



GATE 2026

Electrical Engineering

Forenoon Session

**Memory Based
Questions & Solutions**

Exam held on 14-02-2026

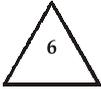
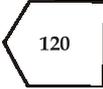
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SECTION - A

GENERAL APTITUDE

Q.1     . Find ?

Ans. (720)

No. of sides = 3

$$3! = 6$$

No. of sides = 4

$$4! = 24$$

No. of sides = 5! = 120

No. of sides = 6! = 720

End of Solution

Q.2 $P^2 = Q^2 + 13$

For positive integers P and Q , the value of $P \times Q$ is

(a) 42

(b) 72

(c) 56

(d) 44

Ans. (a)

$$[P^2 - Q^2] = 13$$

$$(P - Q)(P + Q) = 13 = 1 \times 13$$

$$P - Q = 1$$

$$P + Q = 13$$

$$P = 7$$

and

$$Q = 6$$

$$P \times Q = 42$$

End of Solution

Q.3 How many 3 digit number can be formed using 3 different single digit prime numbers?

(a) 24

(b) 28

(c) 30

(d) 32

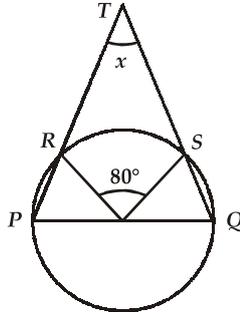
Ans. (a)

Single digit prime number's 2, 3, 5, 7

$$\text{Required number} = {}^4P_3 = 24$$

End of Solution

Q.4 Consider the following figure:



Find the value of x .

- (a) 50° (b) 60°
 (c) 80° (d) 40°

Ans. (a)

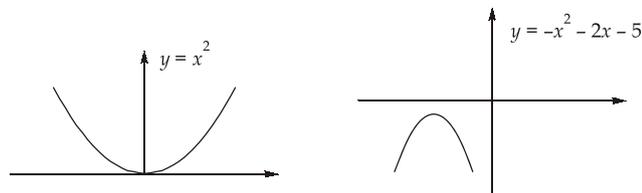
$$\frac{1}{2}(180^\circ - 80^\circ) = 50^\circ$$

End of Solution

Q.5 $y = x^2$, $y = -x^2 - 2x - 5$. Number of points of intersection.

- (a) 3 (b) 0
 (c) 1 (d) 2

Ans. (b)



No intersection points,

$$y = x^2 \quad \text{Always positive}$$

$$y = -x^2 - 2x - 5 \quad \text{Always negative}$$

End of Solution

Q.6 A shopkeeper sells lemon. Here lemon is

- (a) Subject
 (b) Object
 (c) Verb
 (d) Predicate

Ans. (b)

A shopkeeper sells lemon
 Subject Verb Object

End of Solution

Q.7 Match the following:

List-I

- A. LETHAL
- B. LITERAL
- C. LONELY
- D. LOUSY

List-II

- 1. VERBATIM
- 2. SOLITARY
- 3. TERRIBLE
- 4. DEADLY

Code:

- | | A | B | C | D |
|-----|---|---|---|---|
| (a) | 4 | 1 | 2 | 3 |
| (b) | 2 | 3 | 4 | 1 |
| (c) | 1 | 2 | 4 | 3 |
| (d) | 4 | 2 | 3 | 1 |

Ans. (a)

- | | | |
|---------|---|----------|
| LETHAL | → | DEADLY |
| LITERAL | → | VERBATIM |
| LONELY | → | SOLITARY |
| LOUSY | → | TERRIBLE |

End of Solution

■■■■



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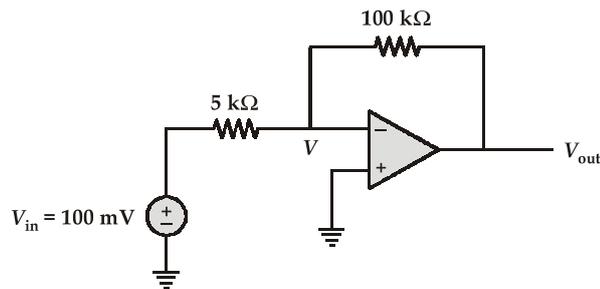


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SECTION - B

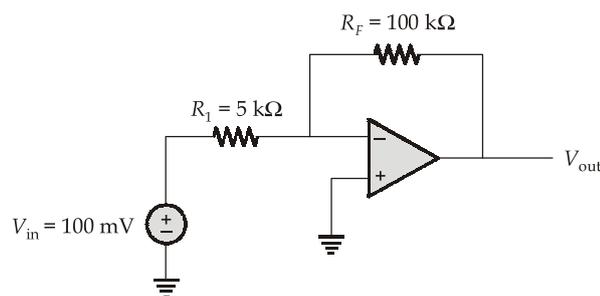
TECHNICAL

Q.8 Consider the op-amp shown in figure below:



The open loop gain, $A_{OL} = 105$, then the output, V_0 is
 (Take $R_{in} = \infty \Omega$, $R_0 = 0 \Omega$)

Ans. (-1.66)



Given,

$$A_{OL} = 105$$

$$V_0 = A_{CL} V_{in}$$

where,

$$A_{CL} = \frac{-R_F}{R_1} \left[\frac{1}{1 + \frac{1}{A_{OL}} \left(1 + \frac{R_F}{R_1} \right)} \right]$$

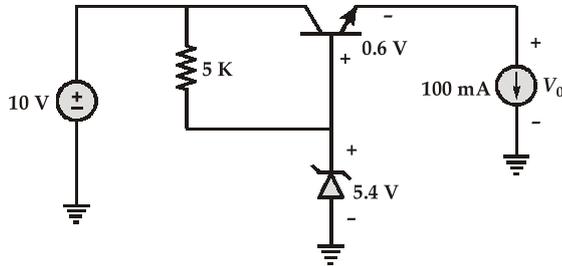
$$= \frac{-100k}{5k} \left[\frac{1}{1 + \frac{1}{105} \left(1 + \frac{100k}{5k} \right)} \right] = \frac{-20}{1 + \frac{1}{105} (21)}$$

$$= \frac{-20}{1 + 0.2} = \frac{-20}{1.2} = -16.66$$

$$V_0 = -16.66 \times 100 \text{ mV} = -1.66 \text{ V}$$

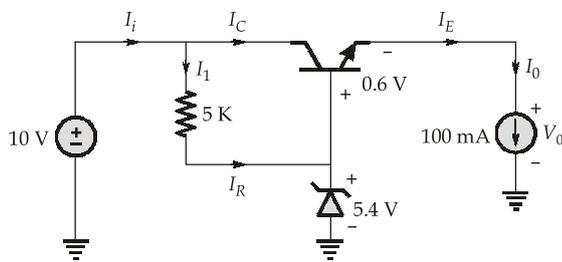
End of Solution

Q.9 Consider the following circuit:



Given: $V_0 = 6\text{ V}$ then Maximum efficiency of Rectifier circuit is _____ %.

Ans. (47.5)



$$\eta = \frac{P_{\text{out}}}{P_{\text{in}}}$$

$$P_{\text{out}} = V_0 \times I_0$$

$$= (V_Z - V_{BE}) \times I_0$$

$$= (5.4 - 0.6) \times 100\text{ mA}$$

$$= 4.8 \times 100\text{ mA} = 480\text{ mW}$$

$$I_1 = \frac{10 - 5.4}{5\text{ k}} = 0.92\text{ mA}$$

$$I_i = I_C + I_1 = 100\text{ mA} + 0.92\text{ mA}$$

$$= 100.92\text{ mA}$$

$$P_{\text{in}} = V_{\text{in}} \times I_i = 10 \times 100.92\text{ mA} = 1009.2\text{ mW}$$

$$\eta = \frac{480}{1009.2} \times 100\% = 47.5\%$$

End of Solution

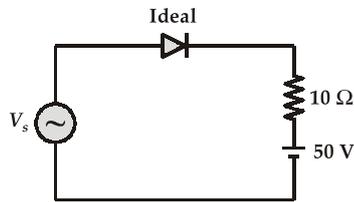
Q.10 Which of the following statements is correct for single stage MOSFET Amplifier?

- (a) CS and CG amplifier are inverting amplifier.
- (b) CS is inverting and CG is non-inverting.
- (c) CS is non-inverting and CG is inverting.
- (d) CS and CG are non-inverting amplifier.

Ans. (b)

End of Solution

Q.11 Consider the following circuit:



$V_s = 100 \sin(2\pi \times 50t)$ volt, then the value of I_{avg} _____ A.

Ans. (1.08)

$V_s > 50$:

$$i = \frac{V_s - 50}{10} = 10 \sin \alpha - 5$$

$$I_{avg} = \frac{1}{2\pi} \int_{\pi/6}^{5\pi/6} i \cdot d\alpha$$

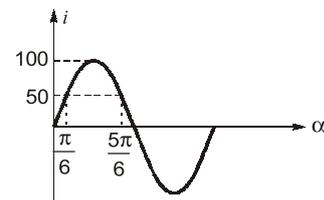
$$= \frac{1}{2\pi} \int_{\pi/6}^{5\pi/6} (10 \sin \alpha - 5) d\alpha$$

$$= \frac{1}{2\pi} [-10 \cos \alpha - 5\alpha]_{\pi/6}^{5\pi/6}$$

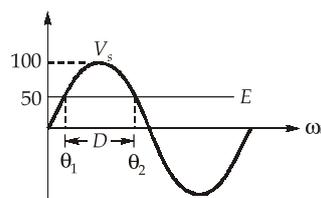
$$= \frac{-1}{2\pi} \left\{ \left[10 \cos \frac{5\pi}{6} - 10 \cos \frac{\pi}{6} \right] + \left[\frac{20\pi}{6} \right] \right\}$$

$$= \frac{-1}{2\pi} \left\{ -10\sqrt{3} + \frac{10\pi}{3} \right\}$$

$$= \frac{1}{2\pi} [10\sqrt{3} - 10.47] = 1.08 \text{ A}$$



Alternate Solution:



$$\theta_1 = \sin^{-1} \frac{E}{V_m} = \sin^{-1} \frac{50}{100} = \frac{\pi}{6}$$

$$\theta_2 = \pi - \frac{\pi}{6} = \frac{5\pi}{6}$$

$$I_D = I_0 = \frac{1}{2\pi} \cdot \int_{\theta_1}^{\theta_2} \left(\frac{V_m \sin \omega t - E}{R} \right) d(\omega t)$$

$$= \frac{1}{2\pi R} \cdot [V_m (\cos \theta_1 - \cos \theta_2) - E(\theta_2 - \theta_1)]$$

$$= \frac{1}{2\pi \cdot 10} \left[100(\cos 30^\circ - \cos 150^\circ) - 50 \left(\frac{5\pi}{6} - \frac{\pi}{6} \right) \right] = 1.08 \text{ A}$$

End of Solution

Q.12 A system whose step response, $y(s) = \frac{100}{s(s+100)}$.

Then, which of the following statement(s) is/are correct?

- (a) The delay time of the system is ($t_d = ?$)
- (b) The rise time of the system is ($t_r = ?$)
- (c) The time constant of the system is ($\tau = ?$)
- (d) ($t_s = ?$)

Ans. (0.7) (2.2), (1), (4)

$$\text{Transfer function} = \frac{100}{s^2 + 100s + 100}$$

$$s = -1, 100$$

$$s = -1 \text{ (dominant root)}$$

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

$$2\xi\omega_n = 100$$

$$\Rightarrow \xi = 5$$

Overdamped system since overdamped system are practically first order system

For 1st order system,

$$\text{Rise time, } t_r = 2.2 T = 2.2 \text{ sec}$$

$$\text{Settling time, } t_s = 4 T = 4 \text{ sec}$$

$$\text{Delay time, } t_d = 0.7 T = 0.7 \text{ sec}$$

End of Solution

Q.13 $\dot{x} = \begin{bmatrix} a & b \\ -a & 0 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$; $y = [1 \quad 2]x$; Pole: $-2 + j3, -2 - j3$.

Find a and b .

- (a) $a = -4, b = -3.25$ (b)
- (c) (d)

Ans. (a)

$$q(s) = |sI - A| = 0$$

$$q(s) = s^2 - as + ab = 0$$

$$q(s) = s^2 + 4s + 13 = 0$$

$$a = -4,$$

$$b = \frac{-13}{4} = -3.25$$

End of Solution



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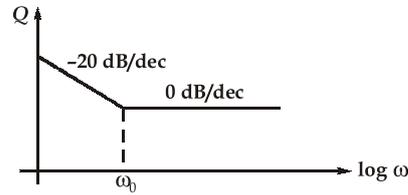
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Q.14 Find transfer function of system.



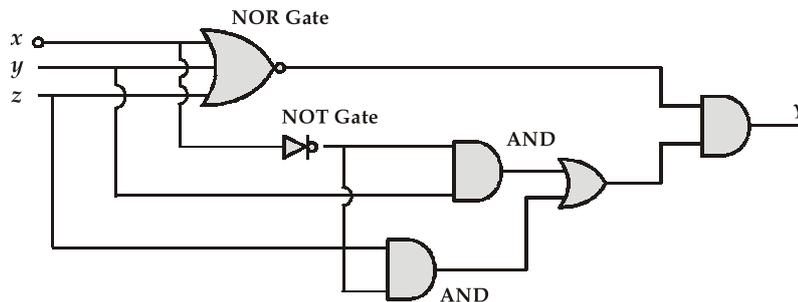
- (a) $GH = \frac{K \left(\frac{s}{\omega_0} + 1 \right)}{s}$ (b)
 (c) (d)

Ans. (a)

$$GH = \frac{K \left(\frac{s}{\omega_0} + 1 \right)}{s}$$

End of Solution

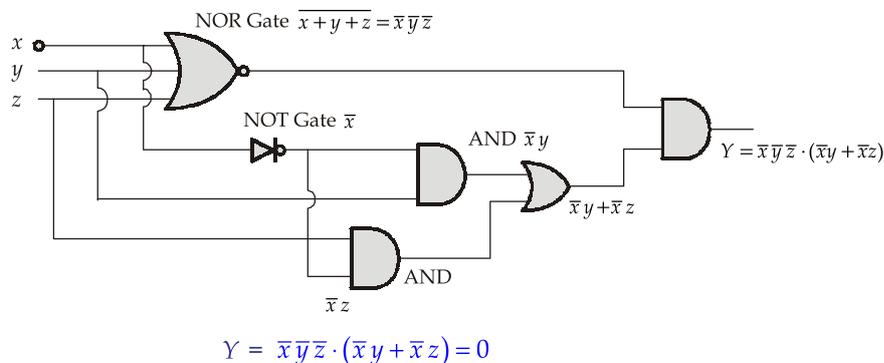
Q.15. Consider the following circuit:



The output Y is

- (a) 0 (b)
 (c) (d)

Ans. (a)



End of Solution

$$I_{\text{RMS}} = \sqrt{\frac{12^2}{2} + \frac{9^2}{2}}$$

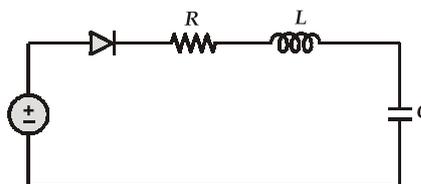
$$= \sqrt{\frac{144 + 81}{2}} = \frac{15}{\sqrt{2}}$$

$$P = VI \cos \phi = \frac{325 \times 12}{2} \times 1$$

$$\cos \theta = \frac{P}{S} = \frac{\frac{325 \times 12}{2}}{\frac{325 \times 15}{2}} = \frac{12}{15} = 0.8$$

End of Solution

Q.18 In the given network which are linear elements?

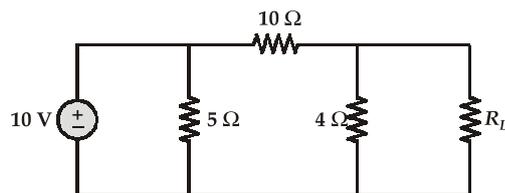


- (a) Diode
 (b) R
 (c) L and C
 (d) R, L and C only

Ans. (d)

End of Solution

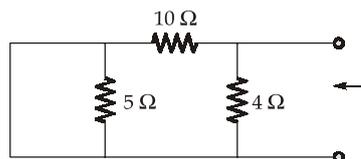
Q.19 Consider the circuit shown in figure below,



Find R_L for maximum power from source to load.

Ans. (2.85)

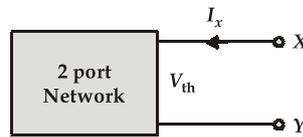
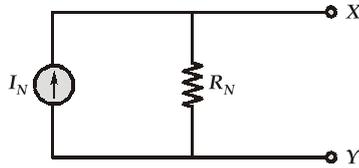
R_{th} :



$$R_{\text{th}} = \frac{10 \times 4}{10 + 4} = \frac{40}{14} = 2.857 \Omega$$

End of Solution

Q.20 Consider the following circuit:



V_x	I_x
30	0.5
36	1

I_N and R_N are respectively

- (a) $I_N = 2 \text{ A}$ and $R_N = 12 \ \Omega$ (b)
 (c) (d)

Ans. (a)

$$0.5 = \frac{30 - V_{th}}{R_{th}}$$

$$0.5R_{th} = 30 - V_{th}$$

$$0.5(36 - V_{th}) = 30 - V_{th}$$

$$18 - 0.5V_{th} = 30 - 18$$

$$V_{th} = \frac{12}{0.5} = 24$$

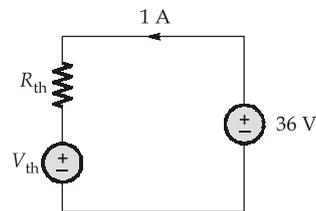
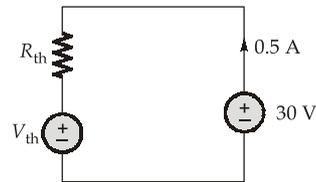
$$\frac{36 - V_{th}}{R_{th}} = 1$$

$$36 - V_{th} = R_{th}$$

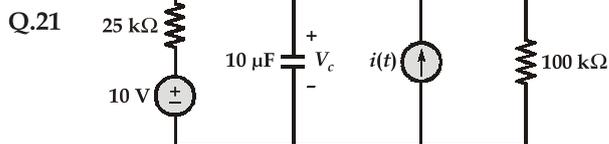
$$36 - 24 = R_{th}$$

$$R_{th} = 12 \ \Omega$$

$$I_N = \frac{24}{12} = 2 \text{ A}$$



End of Solution

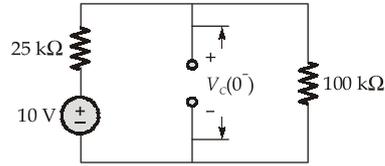


If $i(t) = 1 u(t) \text{ mA}$. Then,

V_c at $t = 0^+$ is V_c at $t = 0.5 \text{ sec}$ is

V_c at $t = \infty$ is

Ans. (8 V, 26.36 V, 28 V)

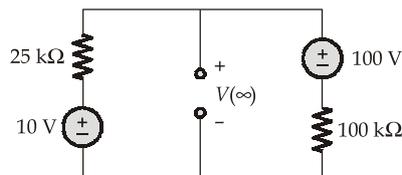
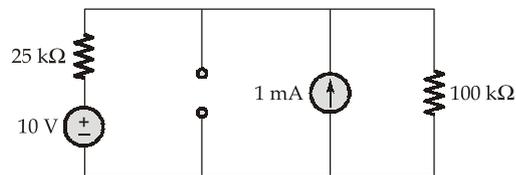


$$V_C(0^-) = 10 \times \frac{100}{100 + 25} = 10 \times \frac{4}{5} = 8 \text{ V}$$

$t = 0^+$

$$V_C(0^+) = 8 \text{ V}$$

$t = \infty$

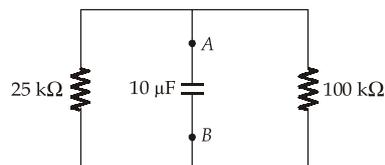


$$\frac{V(\infty) - 10}{25 \times 10^3} + \frac{V_C(\infty) - 100}{100 \times 10^3} = 0$$

$$\frac{4V(\infty) - 40 + V_C(\infty) - 100}{100 \times 10^3} = 0$$

$$\Rightarrow V(\infty) = \frac{140}{5} = 28$$

Time constant



$$R = \frac{100 \times 25}{125} = 20 \text{ k}\Omega$$

$$\tau = RC = 20 \times 10^3 \times 10 \times 10^{-6} = 200 \text{ ms}$$

$$V_C(t) = \left[(V_C(0^+) - V_C(\infty)) e^{-t/RC} + V_C(\infty) \right]$$

$$= [8 - 28] e^{-5t} + 28$$

$t = 0.5$

$$V_C(0.5) = (8 - 28) e^{-5(0.5)} + 28 = 26.36 \text{ V}$$

End of Solution



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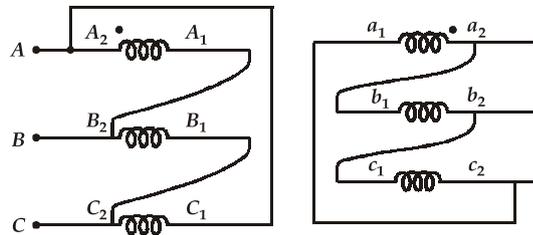
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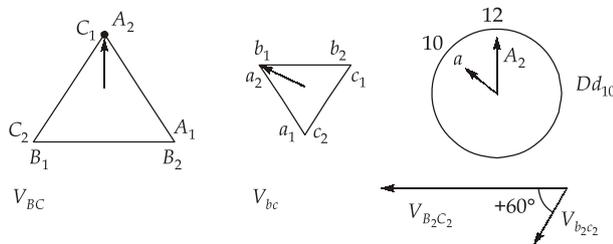
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Q.22 Three single-phase transformers are connected as three-phase transformer as shown. What is the phasor group?



- (a) Dd_6 (b) Dd_0
 (c) Dd_4 (d) Dd_{10}

Ans. (d)

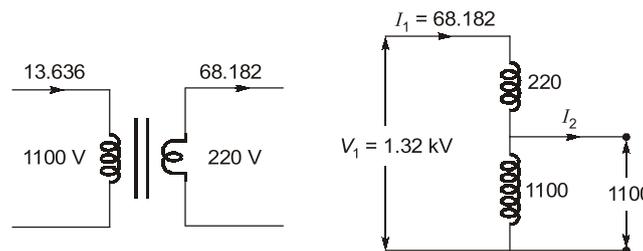


End of Solution

Q.23 Single phase two winding transformer of rating 15 kVA, 1100/220 V. When it is connected as auto transformer of rating 1.32/1.1 kV, find KVA rating of the auto transformer.

- (a) 90 KVA (b) 60 KVA
 (c) 50 KVA (d) 100 KVA

Ans. (a)



KVA Rating: $V_1 I_1$
 $1320 \times 68.182 = 90 \text{ KVA}$

End of Solution

Q.24 Which one of the following is correct for a double cage induction motor?

- (a) At starting a larger portion of current flows in the outer cage.
- (b) The purpose is to reduce the effective resistance at start.
- (c) At rated speed, rotor current flows in outer cage.
- (d) At starting, more current in inner cage.

Ans. (a)

End of Solution

Q.25 A 30 kW, 4 pole, 400 V, 50 Hz wound rotor induction motor with Y connected rotor windings. Motor is driving constant torque load with shorted slip rings under running condition motor runs at 1476 rpm. With an external resistance of 0.27 Ω/ph in the rotor, speed drops to 1404 rpm. Neglect rotational loss, what is actual rotor resistance per phase?

Ans. (0.09)

$$P = 4; f = 50; N_s = \frac{120f}{P} = \frac{120 \times 50}{4} = 1500 \text{ rpm}$$

$$N_1 = 1476; \quad N_2 = 1404$$

$$N_s = 1500; \quad N_s = 1500$$

$$S_1 = \frac{N_s - N_1}{N_s} = \frac{1500 - 1476}{1500} = 0.016$$

$$S_2 = \frac{N_s - N_2}{N_s} = \frac{1500 - 1404}{1500} = 0.064$$

$$T \propto \frac{S}{R_2}$$

Given constant torque

$$\therefore S \propto R_2$$

$$\frac{S_2}{S_1} = \frac{R_2 + R_{ext}}{R_2}$$

$$= \frac{0.064}{0.016} = \frac{R_2 + 0.27}{R_2}$$

$$\therefore R_2 = 0.09 \text{ } \Omega/\text{ph}$$

End of Solution

Q.26 A 220 V/12 V, 1-ph transformer is designed for 100 VA, 50 Hz. If it is used at 110 V/6 V at 60 Hz. What is the correct statement?

- (a) No load current will be small.
- (b) For same load current, losses will be higher.
- (c) Eddy current loss in core is approximately 44% higher.
- (d) Magnetic flux density will be high.

Ans. (a)

$$I_0 = I_c + I_m$$

$$I_c \propto \text{Iron loss}$$

$$I_m \propto B_m \propto \frac{V \downarrow}{f \uparrow} \Rightarrow B_m \downarrow$$

As iron loss reduce $I_c \downarrow$

End of Solution

Q.27 A ring having charge Q uniformly distributed over it having radius R and q point charge is at centre of this ring then the force exerted on q by Q is

- (a) 0 (b) $Qq/4\pi R^2$
(c) $qQ/(4\pi R \times 2\pi R)$ (d) _____

Ans. (a)

End of Solution

Q.28 The value of $I = \oint \frac{(z+1)^2}{(z-1)(z-2)} \cdot |z-2-i| = \frac{3}{2}$ is

- (a) $10\pi i$ (b) _____
(c) _____ (d) _____

Ans. (a)

Singularities are given by $(z-1)(z-2) = 0$
 $\Rightarrow z = 1, 2$

Put, $z = 1$ in $c : |1 - 2 - i| = |-1 - i| = \sqrt{2} < \frac{3}{2} = \text{rad}$

$\therefore z = 1$ lies inside 'c'

Put, $z = 2$ in $c : |2 - 2 - i| = |-i| = 1 < \frac{3}{2} = \text{rad}$

$z = 2$ lies inside 'c'

Both poles are of simple poles.

$$\text{Res}(f(z), z=1) = \lim_{z \rightarrow 1} (z-1) \frac{(z+1)^2}{(z-1)(z-2)} = \frac{4}{-1} = -4$$

$$\text{Res}(f(z), z=2) = \lim_{z \rightarrow 2} (z-2) \frac{(z+1)^2}{(z-1)(z-2)} = \frac{9}{1} = 9$$

By CRT,

$$\oint_c f(z) dz = 2\pi i [\text{Res}_1 - \text{Res}_2]$$

$$= 2\pi i [-4 + 9]$$

$$= 10\pi i$$

End of Solution

Q.29 A, B matrix common eigen value 2, then which of the following is correct?

- (a) $|A - 2I| = 0$ (b) $|A + B - 4I| = 0$
(c) $|A + B - 2I| = 0$ (d) $|B - 2I| = 0$

Ans. (a, b, d)

Given, $\lambda_A = 2, \lambda_B = 2$

Then $|A - 2I| = 0$ by characteristic equation

and $|B - 2I| = 0$ by characteristic equation

$$\begin{aligned} \lambda \text{ of } A + B - 4I &= \lambda_A + \lambda_B - 4 \\ &= 2 + 2 - 4 = 0 \end{aligned}$$

$$\Rightarrow |A + B - 4I| = 0$$

End of Solution

Q.30 The value of $I = \frac{1}{\pi} \int_0^{\infty} \frac{x^{2026}}{(1+x^{2026})(1+x^2)} \cdot dx$

Ans. (0.25)

Put, $x = \frac{1}{x}$

$$dx = -\frac{1}{x^2} dx$$

$$\begin{aligned} I &= \frac{1}{\pi} \int_0^{\infty} \frac{\frac{1}{x^{2026}}}{\left(1 + \frac{1}{x^{2026}}\right) \left(1 + \frac{1}{x^2}\right)} \cdot \frac{1}{x^2} dx \\ &= \frac{1}{\pi} \int_0^{\infty} \frac{1}{(1+x^{2026})(1+x^2)} dx \end{aligned}$$

$$\therefore I + I = \frac{1}{\pi} \int_0^{\infty} \frac{(x^{2026} + 1)}{(1+x^{2026})(1+x^2)} dx$$

$$2I = \frac{1}{\pi} \int_0^{\infty} \frac{1}{1+x^2} dx$$

$$I = \frac{1}{\pi} \frac{1}{2} \left(\frac{\pi}{2} \right) = \frac{\pi}{4} \times \frac{1}{\pi} = \frac{1}{4}$$

End of Solution

Q.31 $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = 0.$

Linear or non-linear differential equation.

Ans.

$$x^2 y'' + x' + y = 0$$

it is Euler - Cauchy D.E and homogeneous which is a linear D.E with variable coefficients.

End of Solution

Q.32 A skew symmetric $m \times n$, $X = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}^T$ $X^T A X = \underline{\hspace{2cm}}$.

Ans. (0)

$$\begin{bmatrix} x_1 & x_2 & x_3 \end{bmatrix} \begin{bmatrix} 0 & a & b \\ -a & 0 & c \\ -b & -c & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = 0$$

End of Solution

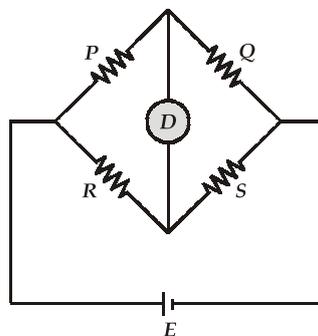
Q.33 $E(x) = 1, E(x) = 2, E(x^2) = 4, E(y^2) = 9, E(xy) = 0.9$
 Find the value of α which minimize $E(x - \alpha y)^2 = ?$

Ans. (0.1)

$$\begin{aligned} E(x - \alpha y)^2 &= E(x^2 + \alpha^2 y^2 - 2\alpha xy) \\ &= E(x^2) + \alpha^2 E(y^2) - 2\alpha E(xy) \\ &= 4 + \alpha^2 (9) - 2\alpha (0.9) \\ &= 9\alpha^2 - 1.8\alpha + 4 \text{ to be minimize is minimum at its stationary pt} \\ \alpha &= \frac{1.8}{2(9)} = \frac{1}{10} \end{aligned}$$

End of Solution

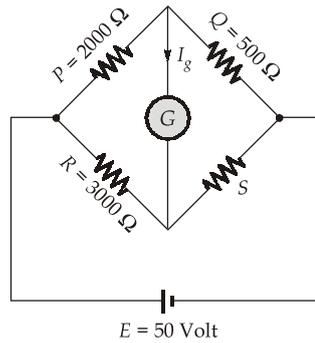
Q.34 Consider the Wheat stone bridge as given the figure shown below:



If the value of elements $P = 2000 \Omega, Q = 500 \Omega, R = 3000 \Omega$ and (Battery voltage)

$E = 50 \text{ V}$ with internal resistance 1Ω .
 (Take Internal Galvanometer Resistance = 50Ω)
 The value of resistance for balanced condition is _____ Ω .

Ans. (750)
 Balanced condition



$$\frac{P}{Q} = \frac{R}{S}$$

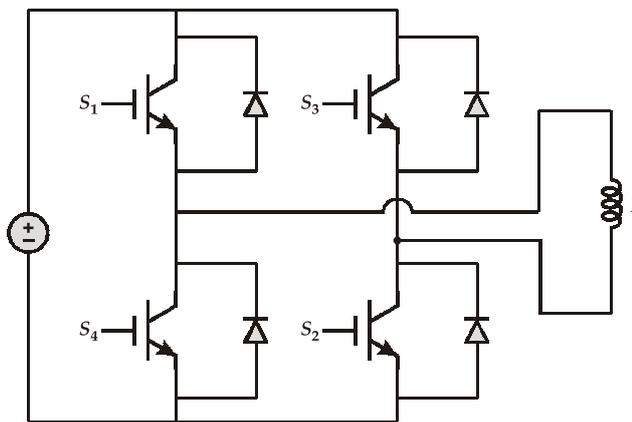
$$\Rightarrow P.S = R.Q$$

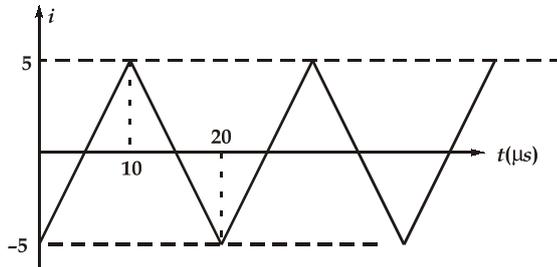
$$S = \frac{3000 \times 500}{2000}$$

$$S = 750 \Omega$$

End of Solution

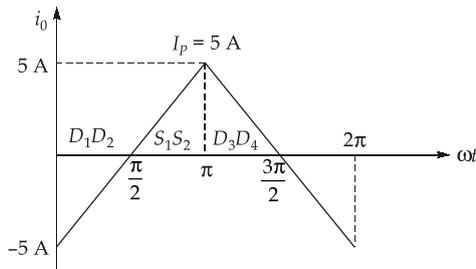
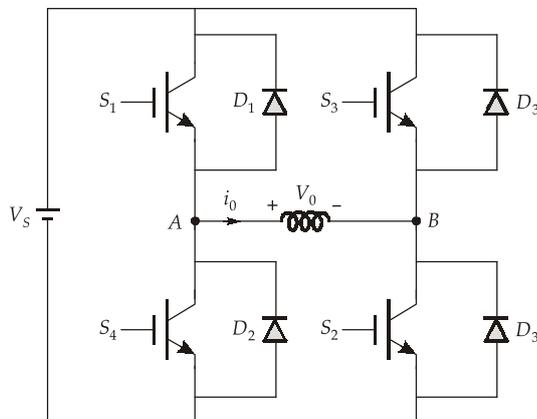
Q.35





$I_{\text{rms}}(S_1) = ?$; if the load is pure inductive.

Ans. (2.04)



$$I_{0 \text{ rms}} = \frac{I_p}{\sqrt{3}} = \frac{5}{\sqrt{3}}$$

I_{rms} (module) switch, diode

$$= I_{0 \text{ rms}} \left(\frac{\pi}{2\pi} \right)^{1/2} = \frac{5}{\sqrt{3}} \cdot \frac{1}{\sqrt{2}} = \frac{5}{\sqrt{6}} = 2.04 \text{ A}$$

End of Solution



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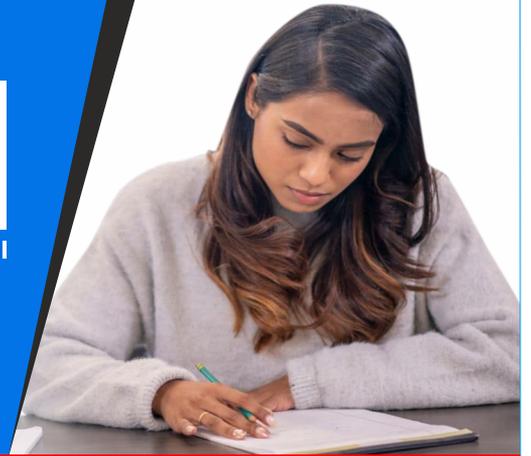


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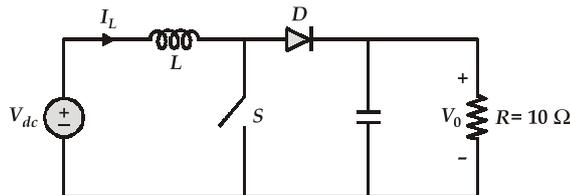
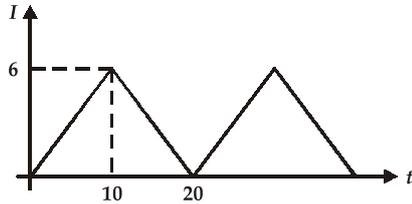
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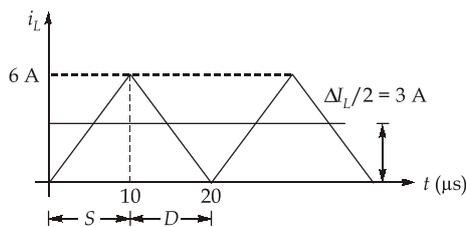
Q.36



$R = 10 \Omega$, $C = 500 \mu\text{F}$

$V_{dc} = ?$

Ans. (7.5)



$$\alpha = D = \frac{10}{20} = \frac{1}{2}$$

$i_L \rightarrow$ At the boundary

$$I_L = \frac{\Delta I_L}{2} [\text{at the boundary}] = \frac{6}{2} = 3 \text{ A}$$

$$I_L = \frac{I_0}{1 - \alpha}$$

$$I_0 = I_L(1 - \alpha) = 3(1 - 0.5) = 1.5 \text{ A}$$

$$V_0 = I_0 R = 1.5 \times 10 = 15 \text{ V}$$

$$V_0 = \frac{V_s}{1 - \alpha}$$

$$\therefore V_s = V_0(1 - \alpha) = 15(1 - 0.5)$$

$$V_{dc} = V_s = \frac{15}{2} = 7.5 \text{ V}$$

End of Solution

- Q.37 $V(t) = 325 \sin(100\pi t)$
 $i(t) = 12 \sin(100\pi t) + 9 \sin(300\pi t)$, pf = ?
 (a) 1 (b) 0
 (c) 0.8 (d) 0.5

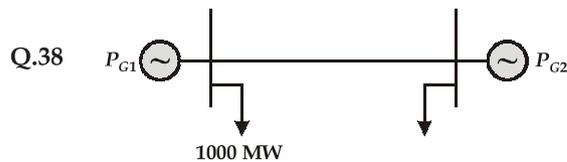
Ans. (c)

$$V = 325 \sin(100\pi t)$$

$$i(t) = 12 \sin(100\pi t) + 9 \sin(300\pi t)$$

$$PF = \frac{P}{S} = \frac{P_1}{V_{rms} \cdot I_{rms}} = \frac{\frac{325}{\sqrt{2}} \cdot \frac{12}{\sqrt{2}} \cdot \cos(0^\circ)}{\frac{325}{\sqrt{2}} \cdot \sqrt{\left(\frac{12}{\sqrt{2}}\right)^2 + \left(\frac{9}{\sqrt{2}}\right)^2}} = 0.8$$

End of Solution



$$C_1 = 0.01P_{g1}^2 + 50P_{g1} + 1000R_s/\text{hr}$$

$$C_2 = 0.001P_{g2}^2 + 50P_{g2} + 2000R_s/\text{hr}$$

$$P_L = 0.001(P_{g1} - 50)^2$$

Find P_L .

Ans. (14.4)

$$\frac{\partial C_1}{\partial P_{g1}} = 0.02P_{g1} + 50$$

$$\frac{\partial P_L}{\partial P_{g1}} = 0.002(P_{g1} - 50)$$

$$L_1 = \frac{1}{1 - \frac{\partial P_L}{\partial P_1}}$$

$$\lambda = L_1(IC) = \frac{1(0.02P_{g1} + 50)}{-0.002(P_{g1} - 50)} = 70.25$$

$$P_{g1} = 170 \text{ MW}$$

$$P_L = 0.001(170 - 50)^2$$

$$= 14.4 \text{ MW}$$

End of Solution

Q.39 A system is consisting of n no. of buses. The no. of G.B are P and L.B are Q . Find the size of the Jacobian.

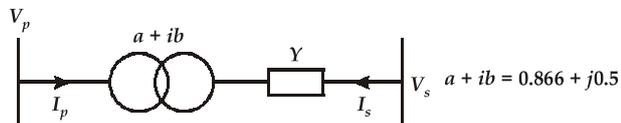
- (a) $(2n - P) \times (2n - P)$ (b)
 (c) (d)

Ans. (a)

$$\begin{aligned} \text{Size of Jacobian} &= (2n - m - 1) \times (2n - m - 1) \\ 2n - m &= 2n - P \\ &= (2n - P) \times (2n - P) \end{aligned}$$

End of Solution

Q.40 Consider the following circuit:



Find the Y_{BUS} .

- (a) $\begin{bmatrix} \frac{Y}{a^2 + b^2} & \frac{-Y}{a - jb} \\ \frac{-Y}{a + jb} & Y \end{bmatrix}$ (b)
 (c)

Ans. (a)

$$\begin{bmatrix} I_p \\ I_s \end{bmatrix} = [Y] \begin{bmatrix} V_p \\ V_s \end{bmatrix}$$

$$Y_{\text{Bus}} = \begin{bmatrix} \frac{Y}{a^2 + b^2} & \frac{-Y}{a - jb} \\ \frac{-Y}{a + jb} & Y \end{bmatrix}$$

End of Solution

Q.41 If magnitude of all phases remain same and all phases angles are incremented by small. The what is the effect on zero sequence component.

- (a) Magnitude remains same phase changes.
 (b) Both magnitude and phase changes.
 (c) Magnitude changes and phase same.
 (d) Magnitude and phase does not changes.

Ans. (d)

End of Solution



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Q.42 A signal $x(n)$ is given as $x(n) = (0.9)^{|n|}$. The region of convergence of signal is

- (a) $|z| > 0.9$ (b) $|z| < \frac{1}{0.9}$
(c) $0.9 < |z| < \frac{1}{0.9}$ (d) none of these

Ans. (c)

$$\begin{aligned} x(n) &= (0.9)^{|n|} \\ &= \begin{cases} (0.9)^{-n}, & n \leq -1 \\ (0.9)^n, & n \geq 0 \end{cases} \\ &= \underbrace{\left(\frac{1}{0.9}\right)^n}_{|z| < \frac{1}{0.9}} u(-n-1) + \underbrace{(0.9)^n}_{|z| > 0.9} u(n) \end{aligned}$$

$$\text{ROC: } 0.9 < |z| < \frac{1}{0.9}$$

End of Solution

Q.43 A continuous time signal $x(t)$ with time period T is sampled with sampling period T_s . If $x(n)$ is the output of sampler then

- (a) $x(n)$ is always periodic.
(b) $x(n)$ will be periodic for $\frac{T}{T_s}$ is rational number.
(c) $x(n)$ will be periodic with all values of $\frac{T}{T_s}$.
(d) $x(n)$ will never be periodic.

Ans. (b)

$$\begin{aligned} x_c(t) &= \sin \omega_0 t, \quad \text{FTP: } T \\ \text{Sampling } t &= nT_s \\ x(n) &= \sin \omega_0 nT_s = \sin(\omega_0 T_s)n = \sin \omega'_0 n \end{aligned}$$

For periodicity of $x(n)$,

$$\begin{aligned} \frac{2\pi}{\omega'_0} &= \text{rational number} \\ \Rightarrow \frac{2\pi}{\omega_0 T_s} &= \text{rational number} \\ \Rightarrow \frac{2\pi}{\frac{2\pi}{T} \cdot T_s} &= \text{rational number} \\ \Rightarrow \frac{T}{T_s} &= \text{rational number.} \end{aligned}$$

End of Solution

Q.44 Consider the differential equation of a system shown below:

$$t^2 y''(t) + 7t \cdot y'(t) + y(t) = \sin t$$

The system is

- (a) Linear, Time-variant (b) Linear, time-invariant
(c) Non-linear, time-variant (d) Non-linear, time-invariant

Ans. (a)

$$t^2 y''(t) + 7t \cdot y'(t) + y(t) = \sin t$$

→ System is linear because it is following superposition law.

→ System is time-variant because coefficient is function of time.

End of Solution

■■■■

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