TEST ID: 108

ACE
Engineering Academy

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

Ph: 040-23234418, 040-2324419, 040-2324420, 040-24750437

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

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

ELECTRONICS & TELECOMMUNICATION ENGINEERING

SUBJECT: SIGNALS & SYSTEMS, BASIC ELECTRICAL ENGINEERING, ADVANCED COMMUNICATION & ADVANCED ELECTRONICS - SOLUTIONS

01. Ans: (c)

Sol: It is a band-pass signal.

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

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

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

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

02. Ans: (b)

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

From duality property

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

$T = 1$

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

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

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

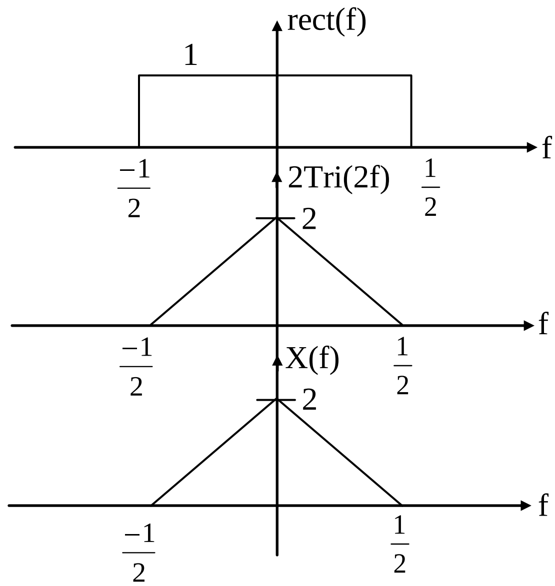
$$T = \frac{1}{2}$$

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

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

Apply Fourier Transform

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



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

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

$a=\sqrt{2}$

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

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

05. Ans: (c)

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

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

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

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

Sinc(t)*Sinc(t) = Sinc(t)

Sinc(t)*2Sinc(2t) = Sinc(t)

07. Ans: (b)

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

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

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

08. Ans: (b)

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

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

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

09. Ans: (b)

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

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

Apply ILT

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

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

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

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

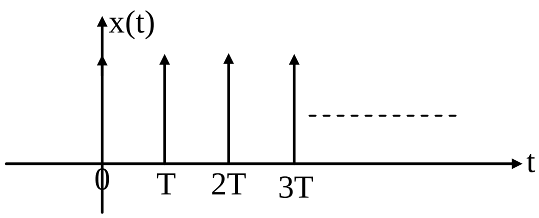
$x(t) = x_1(t) + x_2(t-2)$

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

10. Ans: (d)

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

Apply inverse z-transform

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

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

$x_1(n) = 1$, $n = 0, \pm 2, \pm 4$, …..

$= -1$, $n = \pm 1, \pm 3$, ……..

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

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

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

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

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

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: (d)

Sol: $X(z)=\ell n\left[\frac{1}{1-az^{-1}}\right]$

$$X(z)=-\ell n\left[1-az^{-1}\right]$$

$$\frac{dX(z)}{dz}=-\frac{1}{1-az^{-1}}\left[-a\left[-z^{-2}\right]\right]$$

$$\frac{dX(z)}{dz}=-\frac{az^{-2}}{1-az^{-1}}$$

$$\frac{-zdX(z)}{dz}=\frac{az^{-1}}{1-az^{-1}}$$

Apply IZT

$$(a)^n u(n) \leftrightarrow \frac{1}{1-az^{-1}}$$

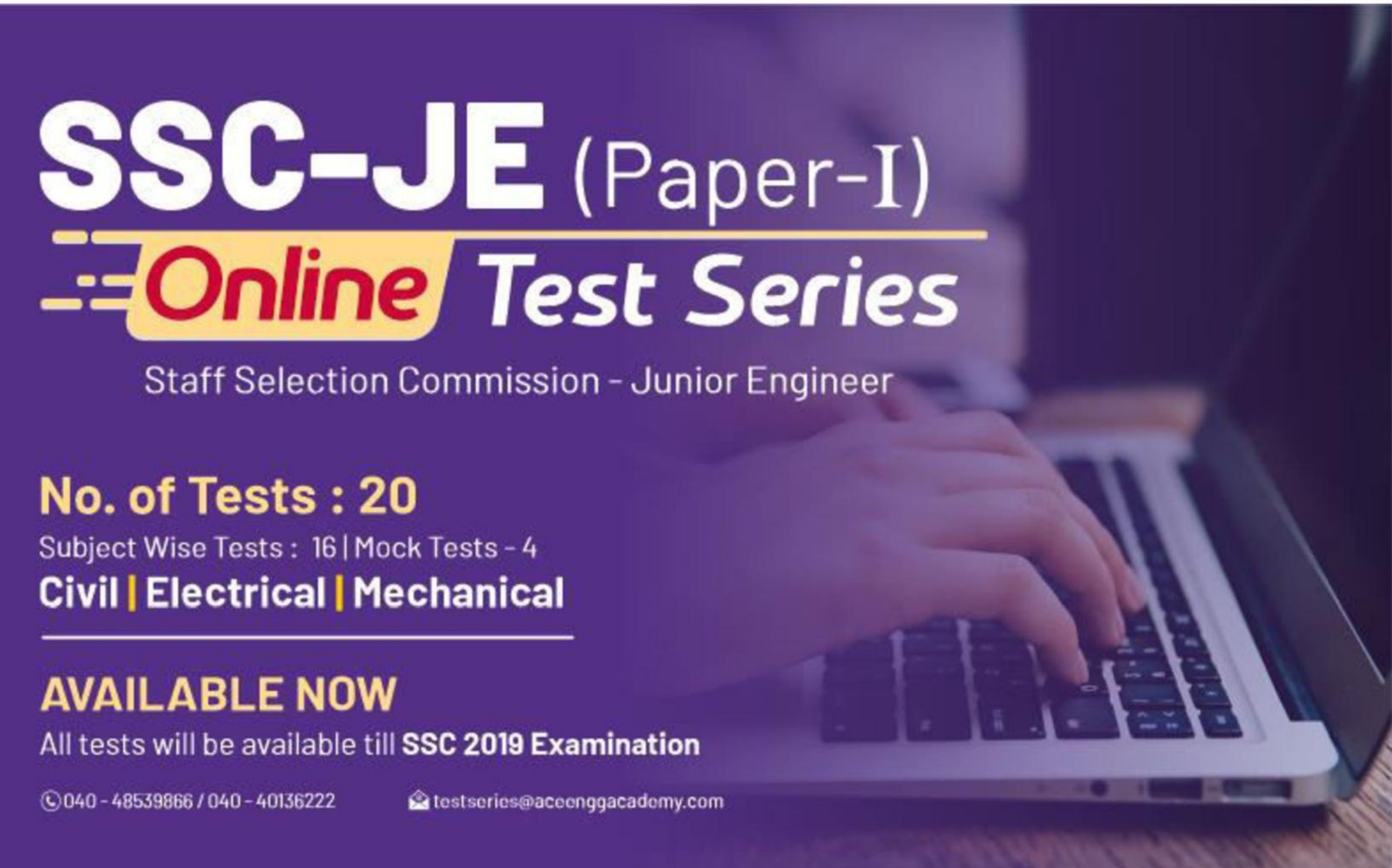
$$(a)^{n-1}u(n-1) \leftrightarrow \frac{z^{-1}}{1-az^{-1}}$$

$$nx(n) \leftrightarrow \frac{-zdX(z)}{dz}$$

So, $nx(n) = a[(a)^{n-1}\, u(n-1)]$

$$x(n)=\frac{(a)^n}{n}u(n-1)$$


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

25. Ans: (c)

Sol: From open circuit and short circuit test we can get both (W_{Cu}) Cu losses and (W_i) Iron losses.

From this we can get the efficiency of transformer.

26. Ans: (a)

Sol: $T_{st} = \frac{180}{2\pi N_s} \times \frac{E_2^2 R_2}{R_2^2 + X_2^2}$

From above equation we can observe that

$R_2 >> \frac{1}{R_2^2 + X_2^2}$

By increasing R_2, T_{st} will increase.

27. Ans: (c)

Sol: Rotor frequency = $\frac{120}{60}$ = 2 Hz

$f_r = sf$

$2 = s \times 50 \Rightarrow s = 0.04$

28. Ans: (b)

Sol: Electrolyte of lead acid battery cell is a solution of sulfuric acid and distilled water. The specific gravity of pure sulfuric acid is about 1.84.

29. Ans: (a)

Sol: N = $\frac{kE}{\phi}$

$\frac{N_2}{N_1} = \frac{E_2}{E_1} \times \frac{\phi_1}{\phi_2}$

$N_2 = \frac{950 \times 90 \times 100}{100 \times 95}$ = 900 rpm

30. Ans: (a)

Sol: Secondary winding of transformer (1) is directly connected across 200V, 50Hz. This winding carries magnetizing current of 0.2A and primary winding caries no current.

$\therefore$ I_P = 0A

31. Ans: (a)

Sol: 10 kV, 50 Hz, copper loss = 0.5 pu

$0.5 = \frac{\text{copper losses}}{\text{out put}}$

$0.5 = \frac{copperlosses}{VI}$

Copper losses = 0.5 × 10 kV × I

As load current is constant, copper losses remain constant

Now, 10 kV, 25 Hz,

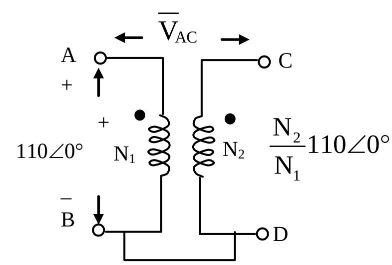
Copper loss = 0.5 × 10 kV × I

Copper loss in pu = $\frac{0.5 \times 10\text{kV} \times I}{10\,\text{kV} \times I}$ = 0.5 pu

$\therefore$ Copper loss does not depend upon frequency.

32. Ans: (d)

Sol:



$\overline{V}_{AC} = \overline{V}_{AB} - \overline{V}_{CD}$.

But a voltmeter measures only magnitude,

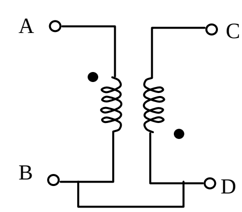
$\therefore V_{AC} = V_{AC} = 110\left(1 - \frac{N_2}{N_1}\right) = \pm 220$

Choosing negative sign,

$$\left(1 - \frac{N_2}{N_1}\right) = -2$$

$$\frac{N_2}{N_1} = 3$$

By choosing positive sign



$V_{AC} = 110\left(1 + \frac{N_2}{N_1}\right) = 220$

$$\frac{N_2}{N_1} = 1$$

33. Ans: (c)

Sol: It should be remembered that individual phase MMF is not a rotating MMF wave, its amplitude merely pulsates or alternates along its own phase axis.

34. Ans: (c)

Sol: (i) Synchronous motor is not - self starting motor. It is started by pony motor, damper bars etc.

(ii) 3 - ϕ induction motors are self starting motors.

(iii) 1 - ϕ induction motors are not self-starting. It is started by resistive split phase, capacitive split windings in stator.

35. Ans: (c)

Sol: The initial energy will be released in form of kinetic energy of particles and electromagnetic radiation for the 200 MeV per fission by a neutron in slow thermal nuclear reactor.

36. Ans: (b)

Sol: (i) The graph drawn between induced voltage [E_g] and armature current (I_a) is called as internal characteristics.

(ii) The graph drawn between terminal voltage [V] and load current (I_L) is called as external characteristics.

37. Ans: (d)

Sol: Surge tank is a reservoir fitted on the penstock near the turbine to receive the rejected water when the pipe line is suddenly closed by the governing mechanism. It helps to reduce water hammer effect in the penstock pipe line.

38. Ans: (a)

Sol: At resistive load, voltage regulation = (%R), since reactive drop (%X) is equal to zero.

Total V.R on secondary side = %R

= 3% of 200 V

i.e 6V

$\therefore$ Voltage across the load

= E_2 – drop on secondary

= 200 – 6

= 194 V

39. Ans: (a)

Sol: $$\text{Specific weight} = \frac{\text{weight of transformer}}{\text{kVA rating}}$$

If flux density is high, then required cross sectional area of core will be less. $\left(\because B \propto \frac{1}{A}\right)$

Therefore transformer weight will be decreased, the transformer should have less specific weight.

40. Ans: (d)

Sol: There must be residual magnetism in the field poles due to retentivity property. All the magnetic material posses some flux even field current is zero this is called residual magnetism. Residual flux is equal to 5% to 10% of rated flux.

41. Ans: (a)

Sol: $\rightarrow$ Direction of induced e.m.f is given by Fleming's right hand rule

$$\rightarrow \underset{(\text{wb/AT})}{\text{Permeance}} = \frac{1}{\text{Reluctance}}$$

$$\& \underset{(\text{sieman})}{\text{Conductance}} = \frac{1}{\text{Resistance}}$$

$$\rightarrow L = \frac{N^2 \mu_r \mu_0 a}{\ell} \Rightarrow L \,\alpha\, N^2$$

42. Ans: (b)

Sol: Primary resistance (R_1) = 2Ω

Secondary resistance (R_2) = 1Ω

Transformation Ratio $K = \frac{N_2}{N_1} = \frac{180}{90} = 2$

Equivalent resistance referred to primary

$$= R_1 + \frac{R_2}{K^2}$$

$$= 2 + \frac{1}{4} = 2.25\Omega$$

43. Ans: (b)

Sol: Rotor output = (1-S)P_{ag}

Rotor copper loss = s. P_{ag}

P_{ag} = air gap input power

S = slip

$$\frac{\text{Rotor output}}{\text{Rotor copper loss}} = \frac{1-S}{S}$$

$$\text{Rotor Cu losses} = \frac{S}{1-S}\text{Rotor output}$$

$$= \frac{\frac{4}{100}}{1-\frac{4}{100}} \times 15 \times 1000$$

$$= \frac{4}{96} \times 15 \times 1000$$

= 625 W

44. Ans: (d)

Sol: Lap winding ⇒ as number of parallel paths is dependent on number of poles

As poles increase ⇒ Parallel paths increases

⇓

High current (I) rating

Wave winding ⇒ as number of parallel paths is two. It is suitable for high voltage.

45. Ans: (d)

Sol: The electro static precipitator is used to remove fine, dust particles there by reduces air pollution around a thermal power station. It is placed between combustion chamber on a chimney.

46. Ans: (d)

Sol: $\text{dBm} = 10\log\frac{20\mu W}{1mW} = -17\text{dBm}$

$\text{dB}\mu = 10\log\frac{20\mu W}{1\mu W} = 13\text{dB}\mu$.

47. Ans: (b)

Sol: For NRZ transmission, the maximum data transmission rate in bps is expressed as

$$f_b = \frac{1}{2\times\Delta t\times L}$$

where Δt, pulse spreading constant is the different between the absolute delay times of the fastest and slowest rays of light propagating down a fiber of unit length L is the total fiber length.

$$f_b = \frac{1}{2\times 5\times 10\,ns} = 10\,Mbps$$

48. Ans: (d)

Sol:

→ In fiber cables coupling losses can occur at any of the following 3 types of optical junctions:
Light source-to-fiber connections, fiber-to-fiber connections and fiber-to-photodetector connections.

→ Modal dispersion is caused by the difference in the propagation times of light rays that take different paths down a fibre.

49. Ans: (c)

Sol: Circumference of geosynchronous orbit, C = 2πα where, α is the semimajor axis of a geosynchronous earth orbit which is the distance from a satellite revolving in the geosynchronous orbit to the centre.

$$\text{velocity} = \frac{2\pi\times 42164\,\text{km}}{24\text{hr}} = 11{,}033\,\text{km/hr}$$


ACE Engineering Academy
Leading Institute for ESE/GATE/PSUs
Since 1995
HEARTY CONGRATULATIONS
TO OUR ESE - 2019 TOP RANKERS
AIR 1 KARTIKEYA SINGH EE
AIR 1 RAJAT SONI E&T
AIR 1 HARSHAL BHOSALE ME
AIR 1 ABUZAR GAFFARI CE
AIR 2 SHAMBHAVI EE
AIR 2 ANKUSH MANGLA E&T
AIR 2 SAHIL GOYAL ME
AIR 3 ABHISHEK ANAND EE
AIR 3 ROHIT KUMAR E&T
AIR 3 KUMAR CHANDAN ME
AIR 3 AMARJEET CE
AIR 4 ANKIT TAYAL EE
AIR 4 AMIR KHAN E&T
AIR 4 SAURAV ME
AIR 4 AMAN GULIA CE
AIR 5 KUMAR MAYANK EE
AIR 5 AYUSH CHANDRA CE
AIR 6 RITESH LALWANI EE
AIR 6 PUSHPAK ME
AIR 6 KABIL BHARGABAVA CE
AIR 7 KARTIKEY SINGH EE
AIR 7 RAHUL JAIN E&T
AIR 7 MANISH RAJPUT ME
AIR 8 KULDEEP KUMAR E&T
AIR 8 HEMANT KUMAR ME
AIR 8 YOGESH KUMAR CE
AIR 9 DEEPITA ROY EE
AIR 9 SHUBHAM KARNANI E&T
AIR 9 D SABAPARA ME
AIR 9 ANKIT KUMAR CE
AIR 10 ANKITA SHARMA EE
AIR 10 GAURAV SRIVASTAVA E&T
AIR 10 SUMIT BHAMBOO ME
and many more...
TOTAL SELECTIONS in Top 10: 33
(EE: 9, E&T: 8, ME: 9, CE: 7) and many more...


ACE ENGINEERING ACADEMY
Since 1995
ACE
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

50. Ans: (d)

Sol: $T_b = \frac{1}{f_b} = \frac{1}{50\times10^6 \text{bps}} = 0.02\times10^{-6}\text{s}$.

(It appears that the units for T_b should be s/bit, but the per bit is implied in the definition of T_b, time of bit).

$E_b = P_t T_b = 1000\text{J/s} (0.02 \times 10^{-6}\text{s}) = 20\mu\text{J}$

(Again the unit appear to be J/bit, but the per bit is implied in the definition of E_b, energy per bit).

$E_b = 10\log (20\times 10^{-6})$

$= -47\text{dBJ}$ or -47dBW/bps.

51. Ans: (a)

Sol:

→ A typical satellite transponder consists of an input band-limiting device (BPF), an LNA, a frequency translator, a low-level power amplifier and an output BPF.

52. Ans: (d)

Sol: The number of cells in the cluster is determined as $N = i^2 + ij + j^2$.

Here, $N = 3^2 + (3)(2) + 2^2$

$N = 19$

53. Ans: (b)

Sol: Co-Channel Interference cannot be reduced by simply increasing transmitted powers because increasing the transmitted power in one cell increases the likelihood of that cell's transmissions interfering with another cell's transmission.

54. Ans: (a)

Sol:

→ Free-space path loss assumes ideal atmospheric conditions, so no electromagnetic energy is actually lost or dissipated it merely spreads out as it propagates away from the source, resulting in lower relative power densities.

→ Free-space path loss, $Lp = \left[\frac{4\pi fD}{c}\right]^2$

$\therefore L_p \,\alpha\, f^2$

55. Ans: (a)

Sol: The pre-emphasis network provides an artificial boost in amplitude to the higher baseband frequencies. This allows the lower base band frequencies to frequency modulate the IF carrier and the higher baseband frequencies to phase modulate it.

56. Ans: (a)

Sol: After consecutive five 1's need to be stuff with 0.

57. Ans: (a)

Sol: $L \geq 2 * T_p * BW$

$= 2 * 1 \times 10^{-3} \times 10^6 = 2000$ bits

58. Ans: (b)

Sol: Transmitter stuff a zero bit after every five consecutive one's

$\underbrace{\underline{01111110}}_{\text{STX}}$ 1011111$\underline{0}$011111$\underline{0}$1011111$\underline{0}$110 $\underbrace{\underline{01111110}}_{\text{ETX}}$

59. Ans: (c)

Sol: For subnet ID

Net ID → (As it is) ⇒ $\underline{150 .50.}$

SubNet ID → $\underline{1110}$

Host ID → (All zero) ⇒ 0000.0

Subnet ID ⇒ $\underline{150. 50.}$ $\underline{1110}$ $\underline{0000.0}$

Subnet ID ⇒ 150. 50. 224. 0

60. Ans: (d) **61. Ans: (c)**

62. Ans: (b)

Sol:

Host	140.38.40.2	40 = 0010 1000
SM	255.255.224.0	224=1110 0000
	140.38.32.0	32 =0010 0000

63. Ans: (c)

Sol:

- Transport layer accepts data from the session layer & passes to the network layer.
- Network layer determines how data can be delivered from source to destination
- Data link layer takes a raw transmission & transform it into a line that appears free of transmission error
- Physical layer transmits raw bits over a communication channel

64. Ans: (c)

Sol: TCP Maximum segment size(MSS) is 65515 bytes because IP MTU is 65535 bytes.

65. Ans: (a)

Sol: Since UDP is a connection less and query/response protocol, it is used for Broadcasting.

66. Ans: (d)

Sol: As the oxide layer becomes thicker, the oxidant must diffuse through the oxide layer to react at the silicon-silicon dioxide interface and the reaction rate becomes diffusion limited and the oxide growth rate becomes proportional to the square root of the oxidation time, which results in a parabolic growth rate.

$\rightarrow$ oxidation grown using dry oxygen have the best electrical properties, but considerably more time is required to grow the same oxide thickness at a given temperature in dry oxygen than in water vapour.

67. Ans: (a)

Sol: Full custom design style is opted when the circuit needs to be highly optimized in terms of power, area and timing. The optimization is done at transistor level.

68. Ans: (d)

Sol: Czochralski technique converts EGS to single crystal silicon.

Silicon float zone technique offers lower contamination from crucible compared to Czochralski method.

69. Ans: (d)

Sol: PAL $\rightarrow$ Programmable Array logic

RTL $\rightarrow$ Register Transfer level

70. 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.

71. 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.

72. Ans: (d)

Sol: The Statement (I) is wrong. All phase windings are located on the three central limbs, one limb for each phase.

But Statement (II) is correct. Yoke cross-section and hence overall height of the transformer unit do get reduced.

73. Ans: (b)

Sol: core loss depends on applied voltage and frequency and it is independent of load current. Core is laminated to minimize eddy current losses.

74. Ans: (b)

Sol: Statement (I): Armature may be the stator (as in ac machines like induction & synchronous machines or it may be the rotor (as in dc machines).

If armature is stator, poles on rotor rotate w.r.t it leading to variation of armature core flux & armature core losses.

If armature is rotor, the rotor rotates wrt the stationary stator poles and again there is a variation of armature core flux and armature core losses.

Armature cores are laminated to reduce this.
Statement I: is true. (eddy current losses are part of armature core losses)

Statement II: is obviously true for ac winding.

Dc winding: while the output is dc, whenever coil undergoes commutation, current in it reverses by the time the commutator action is complete and the coil changes the parallel path in which it is.

But **Statement (I)** does not follows form **Statement (II).**

75. Ans: (a)

Sol:

- The need for mentioning the power factor arises, because an alternator design to operate at 0.9 power factor lagging at rated load, would require more field current compared with 0.8 power factor lagging.
- More field would result in over heating of the field system, which is not desirable. If the alternator power factor given on the name plate details is not mentioned can be taken as lagging
- While stating the kVA or MVA rating of alternator, the power factor (usually from 0.8 to 0.9 lagging) for which they are design to operate under steady state conditions must be mentioned.