Answer Keys

1	B	**2**	A	**3**	B	**4**	C	**5**	C	**6**	C	**7**	A
8	D	**9**	B	**10**	A	**11**	C	**12**	B	**13**	D	**14**	A
15	A	**16**	D	**17**	C	**18**	C	**19**	C	**20**	D	**21**	C
22	D	**23**	B	**24**	B	**25**	A	**26**	D	**27**	A	**28**	B
29	C	**30**	A	**31**	D	**32**	D	**33**	A	**34**	D	**35**	D
36	D	**37**	A	**38**	C	**39**	A	**40**	A	**41**	B	**42**	D
43	B	**44**	A	**45**	B	**46**	B	**47**	C	**48**	B	**49**	C
50	D	**51**	B	**52**	B	**53**	C	**54**	C	**55**	C	**56**	D
57	A	**58**		**59**	B	**60**	D						

Explanations:-

1. The order of differential equation is two

3. $f(t) = \frac{1-\cos 2t + \cos 2t}{2}$, then it has o and $\frac{1}{\pi}$Hz frequency component

7. $\left(\frac{1}{3}\right)^n u(n) \leftrightarrow \frac{1}{1-\frac{1}{3}z^{-1}} \quad |z| > 1/3,$

$$-\left(\frac{1}{2}\right)^n u(-n-1) \leftrightarrow \frac{1}{1-\frac{1}{2}z^{-1}} \quad |z| > 1/2,$$

$$\frac{1}{3} < |z| < 1/2$$

8. Since magnitude plot shows both increasing as well as decreasing plot, it is lead-lag compensator

9. Since Bandwidth is 10 kHz, thus output power is $10 \times 10^{-11} \times 10 \times 10^{3} = 1 \times 10^{-6}$ W

11. Use $n_{c_r}\,(p)^r\,(q)^{n-r}$ [for any two losses which yield head]

$${}^{10}C_2\left(\frac{1}{2}\right)^2\left(\frac{1}{2}\right)^8 = {}^{10}C_2\left(\frac{1}{2}\right)^{10}$$

But in present case it is required only for first two tosses. Thus in this case $\frac{1}{2}.\frac{1}{2}\ldots\left(\frac{1}{2}\right)$ 10 times

12. Since autocorrelation function and power spectral density bears a Fourier transform relation, then sin c required in frequency domain will five rectangular convolutions in time domain, thus it is a triangular function

13. $f'(z) = \left\{\frac{1 + c_0 + z^{-1}}{z}\right\}$

$$f'(z) = \frac{(1 + c_0) + c_1 z^{-1}}{z}$$

$$\int f'(z) = \frac{d}{d^2} z^2 \left\{\frac{(1 + c_0)z + c_1}{z^2}\right\} = 2\pi i(1 + c_0)$$

14. Since 12A current is coming from one source and it is also known that 60V source is absorbing power i.e. current is flowing inside 60V source.

$12 = x + I \Rightarrow I = 12 - x,$ thus possible option is (A)

15. $\mu = \frac{q}{kT} D \Rightarrow \left[\frac{\mu}{D}\right] = V^{-1}$

17. $z_C = \frac{R_L \frac{1}{SC}}{R_L + \frac{1}{SC}}$

$$z_C = \frac{R_L}{SCR_L + 1}$$

$$\frac{V_0(S)}{V_i(S)} = \frac{\frac{R_L}{SCR_L + 1}}{\frac{R_L}{SCR_L} + R} = \frac{R_L}{R_L + RSCR_L + R} = \frac{R_L}{SCRR_L + R + R_L} \Rightarrow R_L = R$$

18. Use the condition of controllability

20. Apply right hand thumb rule

22. $\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} \cdots$

$$\sin(x-\pi) = (x-\pi) - \frac{(x-\pi)^3}{3!} + \frac{(x-\pi)^5}{5!} \cdots$$

$$-\frac{\sin x}{(x-\pi)} = 1 - \frac{(x-\pi)^2}{3!} + \frac{(x-\pi)^2}{5!} - \cdots$$

$$\Rightarrow \frac{\sin x}{(x-\pi)} = -1 + \frac{(x-\pi)^2}{3!}$$

24. Since it is one-sided Laplace transform

25. (i) $\frac{dy}{y} = \frac{dx}{x} \Rightarrow \ln y = \ln x + C$

$\frac{y}{x} = e^C \Rightarrow$ straight line

(ii) $xy =$ constant

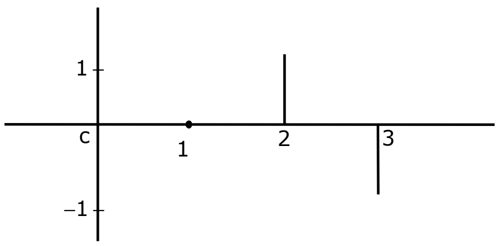
(iii) $x^2 - y^2 =$ constant

(iv) $x^2 + y^2 =$ constant

P-2 Q-3 R-3 S-1

36. $\left[1 + z\{\bar{y} + \bar{z} + \bar{y}\}\right]\left[0 + \bar{z}\right] = 1,\ \bar{z} = 1,\ z = 0$

40.



$H(e^{j\omega}) = e^{-j2\omega} - e^{-j3\omega}$, It is FIR high pass filter

44. $\omega = 1,\ H(j) = \left.\frac{-\omega^2 + 1}{-\omega^2 + 2j\omega + 1}\right|_{\omega=1} = 0$. Thus output is zero for all sampling frequencies

46. The mean is 3

47. $\mu = \dfrac{1}{\sqrt{2}}$, efficiency = $\dfrac{1/2}{2 + 1/2} = 20\%$

48. $C = B\log_2\left[1 + SNR\right]$

$C = B\log_2\left[SNR\right]$

$C' = B\log_2\left[2SNR\right] = B\log_2 SNR + B\log_2 2$

$C' = C_1 + B$

50. $z_1 = \dfrac{(100)^2}{50} = 200, \quad z_2 = 200$

$z' = z_1 \parallel z_2 = 100$

$z_{in} = \dfrac{50 \times 50}{100} = 25\,\Omega$

59. From the figure

P_1	P_2	g
0	0	0
0	1	1
1	0	1
1	1	1

$\Rightarrow g = P_1 + P_2$,

c	e	d
0	0	
0	1	1
1	0	1
1	1	1

$d = c + e$