ESE- 2020 (Prelims) - Offline Test Series Test - 15

ELECTRICAL ENGINEERING

SUBJECT: POWER SYSTEMS + POWER ELECTRONICS + SYSTEMS AND SIGNAL PROCESSING

01. Ans: (c)

Sol: It is a band-pass signal.

Given f_L = 1kHz, f_H = 1.5kHz

BW = $f_H - f_L$ = 0.5kHz

$$N = \frac{f_H}{BW} = \frac{1.5k}{0.5k} = 3$$

$$(f_s)_{min} = \frac{2f_H}{N} = \frac{2\times 1.5k}{3} = 1kHz$$

02. Ans: (b)

Sol: $A\,rect\left(\frac{t}{T}\right) \leftrightarrow AT\,sinc(fT)$

From duality property

$$TSinc(tT) \leftrightarrow rect\left(\frac{f}{T}\right)$$

T = 1

Sinc(t) $\leftrightarrow$ rect(f)

$$ATri\left(\frac{t}{T}\right) \leftrightarrow ATSinc^2(fT)$$

$$TSinc^2(tT) \leftrightarrow Tri\left(\frac{f}{T}\right)$$

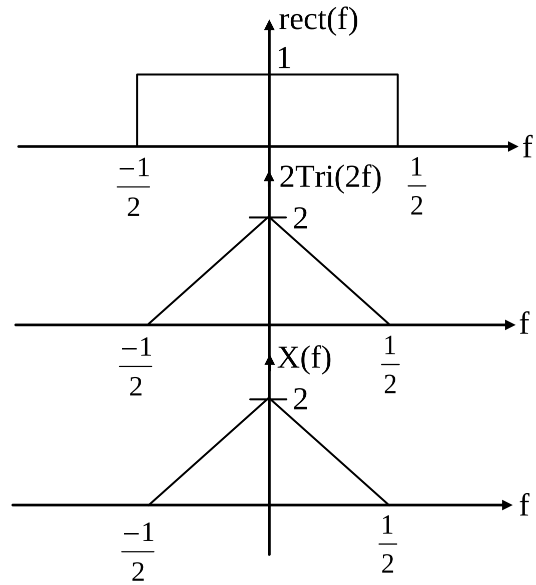
$$T = \frac{1}{2}$$

$$Sinc^2\left(\frac{t}{2}\right) \leftrightarrow 2Tri(2f)$$

Assume x(t) = Sinc(t) $*$ $Sinc^2\left(\frac{t}{2}\right)$

Apply Fourier Transform

X(f) = rect(f) 2Tri (2f)



X(f) = 2Tri (2f)

Apply IFT

$x(t) = \text{Sinc}^2\left(\frac{t}{2}\right)$

03. Ans: (a)

Sol: $f_s = 2\text{kHz} \Rightarrow T_s = 0.5\text{msec}$

$\therefore$ 1msec corresponds to N = 2

04. Ans: (c)

Sol: $e^{-a|t|} \leftrightarrow \frac{2a}{a^2+4\pi^2 f^2}$

$a = \sqrt{2}$

$e^{-\sqrt{2}|t|} \leftrightarrow \frac{2\sqrt{2}}{2+4\pi^2 f^2}$

$\frac{1}{2\sqrt{2}} e^{-\sqrt{2}|t|} \leftrightarrow \frac{1}{2+4\pi^2 f^2}$

05. Ans: (c)

Sol: $\delta(t) \leftrightarrow 1$

$\delta(t-t_0) \leftrightarrow e^{-2\pi f t_0}$ (from time shifting property)

Given x(t) = δ (t + 0.5) – δ (t – 0.5)

Apply Fourier Transform

$X(f) = e^{j2\pi f(0.5)} - e^{-j2\pi f(0.5)}$

$X(f) = e^{j\pi f} - e^{-j\pi f} = 2j\sin(\pi f)$

06. Ans: (c)

Sol: sinc(t) can't be invertible because

sinc(t)*sinc(t) = sinc(t)

sinc(t)*2sinc(2t) = sinc(t)

07. Ans: (b)

Sol: Given $x(t) = e^{-t}\,u(t)$

$$x_e(t) = \frac{x(t)+x(-t)}{2}$$

$$x_e(t) = \frac{e^{-t}u(t)+e^{t}u(-t)}{2} = \frac{1}{2}e^{-|t|}$$

08. Ans: (b)

Sol: $x(nT_s) = x\left[\frac{n}{75}\right] = 2\cos\left[\frac{40\pi n}{75}\right] + \sin\left[\frac{60\pi n}{75}\right]$

$N_1 = 15 \qquad N_2 = 5$

$N = \text{L.C.M}(N_1, N_2) = 15$

09. Ans: (b)

Sol: Assume $X_1(s) = \frac{1}{(s+1)(s+2)} = \frac{A}{s+1} + \frac{B}{s+2}$

$$X_1(s) = \frac{1}{s+1} - \frac{1}{s+2}$$

Apply ILT

$x_1(t) = (e^{-t} - e^{-2t})\,u(t)$

Assume $X_2(s) = \frac{s}{(s+1)(s+2)} = \frac{A}{s+1} + \frac{B}{s+2}$

$$X_2(s) = \frac{-1}{s+1} + \frac{2}{s+2}$$

Apply ILT

$x_2(t) = -e^{-t}u(t) + 2e^{-2t}u(t)$

ILT $[e^{-2s}X_2(s)] = x_2(t-2)$

$= -e^{-(t-2)}\,u(t-2) + 2e^{-2(t-2)}\,u(t-2)$

So, $X(s) = X_1(s) + X_2(s)\,e^{-2s}$

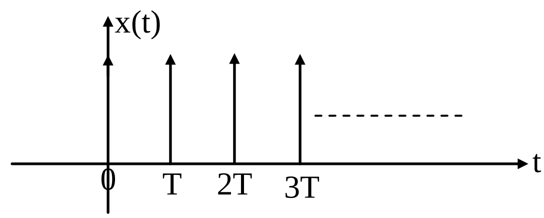
$x(t) = x_1(t) + x_2(t-2)$

$x(t) = (e^{-t} - e^{-2t})u(t) + [2\,e^{-2(t-2)} - e^{-(t-2)}]u(t-2)$

10. Ans: (d)

Sol: Given $x(t) = \sum_{k=0}^{\infty}\delta(t-kT)$

$x(t) = \delta(t) + \delta(t-T) + \delta(t-2T) + \text{-------}$



L.T of periodic signal x(t) is

$$X(s) = \frac{1}{1-e^{-sT}}X_1(s)$$

where $X_1(s)$ is L.T over one period.

So, signal over one period is $\delta(t)$, So, $X_1(s) = 1$

$$X(s) = \frac{1}{1-e^{-sT}}$$

11. Ans: (c)

Sol: Given $y(t) = e^{t}\left[1 + \int_0^t e^{-\tau}y(\tau)d\tau\right] \quad t > 0$

The above expression can be expressed as

$$y(t) = e^{t}u(t) + \int_0^t e^{t-\tau}y(\tau)d\tau$$

$y(t) = e^{t}\,u(t) + e^{t}\,u(t) * y(t)$

Apply L.T

$$Y(s)=\frac{1}{s-1}+\frac{1}{s-1}Y(s)$$

$$Y(s)\left[1-\frac{1}{s-1}\right]=\frac{1}{s-1}$$

$$Y(s)\left[\frac{s-1-1}{s-1}\right]=\frac{1}{s-1}$$

$$Y(s)=\frac{1}{s-2}$$

Apply ILT

$y(t) = e^{2t}\,u(t) = e^{2t}\; t > 0$

12. Ans: (a)

Sol: Given x(n) = {1,2} and y(n) = {2, 3, 1, 6}

$X(z) = 1+2z^{-1}$, $Y(z) = 2 + 3z^{-1} + z^{-2} + 6z^{-3}$

we know that Y(z) = X(z) H(z)

$$H(z)=\frac{Y(z)}{X(z)}=\frac{2+3z^{-1}+z^{-2}+6z^{-3}}{1+2z^{-1}}$$

So, $H(z) = 2-z^{-1} + 3z^{-2}$

Apply IZT

h(n) = {2, –1, 3}

13. Ans: (a)

Sol: x(n) = {1,0,–1,0}

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

x(n) circular convolution

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

14. Ans: (c)

Sol: There is a potential problem for frequency sampling realization of the FIR linear phase filter. The frequency sampling realization of the FIR filter introduces poles and zeros at equally spaced points on the unit circle.

15. Ans: (a)

Sol: Type-II chehyshev filter

– has equiripple in stop-band

– monotonic characteristic in the pass band

– has both zeros and poles

– zero's lie on the imaginary axis on s-plane

16. Ans: (c)

Sol: Given, $g(n) = \{10, 4, 9, \underset{\uparrow}{0}, 9, 4, 10\}$

$\Rightarrow ng(n) = \{-30, -8, -9, \underset{\uparrow}{0}, 9, 8, 30\}$

Also, $g(n)\xleftrightarrow{\text{D.T.F.T}}G(e^{j\Omega})$

By property,

$$ng(n)\leftrightarrow j\frac{d}{d\Omega}G(e^{j\Omega})$$

By parseval's energy theorem

$$\frac{1}{2\pi}\int_{-\pi}^{\pi}\left|X(e^{j\Omega})\right|^2 d\Omega=\sum_{n=-\infty}^{\infty}|x(n)|^2$$

$$\frac{1}{2\pi}\int_{-\pi}^{\pi}\left|j\frac{d}{d\Omega}G(e^{j\Omega})\right|^2 d\Omega=\sum_{n=-3}^{3}|n\,g(n)|^2$$

$$\int_{-\pi}^{\pi}\left|\frac{d}{d\Omega}G(e^{j\Omega})\right|^2 d\Omega=2\pi[900+64+81+0+81+64+900]$$

$$= 2\pi[2090] = 4180\pi$$

17. Ans: (c)

Sol: $X(z) = \frac{z}{3z^2 - 4z + 1} = \frac{z}{(3z-1)(z-1)}$

$$\frac{X(z)}{z} = \frac{1}{(3z-1)(z-1)} = \frac{A}{(3z-1)} + \frac{B}{(z-1)} \quad \ldots.(1)$$

$$\frac{X(z)}{z} = \frac{(-3/2)}{(3z-1)} + \frac{(1/2)}{(z-1)}$$

$$X(z) = \frac{-1}{2}\frac{z}{z-\frac{1}{3}} + \frac{1}{2}.\frac{z}{z-1} \quad \ldots\ldots.(2)$$

Poles of x(z) are $|z| = \frac{1}{3}$ & |z| = 1

R.O.C. is |z| > 1 (given)

Taking I.Z.T. in equation (2)

$$x(n) = -\frac{1}{2}.\left(\frac{1}{3}\right)^n.u(n) + \frac{1}{2}.u(n)$$

$$\therefore\ x(2) = \frac{-1}{2}.\left(\frac{1}{3}\right)^2 + \frac{1}{2} = \frac{4}{9}$$

$$x(2) = \frac{4}{9}$$

18. Ans: (c)

Sol: Given y(n) – 3y(n–1) – 4y(n–2) = x(n) + 2x(n–1)

Apply z-transform

$Y(z)\,[1-3z^{-1}-4z^{-2}] = X(z)\,[1+2z^{-1}]$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{1+2z^{-1}}{1-3z^{-1}-4z^{-2}}$$

$$H(z) = \frac{z(z+2)}{(z^2-3z-4)}$$

$$\frac{H(z)}{z} = \frac{(z+2)}{(z-4)(z+1)}$$

$$\frac{H(z)}{z} = \frac{(z+2)}{(z-4)(z+1)} = \frac{A}{(z-4)} + \frac{B}{(z+1)} \quad \ldots(1)$$

$$H(z) = \frac{6}{5}.\frac{z}{z-4} - \frac{1}{5}.\frac{z}{z+1}$$

Apply inverse z-transform

$$h(n) = \left\{\frac{6}{5}\left[4^n\right] - \frac{1}{5}\left[-1\right]^n\right\}.u(n)$$

19. Ans: (a)

Sol: Systems in (1) and (4) represent recursive discrete systems because present output depends on past outputs.

20. Ans: (c)

Sol: $x_1(n) = e^{j\pi n} = (-1)^n \rightarrow y_1(n) = 1$

y(n) = | x(n) | for all n

$x_1(n) = 1$, n = 0, ± 2, ± 4 , …..

= –1 , n = ± 1, ± 3, ……..

g(n) = x(n – m) → | g(n) | = | x(n – m) |

y(n – m) = | x(n – m) | , S_1 is Time Invariant

α x(n) → | α x(n) | ≠ α | x(n) |, S_1 is not linear.

$x_2(n) = (-1)^n \rightarrow y_2(n) = (-1)^n = x_2(n)$, y(n) = x(n) , S_2 is LTI

S_1 is not LTI but S_2 is LTI

21. Ans: (a)

Sol: a. Continuous time Fourier series

$$c_n = \frac{1}{T}\int_{t=0}^{T} x(t)\, e^{-jn\omega_0 t}\, dt \qquad (3)$$

It's spectrum is Discrete and aperiodic or not periodic

b. Continuous time Fourier transform

$$X(j\omega) = \int_{t=-\infty}^{\infty} x(t)\, e^{-j\omega t}\, dt \qquad (4)$$

It's spectrum is Continuous and aperiodic

c. Discrete time FS

$$C_k = \frac{1}{N}\sum_{n=0}^{(N-1)} x(n)\, e^{-j\frac{2\pi}{N}Kn}, \quad \text{Period} = N$$

(1)

It's spectrum is Discrete and periodic

d. DTFT

$$X(e^{j\omega}) = \sum_{n=-\infty}^{\infty} x(n)\, e^{-j\omega n} \qquad (2)$$

It's spectrum is Continuous and periodic, Period = 2π

22. Ans: (b)

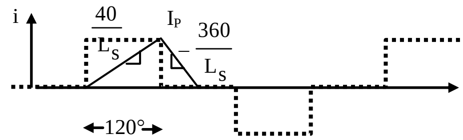
Sol: The ULT of $\frac{d}{dt}x(t)$ is $sX_I(s) - x(0^-)$

23. Ans: (b)

Sol: For a right-handed discrete time signal x(n), the ROC of the z-Transform is of the form $|z| > r_{max}$

24. Ans: (a)

Sol:



$$I_p = \frac{6.66\,\text{ms}}{6.66\,\text{mH}} \times 40$$

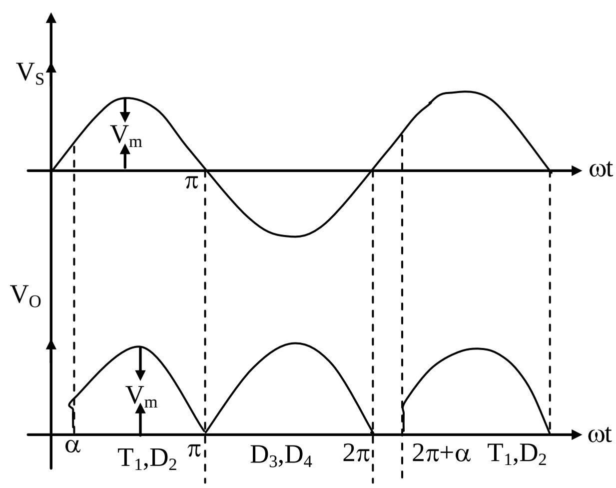
Peak value of load current I_p = 40 A

25. Ans: (c)

26. Ans: (d)

Sol: Given that $v_s = 100 \sin(100\,\pi t)$, $R = \frac{100}{2\pi}\Omega$

$$I_0 = \frac{V_0}{R}$$



$$V_0 = \frac{1}{2\pi}\left\{\int_{\alpha}^{\pi} V_m \sin\omega t\, d\omega t - \int_{\pi}^{2\pi} V_m \sin\omega t\, d\omega t\right\}$$

$$= \frac{V_m}{2\pi}(3 + \cos\alpha)$$

$$I_0 = \frac{100}{2\pi \times \frac{100}{2\pi}}(3 + \cos 30^\circ)$$

= 3.866 A

27. Ans: (b)

Sol: max output voltage $V_{0_{max}} = \frac{3V_{m\ell}}{\pi}$

$$= \frac{3\times\sqrt{2}\times 420}{\pi}$$

$$= 567.2\ V$$

28. Ans: (d)

Sol: Given that V = 415 V, I = 100 A

$\theta_{JC} = 0.01°$ C/W, $\theta_{CS} = 0.08°$ C/W,

$\theta_{SA} = 0.09°$ C/W

$T_A = 35°$ C

During conduction $P_{avg} = 1.5 \times 100 = 150$ W

$$P_{avg} = \frac{T_j - T_A}{\theta_{jA}}$$

$\theta_{jA} = \theta_{jC} + \theta_{CS} + \theta_{SA} = 0.01 + 0.08 + 0.09$

$= 0.18°$ C/W

$$150 = \frac{T_j - 35}{0.18}$$

Junction Temperature $T_j = 35 + 0.18 \times 150$

$T_j = 62°$C

29. Ans: (d)

Sol: The switch utilization ratio

$$= \frac{\text{output VA}}{\text{no of switches}\times V_{T_m}\times I_{T_m}}$$

$$= \frac{200\times 10}{4\times 325\times 10\sqrt{2}} = \frac{\sqrt{2}}{13}$$

30. Ans: (d)

31. Ans: (d)

Sol: $V_s = (R_s + R_L)i + L\frac{di}{dt}$

The solution for above equation is

$$i = I(1 - e^{-t/\tau})$$

Where $I = \frac{V_s}{R_s + R_L}$ and $\tau = \frac{L}{R_s + R_L}$

$$\frac{di}{dt} = I e^{-t/\tau} \times \frac{1}{\tau}$$

$$= \frac{V_s}{R_s + R_L}(e^{-t/\tau}) \times \frac{R_s + R_L}{L}$$

$$\frac{di}{dt} = \frac{V_s}{L}e^{-t/\tau}$$

$\frac{di}{dt}$ is maximum at t = 0

$$\left(\frac{di}{dt}\right)_{max} = \frac{V_s}{L}$$

$$L = \frac{V_s}{\left(\frac{di}{dt}\right)_{max}}$$

$$L = \frac{240}{50} = 4.8\ \mu H$$

32. Ans: (d)

Sol: For a step rise in input voltage, the pulse Transformer output is a positive pulse. In other words, the input signal is transmitted as a derivative of the input waveform for step rise like wise, for a step fall in input voltage a negative pulse appears at the pulse transform output.

33. Ans: (a)

34. Ans: (b)

Sol: For 3-ϕ semi converter

Average output voltage $V_0 = \frac{3V_{m\ell}}{2\pi}(1+cos\alpha)$

$$= \frac{3\times\sqrt{2}\times 400}{2\pi}[1+\cos 45^o]$$

$$= 507\text{ V}$$

$$T = K\, I_a$$

$$I_a = \frac{T}{K} = \frac{50}{2} = 25\text{ A}$$

Back emf $E_b = V_0 - I_aR_a$

$$= 507 - 25 = 482\text{ V}$$

35. Ans: (b)

Sol: For 3-pulse converter PIV $V_{m\ell}$ = 1000 V

For bridge 6 pulse converter PIV = $V_{m\ell}$

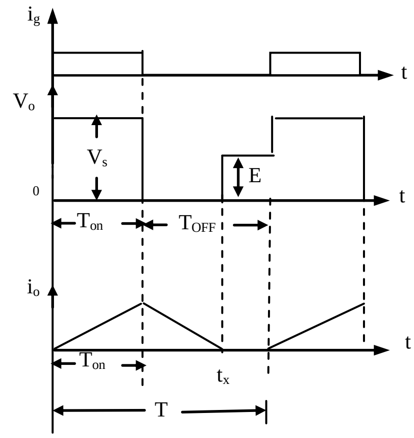
= 1000 V

For midpoint 6-pulse converter PIV =1.155 $V_{m\ell}$

= 1155 V

36. Ans: (b)

Sol:



The average output voltage for the discontinuous current mode as shown in fig.

$$V_o = \frac{1}{T}\int_0^T V_0.\ dt$$

$$= \frac{1}{T}\left[\int_0^{T_{ON}} V_s.dt + \int_{T_{on}}^{t_x} 0.dt + \int_{t_x}^{T} E.dt\right]$$

$$= V_s\frac{T_{on}}{T} + E\left(\frac{T-t_x}{T}\right)$$

$$V_0 = D\,V_s + E\left(1-\frac{t_x}{T}\right)(\text{volts})$$

37. Ans: (b)

38. Ans: (d)

Sol: $N = \frac{f_c}{2f} = \frac{15000}{2\times 500} = 15$

39. Ans: (d)

40. Ans: (d)

Sol: For a squirrel cage induction motor.

Constant $\frac{V}{f}$ and at low frequencies, the maximum torque is decreases, and starting torque increases.

Constant voltage and reduced frequencies, starting torque increases.

41. Ans: (c)

42. Ans: (c)

Sol: Triac can't be used for Inductive load

43. Ans: (b)

Sol: Buck boost converter

$$K = \frac{2fL}{R},\ K_{cr} = (1-D)^2$$

At Boundary conduction $K = K_{cr}$

$$\frac{2fL}{R} = (1-D)^2$$

$$\sqrt{\frac{2L}{RT}} = 1-D$$

$$D = 1-\sqrt{\frac{2L}{RT}}$$

44. Ans: 0 [zero]

Sol: The o/p voltage is free from second harmonic and hence load current can not contain second harmonics.

45. Ans: (c)

Sol: Fast breeder reactor doesn't require a moderator.

46. Ans: (c)

Sol: $3I_{a0} = j\,6 \Rightarrow I_{a0} = j\,2$ p.u., $I_{a1} = -j\,3$ p.u.

LLG $\Rightarrow I_{a1} + I_{a2} + I_{a0} = 0,\ I_{a2} = j\,1$ p.u.

47. Ans: (a)

Sol: $A = \cos \beta l = 0.866$

$$\text{Voltage regulation} = \frac{\left|\frac{V_s}{A}\right| - |V_r|}{|V_r|}$$

$$= \frac{1}{0.866} - 1 = 15.4\ \%$$

48. Ans: (a)

Sol: Velocity wave propagation in per unit form,

$$\nu = \frac{\omega}{\sqrt{L_{pu}/km.C_{pu}/km}}$$

L_{pu}= 0.02 pu $\Rightarrow L_{pu}/km = \frac{0.02}{\ell}$

$C_{pu} = B_{pu} = 2$ PU $\Rightarrow C_{pu}/km = \frac{2}{\ell}$

$$\text{Now, } \nu = \frac{\omega}{\sqrt{\frac{0.02}{\ell} \times \frac{2}{\ell}}}$$

$$\nu = \frac{\omega.\ell}{\sqrt{0.02 \times 2}}$$

$$\ell = \frac{3\times10^5\sqrt{0.02\times2}}{2\pi\times50} = 191 \text{ km}$$

49. Ans: (b)

Sol: Developed power,

$$P = \frac{735.5}{75} \times Q \times W \times H \times \eta \text{ Watts}$$

Here,

Discharge of water (Q) = $2m^3/s$,

Efficiency (η) = 90% and

Water head (H) = 40m

$$\therefore \quad P = \frac{735.5}{75} \times 1000 \times 2 \times 40 \times 0.9 \, kW$$

= 706.32 kW

50. Ans: (d)

Sol: Cost Functions $C_1 = 0.05\ Pg_1^2 + APg_1 + B$

$C_2 = 0.1\ Pg_2^2 + 3\ A\ Pg_2 + 2\ B$

λ = 100 Rs/MWhr

$P_D = P_{g1} + P_{g2}$= 1000 MW

$\lambda = IC_1 = IC_2$ -------------- (1)

$$IC_1 = \frac{\partial C_1}{\partial P_{g1}} = 0.1P_{g1} + A \text{ ----------- (2)}$$

$$IC_2 = \frac{\partial C_2}{\partial P_{g2}} = 0.2P_{g2} + 3A \text{ ----------- (3)}$$

From equation 1 and 2

$0.1P_{g1} + A = 100$ -------- (4)

From equation 1 and 3

$0.2\ P_{g2} + 3A = 100$ ---------(5)

$P_{g1} + P_{g2} = 1000$ ----------(6)

Solving 4,5, 6

P_{g1}= 800 MW ; P_{g_2} = 200 MW

$P_{g1}: P_{g2}$ = 800 : 200

= 4 : 1

51. Ans: (a)

Sol: Given data,

$$\frac{dC_1}{dP_1} = 0.02\,P_1 + 16$$

$$\frac{dC_2}{dP_2} = 0.04\,P_2 + 20$$

$P_L = B_{11} P_1^2$

$$B_{11} = \frac{10}{(100)^2} = 260$$

$P_1 + P_2 - P_L = 260$

$P_1 + P_2 - B_{11}\ P_1^2 = 260$

$P_1 + P_2 - 1\times 10^{-3}\ P_1^2 = 260$ ....(1)

Assuming loss less problem

$$\frac{dC_1}{dP_1} = \frac{dC_2}{dP_2} \Rightarrow 0.02\,P_1 + 16 = 0.04\ P_2 + 20$$

$$\Rightarrow \; P_2 = \frac{0.02\,P_1 - 4}{0.04}$$

$P_2 = 0.5\ P_1 - 100$ .... (2)

Substitute (2) in (1)

$P_1 + 0.5P_1 - 100 - 1 \times 10^{-3} P_1^2 = 260$

$1 \times 10^{-3\,+} P_1^2 - 1.5\ P_1 + 360 = 0$

$P_1 = 1200,\ P_1 = 300$

$\therefore P_2$ = 500 & 50.

The optimum distribution is P_1= 300 MW & P_2 = 50 MW.

52. Ans: (c)

Sol: A dummy bimetallic element is designed to oppose the bending of the main bimetallic strip.

53. Ans: (a)

Sol: $\begin{bmatrix} V_s \\ I_s \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_r \\ I_r \end{bmatrix}$

$\Rightarrow \begin{bmatrix} V_r \\ I_r \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_s \\ I_s \end{bmatrix}$

$\Rightarrow \begin{bmatrix} V_r \\ I_r \end{bmatrix} = \frac{1}{(AD-BC)} \begin{bmatrix} D & -B \\ -C & A \end{bmatrix} \begin{bmatrix} V_s \\ I_s \end{bmatrix}$

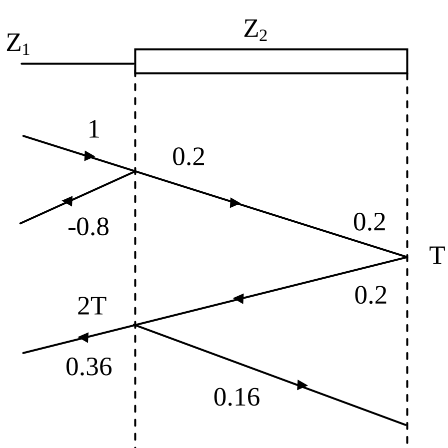
AD–BC = 1 (reciprocal network property)

$\Rightarrow \begin{bmatrix} V_r \\ I_r \end{bmatrix} = \begin{bmatrix} D & -B \\ -C & A \end{bmatrix} \begin{bmatrix} V_s \\ I_s \end{bmatrix}$

$Z_{out} = \frac{V_r}{I_r} = \frac{DV_s - BI_s}{-CV_s + AI_s}$

54. Ans: (b)

Sol: Draw the β_{ew} lay lattice diagram as,



Reflection coefficient C line to cable

$$\alpha_1 = \frac{Z_2 - Z_1}{Z_2 + Z_1} = \frac{1 - \frac{Z_1}{Z_2}}{1 + \frac{Z_1}{Z_2}} = -0.8$$

Refraction coefficient (line to cable)

$$\beta_1 = \frac{2\times 1}{1+9} = 0.2$$

Refraction coefficient (cable to line)

$$\beta_2 = \frac{2\times 9}{9+1} = 1.8$$

V(after 2T) = 1–0.8+0.36 = 0.56

55. Ans: (c)

Sol: Most of the fault at alternator will be single line to ground fault. In case of 3-phase CB the output power will be zero even for line to ground fault. So the acceleration is high. To limit the acceleration, single pole CB are placed so that the corresponding phase only will trip and the real power transfer will continue through healthy phases.

56. Ans: (b)

Sol: $J = (2n-2-m-l) \times (2n-2-m-l)$

57. Ans: (b)

Sol: $C = 2\pi \varepsilon_0 \varepsilon_r$

$= 2\pi \times 8.854 \times 10^{-12} \times 4$ F/m

$= 2.225 \times 10^{-10}$ F/m

$C = 2.225 \times 10^{-10} \times 20K$

$= 4.45\ \mu F$

58. Ans: (c)

59. Ans: (b)

Sol: The flux produced by negative sequence component is having speed of $-N_S$. However with respect to rotor, it has relative speed of $2N_S$. So that negative sequence flux will cut the rotor field winding which will produce an induced emf. Induced emf will once again produce circulating current in rotor field winding with double the frequency. The circulating current will result in rotor field winding getting over heated. In order to protect the rotor due to over heating negative sequence relay is employed in stator.

60. Ans: (d)

Sol: For the system to be transiently stable synchronizing coefficient should be positive.

61. Ans: (d)

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

62. Ans: (a)

Sol: Electrical island means separating a small part of distribution power network from the main grid such that the disconnected distribution system part has its own generating resource, which can supply the load existing in that part.

If the DG available in that island is capable to supply that demand then that island is known to be sustained island.

r

63. Ans: (b)

Sol: Reactive power compensation is required at the converter stations. The inter connection of two systems is alone by using isolation transformers so that the fault on one side will not be reflected on to other side. By using dc transmission corona can be reduced but not completely avoided.

64. Ans: (c)

Sol: $I_2 = I_1 + I_g$

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

$c_2 = c_1 + c_g$

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

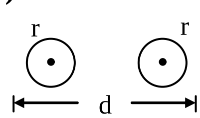
$\Rightarrow c_2 = 11\mu F$

65. Ans: (b)

Sol: In distribution applications vacuum circuit breaker is preferred, where as in transmission SF_6 circuit breaker is preferred.

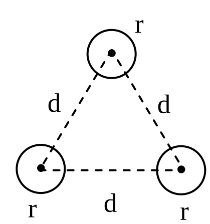
66. Ans: (c)

Sol:



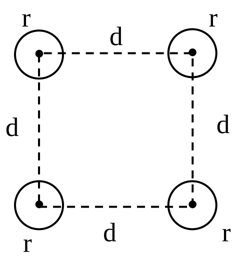
$$D_s = \sqrt[4]{(r'd)(r'd)}$$

$$= \sqrt{(r'd)} ------ (1)$$



$$D_s = \sqrt[9]{(r'dd)(r'dd)(r'dd)}$$

$$= \sqrt[3]{(r'd^2)} ------ (2)$$



$$D_s = \sqrt[16]{(r'dd\sqrt{2}d)^4}$$

$$= \mathbf{10.91}\sqrt[4]{r'd^3} - - - - - (3)$$

67. Ans: (c)

Sol: There are no convergence issues with the discrete-time Fourier series in general as it consists of only a finite number of terms =N, where N is a period of discrete-time signal. So, Statement (I) is correct.

A discrete-time signal is not always obtained by sampling a continuous-time signal.

So, Statement (II) is false.

68. Ans: (a)

Sol: A system is memory less if output, y(t) depends only on x(t) and not on past or future values of input, x(t).

A system is causal if the output, y(t) at any time depends only on values of input, x(t) at that time and in the past.

69. Ans: (a)

Sol: Both statements are correct and statement (II) is correct explanation for statement (I).

70. Ans: (d)

71. Ans: (c)

Sol: Fly back converter is also called Isolated buck-boost converter

72. Ans: (d)

73. Ans: (a)

74. Ans: (d)

Sol: The best location for SVC is at a point where voltage swings are greatest.

75. Ans: (a)

Sol: Circuit breaking is easy in ac currents than in dc currents because natural zero occurs in ac but not in dc.