ESE- 2019 (Prelims) - Offline Test Series Test-15

ELECTRICAL ENGINEERING

SUBJECT: Power Electronics & Drives, Power Systems and Signals & Systems

SOLUTIONS

01. Ans: (b)

Sol: Power diode recovery depends on the charge stored in the diode during forward condition. $Q_R = \frac{1}{2} I_{RR} t_{rr}$. I_{RR} depends on $\frac{di}{dt}$. So, as frequency increases, time decreases and slope of current time graph increases, so charge stored increases and thus frequency plays an important role in transient recovery.

02. Ans: (b)

Sol: In a power transistor with large junction area, under certain conditions of current and voltage, the collector current concentrates in a small spot of the base-emitter junction. This often leads to the destruction of transistor. This is called secondary break down of BJT.

03. Ans: (b)

Sol: To design a base drive circuit, base current and base voltage are required and the relation between base current and base voltage for different values of base current is required. So, we use I_B vs V_{BE} characteristics.

04. Ans: (c)

Sol: Any switch is operated in hard saturation state or in cut off state. For example, if the V_{ce}, sat = 0.7 V for a transistor, it is not safe to operate at V_{ce} =0.7V (at the verge of saturation). There is a scope of transistor going into linear mode. So, it is ensured that it is operated in the hard saturation state. BJT can't operate at high frequency, since it is majority carrier device. So, if operated at high frequency active mode and soft saturation losses will be more.

05. Ans: (a)

Sol: During reverse bias, J_1 and J_3 are reverse bias and J_2 is forward biased. So, gate current can't effect the J_1,J_3 junction status, whereas temperature effect the reverse saturation current through the junction.

06. Ans: (b)

Sol: Inverter grade thyristors are used in inverter applications. In a inverter switches operate at more than fundamental output frequency. In PWM inverters the switching frequency is much more compared to fundamental frequency. So, thyristors are designed for less turn-off. Converter grade thyristors are used in rectifier circuits. So, switching frequency is comparable to source voltage frequency. So, they have high turn off times.

07. Ans: (d)

Sol: For any rectifier, if it is a n-pulse converter then the source side harmonics are given by nk ± 1 harmonics and load side harmonics are given by nk. Source side contains odd harmonics and load side contains even harmonics. So, lowest harmonic in source current is $12 - 1 = 11^{th}$ harmonic.

08. Ans: (c)

Sol: $V(t) = 10 \sin (100 \pi t)$

$$V_{rms} = \frac{V_m}{2} = \frac{10}{2} = 5V$$

$$P = \frac{V_{rms}^2}{R} = \frac{25}{100} = 0.25W$$

09. Ans: (b)

Sol: MOSFET operates in three regions of operation.

1. Cut-off region: $V_{GS} < V_{GS(th)}$
2. Triode region/ ohmic region:
   $V_{DS} < V_{GS} - V_{GS(th)}$
3. Saturation region: $V_{DS} > V_{GS} - V_{GS(th)}$

10. Ans: (b)

Sol: Diode is in ON condition, in the first half positive cycle the inductor absorbs energy and in the second half negative cycle inductor releases energy. So, diode conducts the voltage source for 360°. So, the whole source voltage drops across the inductor.

$V_d = V_{M1} = 0$; $V_{M2} = V_{rms}$

$$= \frac{200}{\sqrt{2}}$$

$$=141.4V$$

11. Ans: (d)

Sol: The conduction of line current to load takes place from 60° + α to 120° + α. So, from this we can infer that if α > 60° then as it is R-load, voltage becomes zero discontinuity occurs.

12. Ans: (d)

Sol: In 3-ϕ, half wave rectifier,

$$V_0 = \frac{3V_{ml}}{2\pi}$$

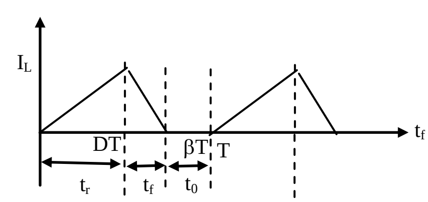
$$\Rightarrow \frac{V_0}{V_{ml}} = \frac{3}{2\pi} = 0.4775$$

13. Ans: (d)

Sol: Because of source inductance the switch currents cannot become zero abruptly. So, there is overlap angle where switch currents overlap and this extends the commutation time of the switches. This overlap is called commutation overlap and the overlap angle is denoted by μ.

14. Ans: (c)

Sol:



$$V_0 = \left(\frac{DT}{\beta T - DT}\right).V_{dc}$$

$$= \left(\frac{t_r}{t_r + t_f - t_r}\right).V_{dc}$$

$$V_0 = \left(\frac{t_r}{t_f}\right).V_{dc}$$

15. Ans: (c)

Sol: Ripple factor $= \sqrt{\frac{V_{rms}^2 - V_{dc}^2}{V_{dc}^2}}$

$$= \sqrt{\frac{D.V_{dc}^2 - D^2.V_{dc}^2}{D^2.V_{dc}^2}}$$

$$= \sqrt{\frac{1}{D} - 1}$$

$$= \sqrt{\frac{1}{\left(\frac{1}{3}\right)} - 1} = \sqrt{2}$$

16. Ans: (c)

Sol: $V_{rms} = \sqrt{D}V_{dc}$

$$= \left(\sqrt{0.49}\right).200$$

$$= 140V$$

$$\Rightarrow I_{rms} = \frac{140}{10} = 14A$$

$$V_0 = D.V_{dc}$$

$$= (0.49).200$$

$$= 98V$$

$$I_0 = \frac{98}{10} = 9.8A$$

17. Ans: (c)

Sol: Circuit turn of time for main SCR, $t_c = \frac{CV_S}{I_0}$

$$= \frac{(4\mu).200}{10}$$

$$= 80\mu s$$

Circuit turn of time for auxiliary

$$\text{SCR} = \frac{\pi}{2}\sqrt{LC}$$

$$= \frac{\pi}{2}\sqrt{4\mu \times 16\mu}$$

$= 4\pi\mu$

$= 12.56\ \mu s$

18. Ans: (b)

Sol: In the above fig. b, the input current is continuous. So, the answer cannot be Buck converter or a buck-boost converter. From fig. a, output voltage is less than input voltage. So, the answer cannot be boost converter. So, the answer is boost-buck converter or C'uck Converter.

19. Ans: (c)

Sol: V_{dc} = 100V; V_0= 400V

$$T = \frac{1}{f} = 0.1\text{ms}$$

$$V_0 = \left(\frac{D}{1-D}\right).V_{dc}$$

$$\frac{1-D}{D} = \frac{1}{4}$$

$$\Rightarrow \frac{1}{D} = \frac{5}{4} \Rightarrow D = \frac{4}{5}$$

$\therefore$ T_{on} = DT

$$= \left(\frac{4}{5}\right) \times 100\mu s$$

$= 80\mu s$

20. Ans: (a)

Sol: $$\Delta I_L = \frac{V_{dc}.D(1-D).T}{L}$$

$$= \frac{(60).(0.2).(0.8).(1\text{ms})}{(20\text{mH})}$$

$= 3 \times (0.16)$

$= 0.48\text{A}$

21. Ans: (d)

Sol: E = 307V

$$V_{ml} = 440\sqrt{2}V$$

$$V_o = \frac{3 \times 440\sqrt{2}}{\pi}\cos\alpha$$

I_o = 20 Amp

R= 0.5Ω

$$I_o = \frac{E - (-V_o)}{R}$$

$$20 = \frac{307 + \frac{3 \times 440\sqrt{2}}{\pi}\cos\alpha}{0.5}$$

$\alpha = 120°$.

22. Ans: (d)

Sol: As the size of conductor increases keeping distance between conductors constant the value of inductance decreases and capacitance remains same, so the value of surge impedance reduces. As the distance between conductors is fixed charging current also remains constant.

As the inductive reactance reduces Ferranti effect increases. So statement 2 is incorrect.

23. Ans: (d)

Sol: By using synchronous condenser it is not economical to regulate reactive power flow individually in each phase. By using static compensator we can easily regulate reactive power individually in each phase.

24. Ans: (a)

Sol: $3C_s = 12.6$

$\Rightarrow \quad C_s = 4.3\ \mu F$

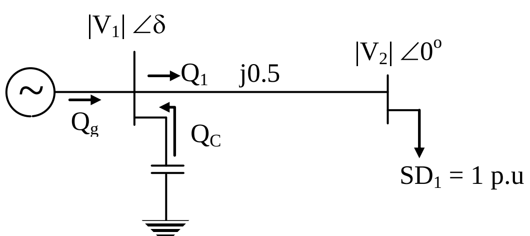
$C_s + 3C_c = 9$

$\Rightarrow \quad 3C_c = 9 - 4.3 = 4.7$

$C_c = 1.6\ \mu F$

25. Ans: (b)

Sol: Load angle $\delta = \sin^{-1}\left(\frac{1}{\left(\frac{1\times 1}{0.5}\right)}\right) = 30^o$



$Q_g + Q_c = Q_1$

$\Rightarrow \quad Q_c = Q_1 - Q_g$

$$Q_1 = \frac{|V_1|}{X}\left[|V_1| - |V_2|\cos\delta\right]$$

$$= \frac{1}{0.5}\left[1 - \cos 30^o\right]$$

$= 0.268$ p.u

Capacitor, $Q_c = 0.268 - 0.1$

$= 0.168$ p.u

26. Ans: (d)

Sol: $\frac{dP}{d\delta} = \frac{EV}{X}\cos\delta$

27. Ans: (d)

Sol: E = 1.0 pu,

v = 1.0 pu

$$P_{max1} = \frac{Ev}{x_{eq}}$$

$$P_{max1} = \frac{1.0\times 1.0}{0.6} = \frac{1}{0.6}$$

$$P_{max3} = \frac{1.0\times 1.0}{1.0} = 1$$

$$\frac{P_{max1}}{P_{max3}} = \frac{1}{0.6} = 1.667$$

28. Ans: (b)

Sol: Fault current $\propto \frac{1}{x\ (\text{during fault})}$

$$\frac{I_{in}}{I_f} = \frac{I_{sub-transient}}{I_{synchronous}} = \frac{X_{syn}}{X_{sub-trans}}$$

$$= \frac{1.25}{0.25} = 5$$

29. Ans: (b)

Sol: **Under reach:** when impedance seen by the relay due to presence of arc resistance, the impedance seen by the relay appears to be more than the actual value of the impedance up to the fault point and the relay tends to under reach.

Over reach: When impedance seen by the relay is less than the set value the distance relay is prone to over reach on a transient fault consisting of a dc offset. All high speed distance relay tends to see more current due to the presence of dc offset.

30. Ans: (a)

Sol: A = cos hr$l$

B = Z_c sin hr$l$

if l is reducing, A is increasing

B is decreasing

31. Ans: (a)

32. Ans: (c)

Sol: $P = \frac{EV}{X} sin(\theta_1 - \theta_2)$

$1 = \frac{1 \times 1}{0.2} sin(\theta_1 - \theta_2)$

$\sin(\theta_1 - \theta_2) = 0.2$

θ_1, θ_2 are very small

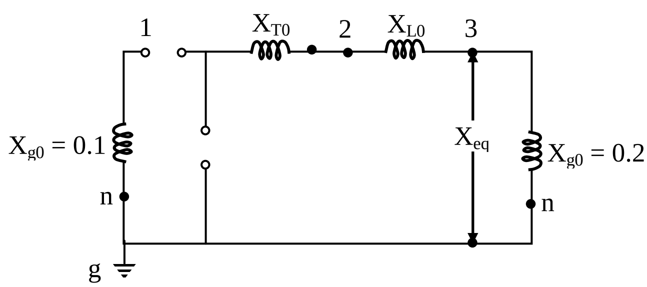
$\theta_1 - \theta_2 = 0.2$

33. Ans: (d)

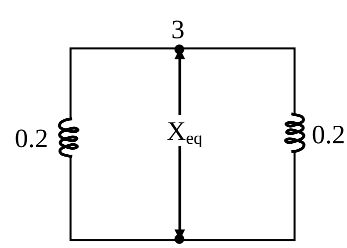
Sol: For a n bus power system, we consider one bus as slack bus and remaining (n −1) buses are either generator bus or load bus for which active power should be specified. Only for generator and slack bus voltage should be specified for generator bus voltage is not specified so it is a wrong statement.

34. Ans: (c)

Sol: Zero sequence network for the given system is equivalent impedance as seen from node 3 is



Equivalent impedance as run from node 3 is



$\therefore X_{eq} = 0.2 \parallel 0.2$

$X_{eq} = \frac{0.2 \times 0.2}{2 \times 0.2} = 0.1$ pu

35. Ans: (b)

Sol: The line is normally operating with negative polarity as the corona loss and the radio interference are reduced

36. Ans: (c)

Sol: $I_2 = I_1 + I_g$

$V\omega c_2 = V\omega c_1 + V\omega c_g$

$c_2 = c_1 + c_g \Rightarrow c_2 = (10+1)\mu F \Rightarrow c_2 = 11\mu F$

37. Ans: (d)

Sol: $V = \dfrac{1}{\sqrt{LC}} = 3\times10^5$ km/s

$$z_c = 333.33 = \frac{1000}{3} = \sqrt{\frac{L}{C}}$$

$$\frac{1}{\sqrt{LC}}\sqrt{\frac{L}{C}} = 3\times10^5\times\frac{1000}{3} = 10^8$$

$$\Rightarrow \quad \frac{1}{C} = 10^8$$

$$C = 10^{-8}\ \text{F/Km}$$

$$= 10^{-2}\ \mu\text{F/km} = 0.01\ \mu\text{F/km}$$

38. Ans: (c)

Sol: $L_{int} = \dfrac{\mu}{8\pi} = \dfrac{\mu_0\mu_r}{8\pi}$

$$L_{int} = \frac{1}{2}\times\mu_r\times10^{-7}\ \text{H/m}$$

$L_{int} \propto \mu_r$

$$\frac{(L_{int})_2}{(L_{int})_1} = \frac{(\mu_r)_2}{(\mu_r)_1}$$

$$(L_{int})_2 = \frac{8}{1}\times0.05 = 0.4$$

39. Ans: (c)

Sol: Generator buses = 10

Load buses = 90

5 load buses are converted into generator buses total generator buses = 15

Load buses = 85

Generator equations = (15 - 1) × 1 = 14

Load bus equations = 85 × 2 = 170

Total number of equations = 184.

40. Ans: (b)

41. Ans: (a)

Sol: Self GMD = $\sqrt[3]{r' \times S\times S}$

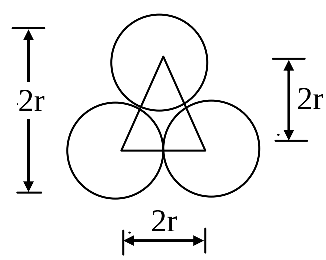
where r^1= imaginary radius due to internal as well as external turn linkages.

$$r^1 = re^{\frac{-1}{4}} = 0.7788\,r$$

S = distance between two conductors (centre to centre)

$$\text{Self GMD} = \sqrt[3]{0.7788\times2r\times2r}$$

$$= r(0.7788\times2\times2)^{\frac{1}{3}}$$



42. Ans: (d)

Sol: If any machine over excited then it always delivers lagging vars

43. Ans: (d)

Sol: Electrostatic precipitator is used to collect the dust particles from flue gases.

44. Ans: (d)

Sol: Given $x(t) = u(t-2)$ & $h(t) = u(t-1)$

We know that $u(t) * u(t) = r(t)$

$u(t-t_1) * u(t-t_2) = r(t-t_1-t_2)$,

$u(t-1) * u(t-2) = r(t-1-2)$

$= r(t-3)$

$= (t-3)u(t-3)$

45. Ans: (b)

Sol: Given $x(t) = m(t)\, y(t)$ ……….. (1)

and $Y(\omega) = 2X(\omega - \omega_c)$ ……….. (2)

Apply IFT to equation (2)

$$y(t) = 2x(t)e^{j\omega_c t}$$

$$x(t) = \frac{1}{2}y(t)e^{-j\omega_c t} \quad \text{……….. (3)}$$

Comparing (1) & (3), then $m(t) = \frac{1}{2}e^{-j\omega_c t}$

46. Ans: (b)

Sol: Given $\frac{dw(t)}{dt} = y(t) + x(t)$ ……….. (1)

$$\frac{dy(t)}{dt} = -w(t) \quad \text{………. (2)}$$

Apply Laplace transform to equation (1)

$sW(s) = Y(s) + X(s)$ ……….. (3)

Apply Laplace transform to equation (2)

$sY(s) = -W(s)$ ……….. (4)

From (3) & (4)

$s[-sY(s)] = Y(s) + X(s)$

$-s^2Y(s) - Y(s) = X(s)$

$$H(s) = \frac{Y(s)}{X(s)} = -\frac{1}{s^2+1}$$

Apply Inverse Laplace Transform

$h(t) = -\sin(t)u(t)$

47. Ans: (c)

Sol: 1. $y(n) - 0.4y(n-1) = x(n)$

Apply z-transform

$Y(z) - 0.4\, z^{-1}Y(z) = X(z)$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{1}{1-0.4z^{-1}}$$

Pole = 0.4, lies inside the unit circle. So, it is stable. Statement (1) is false.

2. All poles of FIR filter lies inside the unit circle. So, FIR filters are always stable. Statement (2) is true.

3. $$\sum_{n=-\infty}^{\infty}|h(n)| = \sum_{n=0}^{\infty}2(0.4)^n$$

$$= \frac{2}{1-0.4} < \infty,$$

So, it is stable.

Statement (3) is false.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48. Ans: (b)

Sol: Given x(n) = 2δ(n + 2) + 2δ(n – 2)

$$X(e^{j\omega}) = 2e^{2j\omega} + 2e^{-2j\omega}$$

and $H(e^{j\omega}) = 4 - 2e^{-2j\omega}$

$$Y(e^{j\omega}) = X(e^{j\omega})\,H(e^{j\omega})$$

$$= 8e^{2j\omega} - 4 + 8e^{-2j\omega} - 4e^{-4j\omega}$$

Apply IDTFT

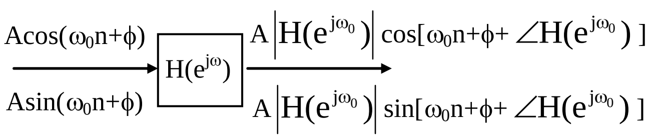
y(n) = 8δ(n + 2) – 4δ(n) + 8δ(n – 2) – 4δ(n – 4)

$$y(n) = \{8, 0, \underset{\uparrow}{-4}\ 0, 8, 0, -4\}$$

y(–1) = 0

49. Ans: (b)

Sol:



Given

$$x(n) = 4\sin\left(\frac{\pi}{3}n + \frac{\pi}{4}\right) - \cos\left(\frac{3\pi}{4}n + \frac{\pi}{6}\right)$$

Consider $x_1(n) = 4\sin\left(\frac{\pi}{3}n + \frac{\pi}{4}\right)$

$\omega_0 = \frac{\pi}{3}$ lies in the range of $-\frac{\pi}{2} \le \omega \le \frac{\pi}{2}$

So, $y_1(n) = 4k\sin\left(\frac{\pi}{3}n + \frac{\pi}{4} + \frac{3\pi}{3}\right)$

$$y_1(n) = 4k\sin\left(\frac{\pi}{3}(n+3) + \frac{\pi}{4}\right)$$

$$x_2(n) = \cos\left(\frac{3\pi}{4}n + \frac{\pi}{6}\right)$$

$\omega_0 = \frac{3\pi}{4}$ is not in the range of $-\frac{\pi}{2}$ to $\frac{\pi}{2}$.

So, $y_2(n) = 0$

$y(n) = y_1(n) + y_2(n)$

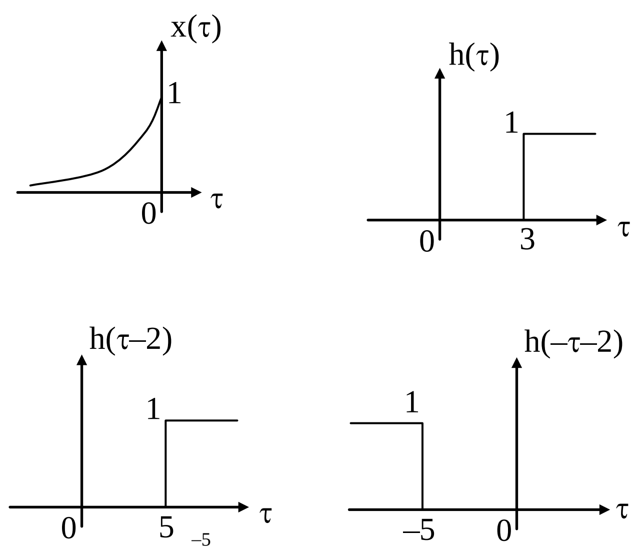
$$y(n) = 4k\sin\left(\frac{\pi}{3}(n+3) + \frac{\pi}{4}\right)$$

50. Ans: (b)

Sol: y(t) = x(t)*h(t)

$$y(t) = \int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau$$

$$y(-2) = \int_{-\infty}^{\infty} x(\tau)h(-2-\tau)d\tau$$



$$y(-2) = \int_{-\infty}^{-5} e^{2\tau}.1.1d\tau$$

$$y(-2) = \left.\frac{e^{2\tau}}{2}\right|_{-\infty}^{-5} = \frac{1}{2}\left[e^{-10} - 0\right] = \frac{e^{-10}}{2}$$

51. Ans: (a)

Sol: Assume $y(t) = \frac{dx(t)}{dt}$

From differentiation in time domain property

$$\frac{dx(t)}{dt} \leftrightarrow jk\omega_0 a_k$$

Assume y(t) coefficients is 'b_k' then

$b_k = 0$ $\quad\quad\quad\quad$ k = 0

$= -k\left(\frac{1}{2}\right)^{|k|}\omega_0$ $\quad\quad$ otherwise

So, $b_0 = 0$

52. Ans: (d)

Sol: $x_1(t) \leftrightarrow X_1(s)$, ROC R_1

$x_2(t) \leftrightarrow X_2(s)$, ROC R_2

$x_1(t) * x_2(t) \leftrightarrow X_1(s)X_2(s)$, ROC $R_1 \cap R_2$

53. Ans: (a)

Sol: Rectangular window main lobe width is $\frac{4\pi}{N}$

Hanning window main lobe width is $\frac{8\pi}{N}$

Hamming window main lobe width is $\frac{8\pi}{N}$

Blackmann window main lobe width is $\frac{12\pi}{N}$

54. Ans: (b)

Sol: $y(n) = x(n) + 2nx(n-1)$

$y_1(n) = x_1(n) + 2nx_1(n-1)$

$y_2(n) = x_2(n) + 2nx_2(n-1)$

$y_3(n) = [\alpha x_1(n) + \beta x_2(n)] +$

$\quad\quad 2n[\alpha x_1(n-1) + \beta x_2(n-1)]$

$y_3(n) = \alpha y_1(n) + \beta y_2(n)$

So, linear system

$y_1(n) = x(n-k) + 2nx(n-k-1)$

$y(n-k) = x(n-k) + 2(n-k)x(n-k-1)$

$y_1(n) \neq y(n-k)$

So time variant.

55. Ans: (c)

Sol: The peak side lobe in the case of Hanning window has a value of – 32dB.

56. Ans: (b)

Sol: $\frac{z^2Y(z)}{z^2} = \frac{1}{1+2z^{-1}}$

$$Y(z) = \frac{1}{1+2z^{-1}}$$

$$(-2)^n u(n) \leftrightarrow \frac{1}{1+2z^{-1}}$$

So, $y(n) = (-2)^n u(n)$

57. Ans: (c)

Sol: If $\quad x(n) = z^n \Rightarrow y(n) = z^n H(z)$

$x(n) = (-1)^n \Rightarrow y(n) = (-1)^n H(z)\big|_{z=-1}$

$$H(z) = \frac{1}{1-\frac{1}{2}z^{-1}} = \frac{Y(z)}{X(z)}$$

$$H(z)\big|_{Z=-1} = \frac{1}{\frac{3}{2}} = \frac{2}{3}$$

So, $y(n) = \frac{2}{3}(-1)^n$

58. Ans: (b)

Sol: $X(k) = \sum_{n=0}^{7} x(n)e^{-j\frac{2\pi}{8}nk}$

$$X(0) = \sum_{n=0}^{7} x(n)$$

$= x(0)+ x(1)+ x(2) + x(3) + x(4) + x(5) + x(6) + x(7)$

$$X(4) = \sum_{n=0}^{7} x(n)(-1)^n$$

$= x(0) – x(1) + x(2) –x(3) + x(4) – x(5) + x(6) – x(7)$

$X(0) + X(4) = 2x(0) + 2x(2) + 2x(4) + 2x(6)$

$$2\sum_{n=0}^{3} x(2n) = X(0) + X(4)$$

$$\sum_{n=0}^{3} x(2n) = \frac{16+0}{2} = 8$$

59. Ans: (c)

Sol: $Sgn(t) \leftrightarrow \frac{1}{j\pi f}$

From Time reversal property

$$Sgn(-t) \leftrightarrow \frac{-1}{j\pi f}$$

$$-3Sgn(t) \leftrightarrow \frac{-3}{j\pi f}$$

So, $x(t) = -3Sgn(t)$

$x(t) = -3Sgn(t) = -3 \quad t > 0$

$= 3 \quad t < 0$

60. Ans: (a)

Sol: $X_2(\omega) = 2X_1(\omega) \quad \omega > 0$

$= 0 \quad \omega < 0$

$$E_{X_2(\omega)} = \frac{1}{2\pi}\int_0^{\infty} |2X_1(\omega)|^2 d\omega$$

$$= 4\left[\frac{1}{2\pi}\int_0^{\infty} |X_1(\omega)|^2 d\omega\right]$$

$$= 4 \times \frac{E_1}{2} = 2E_1$$

61. Ans: (b)

Sol: $X(s) = \int_{-\infty}^{\infty} x(t)e^{-st}dt$

Convergence condition is

$$= \int_{-\infty}^{\infty} \left|x(t)e^{-\sigma t}\right| dt < \infty$$

62. Ans: (b)

Sol: The necessary and sufficient condition for a period signal x(t) can expanded by Fourier series is $\int_0^T |x(t)|\,dt < \infty$

63. Ans: (b)

Sol: $e^{-t}u(t) \leftrightarrow \frac{1}{s+1}$

$$e^{-(t-1)}u(t-1) \leftrightarrow \frac{e^{-s}}{s+1}$$

$$e^{-(t+1)}u(t) \leftrightarrow \frac{e^{-1}}{s+1}$$

$$e^{-t}u(t-1) \leftrightarrow \frac{e^{-(s+1)}}{s+1}$$

64. Ans: (a)

Sol: Phase delay $t_p(\omega) = \frac{-\theta(\omega)}{\omega}$

$$= \frac{\frac{\pi}{2}}{2000\pi}$$

$$= \frac{1}{4000} = 0.25\text{msec}$$

65. Ans: (c)

Sol: The maximum frequency $\omega_m = 8000\,\pi$,

$f_m = 4000$Hz

Nyquist interval $= \frac{1}{2f_m}$

$$= \frac{1}{8000} = 0.125 \text{ msec}$$

66. Ans: (a)

Sol: $x(n) = \{1,0,-1,0\}$

$h(n) = \{1,2,4,8\}$

$$\begin{bmatrix} 1 & 8 & 4 & 2 \\ 2 & 1 & 8 & 4 \\ 4 & 2 & 1 & 8 \\ 8 & 4 & 2 & 1 \end{bmatrix}\begin{bmatrix} 1 \\ 0 \\ -1 \\ 0 \end{bmatrix} = \begin{bmatrix} -3 \\ -6 \\ 3 \\ 6 \end{bmatrix}$$

So, $y(n) = \{-3, -6, 3, 6\}$

67. Ans: (a)

Sol: Condition for stability of LTI System is

$$\int_{-\infty}^{\infty} |h(t)|dt < \infty$$

68. Ans: (a)

Sol: Given $y(n + 2) - 5y(n + 1) + 6y(n) = x(n)$

Apply z-transform

$$Y(z) = \frac{X(z)}{z^2 - 5z + 6}$$

$$= \frac{X(z)}{(z-2)(z-3)}$$

Characteristic equation is

$(z - 2)(z - 3) = 0$

Poles are 2, 3.

Poles are lies outside the unit circle. So, it is unstable system. So, statement (I) is correct.

A system is unstable if the roots of the characteristic equation lies outside the unit circle. So, statement (II) is correct.

69. Ans: (d)

Sol: Statement I is not correct and statement II is correct

70. Ans: (d)

Sol: For LLG fault positive sequence current is given by

$$I_{a1} = \frac{E_a}{Z_1 + \frac{Z_0 Z_2}{Z_0 + Z_2}}$$

And for LG fault positive sequence current is given by $I_{a1} = \frac{E_a}{Z_0 + Z_1 + Z_2}$.

So, $I_{a1(LG)} < I_{a2(LLG)}$

Zero sequence in synchronous matrix depends upon the chording and breadth factors. However, zero sequence impedance is much smaller than positive and negative sequence impedance.

71. Ans: (a)

Sol: Both correct and (R) is the correct explanation of (A).

72. Ans: (d)

Sol: The output ripple frequency of 3-ϕ full bridge rectifier is 6f and output ripple frequency of 1-ϕ full bridge rectifier is 2f.

73. Ans: (a)

Sol: In a $3 - \phi$ Full wave rectifier, if firing angle increases it draws reactive power from ac supply due to lagging power factor. The nature of current in the supply line would be non sinusoidal.

74. Ans: (a)

Sol: In forward blocking state of SCR, junction J_2 is reverse biased and acts like a capacitor whereas junction J_1 and J_2 are forward biased. So, if large $\frac{dv}{dt}$ is applied to the SCR a large charging current flows and turns ON the SCR. So, Statement-I validates Statement-II.

75. Ans: (a)

Sol: In CSI drives, the source is current source. So, a large inductance is present on source side which stabilises the current in the source. As, the source is current stiff element load has to be voltage stiff like capacitor. So, inductive loads are not preferable. Hence Statement-II validates Statement-I.

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