = 0 - Z \quad \Rightarrow \quad Z = 0 \Rightarrow \text{So, closed loop system is stable}$$

When the point ($-1 + j0$) is in region-II :



$$N = -2 \,;\, P = 0$$
$$N = P - Z$$
$$-2 = 0 - Z$$
$$Z = 2 \Rightarrow \text{So, closed loop system is unstable}$$

68. (a)

$$G'(s) = \frac{\frac{1}{s(s+1)}}{\frac{s(s+1)+Ks}{s(s+1)}} = \frac{1}{s(s+1)+Ks}$$

and
$$\frac{C(s)}{R(s)} = \frac{25}{s(s+1)+Ks+25} = \frac{25}{s^2+(K+1)s+25}$$

On comparing it with standard transfer function, we get,

$$2\xi\omega_n = (K+1) \text{ and } \omega_n^2 = 25$$
$$\xi = \frac{K+1}{2\omega_n} = \frac{K+1}{10} = 0.6$$
$$K = 5$$

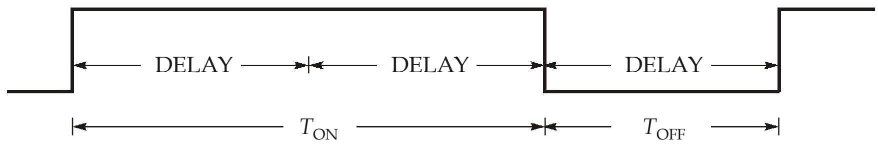
69. (b)

70. (d)

The given program adds 19H = $(25)_{10}$ to the accumulator (A) 10 times and transfers the final contents to R5.

So, required answer = 25 × 10 = $(250)_{10}$ = FAH

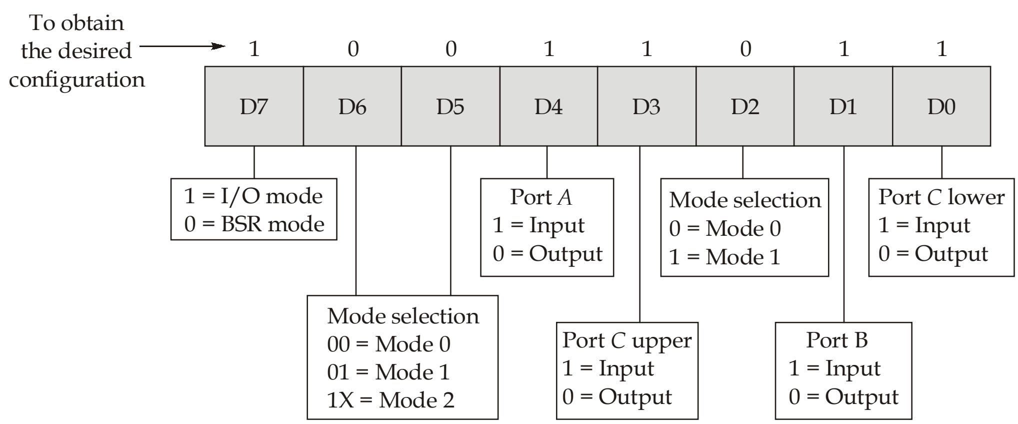
71. (d)



$$\text{Duty cycle} = \frac{T_{ON}}{T_{ON} + T_{OFF}} \times 100 = \frac{2}{3} \times 100 = 66.66\% \simeq 66\%$$

72. (a)

The format of 8255 control word is as follows:



So, the required control byte is = $(1001\ 1011)_2$ = 9BH

73. (c)

There is no register control block in 8237 DMA controller.

74. (c)

The corner frequency is either a finite pole or a finite zero location in the form of magnitude.

75. (c)

A causal non-minimum phase system has at least one zero in the right half of *s*-plane.

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