



ACE

Engineering Academy

TEST ID: 208

Head Office : Sree Sindhi Guru Sangat Sabha Association, # 4-1-1236/1/A, King Koti, Abids, Hyderabad - 500001.

Ph: 040-23234418, 040-23234419, 040-23234420, 040 - 24750437

Hyderabad | Delhi | Bhopal | Pune | Bhubaneswar | Lucknow | Patna | Bengaluru | Chennai | Vijayawada | Vizag | Tirupati | Kukatpally | Kolkata | Ahmedabad

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.

$$\text{Given } f_L = 1\text{kHz}, f_H = 1.5\text{kHz}$$

$$BW = f_H - f_L = 0.5\text{kHz}$$

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

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

02. Ans: (b)

$$\text{Sol: } \text{Arect}\left(\frac{t}{T}\right) \leftrightarrow AT \text{sinc}(fT)$$

From duality property

$$T \text{sinc}(fT) \leftrightarrow \text{rect}\left(\frac{f}{T}\right)$$

$$T = 1$$

$$\text{sinc}(t) \leftrightarrow \text{rect}(f)$$

$$AT \text{Tri}\left(\frac{t}{T}\right) \leftrightarrow AT \text{sinc}^2(fT)$$

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

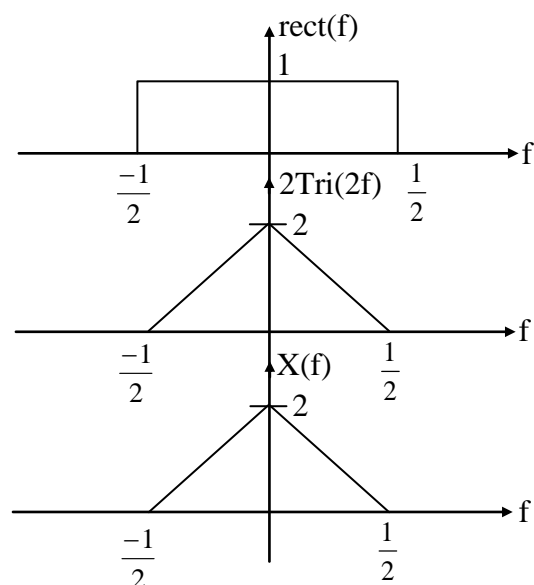
$$T = \frac{1}{2}$$

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

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

Apply Fourier Transform

$$X(f) = \text{rect}(f) 2\text{Tri}(2f)$$





ACE[®]
Engineering Academy
Leading Institute for ESE/GATE/PSUs



 **48**
ALL INDIA
1st RANKS IN GATE

 **15**
ALL INDIA
1st RANKS IN ESE

ESE - MAINS

Classes Start from:

13th FEB 2020



@ DELHI



@ HYDERABAD



**Students who Qualify in Prelims
can avail 100 % Fee Waiver**

ESE-2018, 2019 Prelims Qualified Students are also eligible

for more details Contact: **040-23234418/19/20**, Email: **hyderabad@aceenggacademy.com**

www.aceenggacademy.com

HYDERABAD || AHMEDABAD | DELHI | PUNE | BHUBANESWAR | LUCKNOW | KOLKATA | VIJAYAWADA | VIZAG | TIRUPATI | CHENNAI | BENGALURU

$$X(f) = 2\text{Tri}(2f)$$

Apply IFT

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

03. Ans: (a)

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

\therefore 1msec corresponds to $N = 2$

04. Ans: (c)

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

$$a = \sqrt{2}$$

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

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

05. Ans: (c)

$$\text{Sol: } \delta(t) \leftrightarrow 1$$

$$\delta(t - t_0) \leftrightarrow e^{-j2\pi f t_0} \text{ (from time shifting}$$

property)

$$\text{Given } x(t) = \delta(t + 0.5) - \delta(t - 0.5)$$

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

$$\text{sinc}(t) * \text{sinc}(t) = \text{sinc}(t)$$

$$\text{sinc}(t) * 2\text{sinc}(2t) = \text{sinc}(t)$$

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)

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

$$N_1 = 15 \quad N_2 = 5$$

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

09. Ans: (b)

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

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

Apply ILT

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

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

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

Apply ILT

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

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

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

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

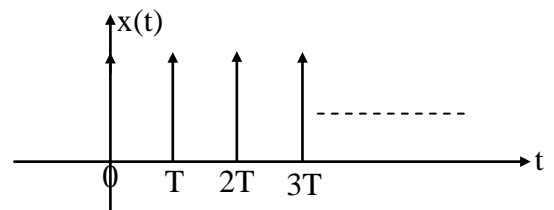
$$x(t) = x_1(t) + x_2(t-2)$$

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

10. Ans: (d)

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

$$x(t) = \delta(t) + \delta(t-T) + \delta(t-2T) + \dots$$



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)

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

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 $Y(z) = X(z) H(z)$

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

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

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 chebyshev 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, $g(n) = \{10, 4, 9, 0, 9, 4, 10\}$

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

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

By property,

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

By parseval's energy theorem

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

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

$$\begin{aligned} \int_{-\pi}^{\pi} \left| \frac{d}{d\Omega} G(e^{j\Omega}) \right|^2 d\Omega &= 2\pi[900 + 64 + 81 + 0 + 81 + 64 + 900] \\ &= 2\pi[2090] = 4180\pi \end{aligned}$$



17. Ans: (c)

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

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

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

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

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)

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

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

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

18. Ans: (c)

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

Apply z-transform

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

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

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

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

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

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

Apply inverse z-transform

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

19. Ans: (a)

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

20. Ans: (c)

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

$$y(n) = |x(n)| \text{ for all } n$$

$$x_1(n) = 1, \quad n = 0, \pm 2, \pm 4, \dots$$

$$= -1, \quad n = \pm 1, \pm 3, \dots$$

$$g(n) = x(n-m) \rightarrow |g(n)| = |x(n-m)|$$

$$y(n-m) = |x(n-m)|, \quad S_1 \text{ is Time Invariant}$$

$\alpha x(n) \rightarrow |\alpha x(n)| \neq \alpha |x(n)|$, S_1 is not linear.

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

S_1 is not LTI but S_2 is LTI

TEST YOUR PREP

IN A REAL TEST ENVIRONMENT

Pre GATE - 2020

Date of Exam : **18th January 2020**
Last Date to Apply : **31st December 2019**

Highlights:

- ◆ Get real-time experience of **GATE-20** test pattern and environment.
- ◆ Virtual calculator will be enabled.
- ◆ Post exam learning analytics and All India Rank will be provided.
- ◆ Post **GATE** guidance sessions by experts.
- ◆ Encouraging awards for **GATE-20** toppers.

PAN INDIA
PRESENCE AVAILABLE IN MORE THAN

30
CITIES

SSC-JE (Paper-I)

Online Test Series

Staff Selection Commission - Junior Engineer

No. of Tests : 20

Subject Wise Tests : 16 | Mock Tests - 4

Civil | Electrical | Mechanical

AVAILABLE NOW

All tests will be available till **SSC 2019 Examination**



21. Ans: (a)

Sol: a. Continuous time Fourier series

$$c_n = \frac{1}{T} \int_0^T x(t) e^{-jn\omega_0 t} dt \quad (3)$$

It's spectrum is Discrete and aperiodic or not periodic

b. Continuous time Fourier transform

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

It's spectrum is Continuous and aperiodic

c. Discrete time FS

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

(1)

It's spectrum is Discrete and periodic

d. DTFT

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

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

22. Ans: (b)

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

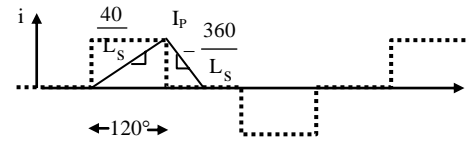
23. Ans: (b)

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:



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

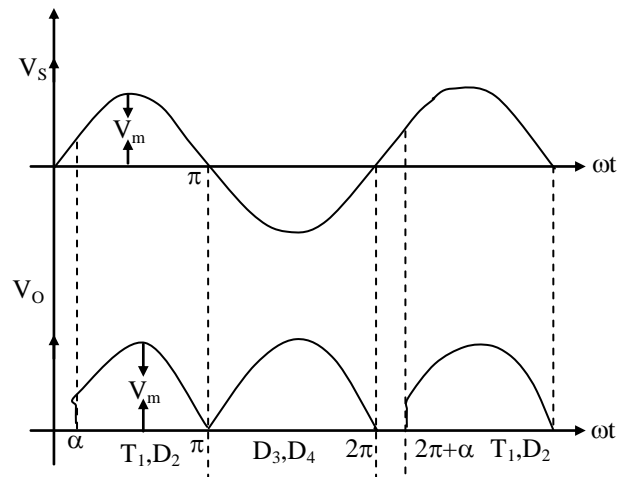
Peak value of load current $I_p = 40 \text{ A}$

25. Ans: (c)

26. Ans: (d)

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

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



$$\begin{aligned} V_0 &= \frac{1}{2\pi} \left\{ \int_0^\pi V_m \sin \omega t d\omega t - \int_\pi^{2\pi} V_m \sin \omega t d\omega t \right\} \\ &= \frac{V_m}{2\pi} (3 + \cos \alpha) \\ I_0 &= \frac{100}{2\pi \times \frac{100}{2\pi}} (3 + \cos 30^\circ) \\ &= 3.866 \text{ A} \end{aligned}$$



27. Ans: (b)

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

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

$$= 567.2 \text{ V}$$

28. Ans: (d)

Sol: Given that $V = 415 \text{ V}$, $I = 100 \text{ A}$

$$\theta_{JC} = 0.01^\circ \text{ C/W}, \theta_{CS} = 0.08^\circ \text{ C/W},$$

$$\theta_{SA} = 0.09^\circ \text{ C/W}$$

$$T_A = 35^\circ \text{ C}$$

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

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

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

$$= 0.18^\circ \text{ C/W}$$

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

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

$$T_j = 62^\circ \text{ C}$$

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 $t = 0$

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

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

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

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

$$\begin{aligned}\text{Average output voltage } V_o &= \frac{3V_{m\ell}}{2\pi} (1 + \cos \alpha) \\ &= \frac{3 \times \sqrt{2} \times 400}{2\pi} [1 + \cos 45^\circ] \\ &= 507 \text{ V}\end{aligned}$$

$$T = K I_a$$

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

$$\begin{aligned}\text{Back emf } E_b = V_o - I_a R_a \\ = 507 - 25 = 482 \text{ V}\end{aligned}$$

35. Ans: (b)

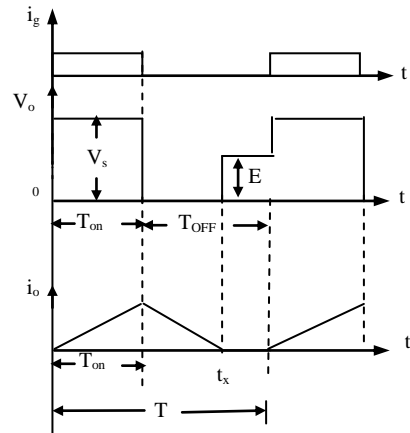
Sol: For 3-pulse converter PIV $V_{m\ell} = 1000 \text{ V}$

$$\begin{aligned}\text{For bridge 6 pulse converter PIV} &= V_{m\ell} \\ &= 1000 \text{ V}\end{aligned}$$

$$\begin{aligned}\text{For midpoint 6-pulse converter PIV} \\ &= 1.155 V_{m\ell} \\ &= 1155 \text{ V}\end{aligned}$$

36. Ans: (b)

Sol:



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

$$\begin{aligned}V_o &= \frac{1}{T} \int_0^T V_o \cdot dt \\ &= \frac{1}{T} \left[\int_0^{T_{ON}} V_s \cdot dt + \int_{T_{ON}}^{t_x} 0 \cdot dt + \int_{t_x}^T E \cdot dt \right] \\ &= V_s \frac{T_{on}}{T} + E \left(\frac{T - t_x}{T} \right) \\ V_o &= D V_s + E \left(1 - \frac{t_x}{T} \right) (\text{volts})\end{aligned}$$

37. Ans: (b)

38. Ans: (d)

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

39. Ans: (d)

HEARTY CONGRATULATIONS TO OUR **ESE - 2019** TOP RANKERS



KARTIKEYA SINGH **EE**



RAJAT SONI **E&T**



HARSHAL BHOSALE **ME**



ABUZAR GAFFARI **CE**



SHAMBHAVI **EE**



ANKUSH MANGLA **E&T**



SAHIL GOYAL **ME**



ABHISHEK ANAND **EE**



ROHIT KUMAR **E&T**



KUMAR CHANDAN **ME**



AMARJEET **CE**



ANKIT TAYAL **EE**



AMIR KHAN **E&T**



SAURAV **ME**



AMAN GULIA **CE**



KUMAR MAYANK **EE**



AYUSH CHANDRA **CE**



RITESH LALWANI **EE**



PUSHPAK **ME**



KABIL BHARGAVA **CE**



KARTIKEY SINGH **EE**



RAHUL JAIN **E&T**



MANISH RAJPUT **ME**



KULDEEP KUMAR **E&T**



HEMANT KUMAR **ME**



YOGESH KUMAR **CE**



DEEPIKA ROY **EE**



SHUBHAM KARNANI **E&T**



D SABAPARA **ME**



ANKIT KUMAR **CE**



ANKITA SHARMA **EE**



GAURAV SRIVASTAVA **E&T**



SUMIT BHAMBO **ME**

and many more...

TOTAL SELECTIONS in Top 10: 33

(**EE: 9, E&T: 8, ME: 9, CE: 7**) and many more...



DIGITAL CLASSES

for

ESE 2020/2021

General Studies &
Engineering Aptitude

GATE 2020/2021

Computer Science &
Information Technology

Access the Course at

www.deep-learn.in



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

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

47. Ans: (a)

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

$$\begin{aligned} \text{Voltage regulation} &= \frac{\left| \frac{V_s}{A} \right| - |V_r|}{|V_r|} \\ &= \frac{1}{0.866} - 1 = 15.4 \% \end{aligned}$$

48. Ans: (a)

Sol: Velocity wave propagation in per unit form,

$$v = \frac{\omega}{\sqrt{L_{pu}/\text{km} \cdot C_{pu}/\text{km}}}$$

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

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

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

$$v = \frac{\omega \cdot \ell}{\sqrt{0.02 \times 2}}$$

$$\ell = \frac{3 \times 10^5 \sqrt{0.02 \times 2}}{2\pi \times 50} = 191 \text{ km}$$



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) = 2m³/s,

Efficiency (η) = 90% and

Water head (H) = 40m

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

$$= 706.32 \text{ kW}$$

50. Ans: (d)

Sol: Cost Functions $C_1 = 0.05 P_{g1}^2 + A P_{g1} + B$

$$C_2 = 0.1 P_{g2}^2 + 3 A P_{g2} + 2 B$$

$$\lambda = 100 \text{ Rs/MWhr}$$

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

$$\lambda = IC_1 = IC_2 \text{ ----- (1)}$$

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

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

From equation 1 and 2

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

From equation 1 and 3

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

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

Solving 4, 5, 6

$$P_{g1} = 800 \text{ MW} ; P_{g2} = 200 \text{ MW}$$

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

$$= 4 : 1$$

51. Ans: (a)

Sol: Given data,

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

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

$$P_L = B_{11} P_1^2$$

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

$$P_1 + P_2 - P_L = 260$$

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

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

Assuming loss less problem

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

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

$$P_2 = 0.5 P_1 - 100 \text{ (2)}$$

Substitute (2) in (1)

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

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

$$P_1 = 1200, P_1 = 300$$

$$\therefore P_2 = 500 \text{ \& 50.}$$

The optimum distribution is $P_1 = 300 \text{ MW}$ \&

$P_2 = 50 \text{ MW.}$



52. Ans: (c)

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

53. Ans: (a)

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

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

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

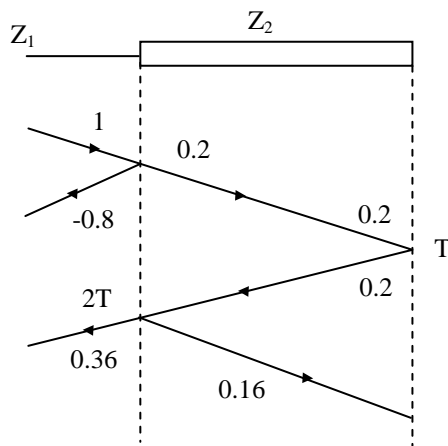
$AD-BC = 1$ (reciprocal network property)

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

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

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)

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

$$V(\text{after } 2T) = 1 - 0.8 + 0.36 = 0.56$$

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)

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

57. Ans: (b)

$$\begin{aligned} \text{Sol: } C &= 2 \pi \epsilon_0 \epsilon_r \\ &= 2 \pi \times 8.854 \times 10^{-12} \times 4 \text{ F/m} \\ &= 2.225 \times 10^{-10} \text{ F/m} \\ C &= 2.225 \times 10^{-10} \times 20K \\ &= 4.45 \mu\text{F} \end{aligned}$$

58. Ans: (c)

SSC-JE (Paper-II) MAINS 2018

OFFLINE TEST SERIES

Streams: Civil | Electrical | Mechanical

FULL LENGTH MOCK TEST-1

Exam Date: **01.12.2019**

Exam Timing: **6:00 pm to 8:00 pm**

FULL LENGTH MOCK TEST-2

Exam Date: **15.12.2019**

Exam Timing: **6:00 pm to 8:00 pm**

- ✓ All tests will be conducted in **Question Paper Booklet** format.
- ✓ Test Series will be conducted at all our centres.

Hyderabad | Delhi | Pune | Bhubaneswar | Bengaluru | Chennai | Vijayawada | Vizag | Tirupathi | Kukatpally | Kolkata | Ahmedabad

📞 040 - 48539866 / 040 - 40136222 ✉ testseries@aceenggacademy.com

ISRO ONLINE TEST SERIES

No. of Tests : 15

Subject Wise Tests : 12 | Mock Tests : 3

Indian Space Research Organisation (ISRO)
Recruitment of Scientist/Engineer 'SC'

ELECTRONICS | MECHANICAL | COMPUTER SCIENCE

✓ Starts from **5th November 2019**

All tests will be available till 12-01-2020.

📞 040 - 48539866 / 040 - 40136222 ✉ testseries@aceenggacademy.com





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)

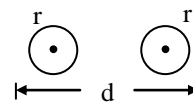
Sol: $I_2 = I_1 + I_g$
 $V \omega C_2 = V \omega C_1 + V \omega C_g$
 $C_2 = C_1 + C_g$
 $\Rightarrow C_2 = (10+1) \mu F$
 $\Rightarrow C_2 = 11 \mu F$

65. Ans: (b)

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

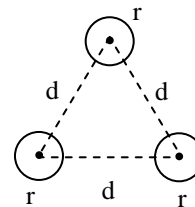
66. Ans: (c)

Sol:



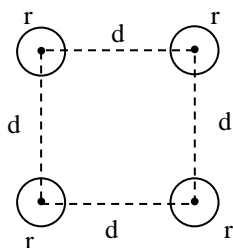
$$D_s = \sqrt[4]{(r'd)(r'd)}$$

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



$$D_s = \sqrt[3]{(r'dd)(r'dd)(r'dd)}$$

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



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

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

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.