



**GATE  
2025**

# **Electrical Engineering**

**Memory based  
Questions & Solutions**

**Exam held on  
02/02/2025 (Afternoon Session)**



### SECTION - A

### GENERAL APTITUDE

Q.1 The value of  $\left(\frac{3^{81}}{27^4}\right)^{1/3}$

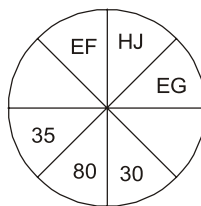
- (a)  $3^{40}$  (b)  $3^{23}$   
(c)  $3^{69}$  (d)  $3^{46}$

Ans. (b)

$$\begin{aligned}\left(\frac{3^{81}}{27^4}\right)^{1/3} &= \left(\frac{3^{81}}{(3^3)^4}\right)^{1/3} = \left(\frac{3^{81}}{3^{12}}\right)^{1/3} = (3^{81-12})^{1/3} = (3^{69})^{1/3} \\ &= 3^{23}\end{aligned}$$

End of Solution

Q.2 Blank spaces represent



- (a) FG = 72 (b) FG = 42  
(c) GH = 52 (d) FJ = 40

Ans. (b)

$$EF = 5 \times 6 = 30; HJ = 8 \times 10 = 80; EG = 5 \times 7 = 35$$

From the options only  $FG = 6 \times 7 = 42$  satisfies this logic.

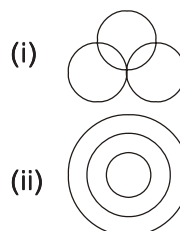
End of Solution

Q.3 Match the venn-diagram:

List-I

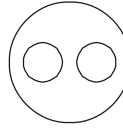
- (a) Animal, Zebra, Giraffe  
(b) Producer, Director, Actor

List-II



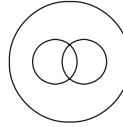
(c) Pianist, Guitarist, Instrumentalist

(iii)



(d) Novel, Word, Sentence

(iv)



Ans. ( )

(a) – (iii); (b) – (i); (c) – (iv); (d) – (ii)

End of Solution

Q.4 Good : Evil :: Genuine : ?

(a) Counterfeit

(b) Counterpart

(c) Counterfoil

(d) Contraband

Ans. (a)

End of Solution





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### SECTION - B

### TECHNICAL

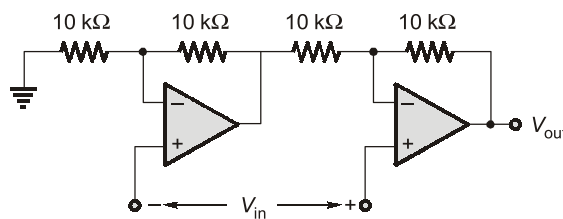
## ANALOG ELECTRONICS

- Q.5** Which one of the following statements is true about the small signal voltage gain of a MOSFET based single stage amplifier?
- (a) Common source and common gate amplifiers are both inverting amplifiers
  - (b) Common source and common gate amplifiers are both non-inverting amplifiers
  - (c) Common source amplifiers is non-inverting and common gate amplifier is inverting amplifier
  - (d) Common source amplifier is inverting and common gate amplifier is non-inverting amplifier

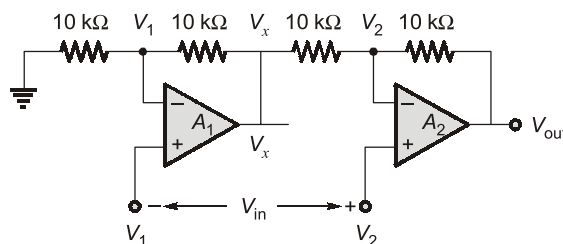
**Ans. (d)**  
MOSFET CS amplifier is inverting.  
CG amplifier is non-inverting.

**End of Solution**

- Q.6** The op-amps in the following circuit are ideal. The voltage gain of the circuit is \_\_\_\_\_.  
(Round off to the nearest integer)



**Ans. (2)**



Assume  $V_{in} = V_2 - V_1$   
Op-amp  $A_1$  :

$$V_x = \left(1 + \frac{10k}{10k}\right) V_1 = 2V_1$$

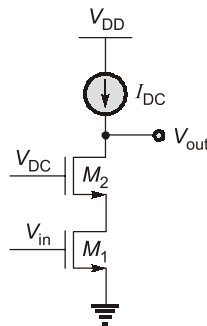
Op-amp  $A_2$  :

KCL at  $A_2$   $\frac{V_x - V_2}{10k} = \frac{V_2 - V_0}{10k}$

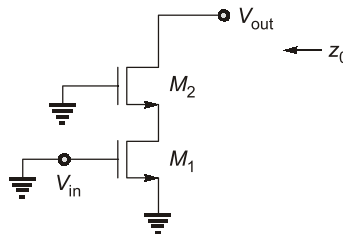
$$\begin{aligned}
 V_x &= 2V_2 - V_0 \\
 V_0 &= 2V_2 - V_x \\
 &= 2V_2 - 2V_1 \\
 &= 2(V_2 - V_1) \\
 \frac{V_0}{V_2 - V_1} &= 2
 \end{aligned}$$

**End of Solution**

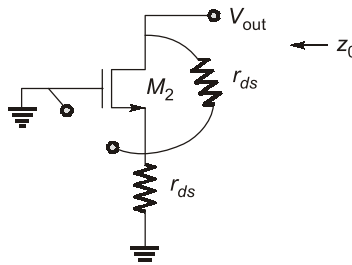
- Q.7** In the circuit,  $I_{DC}$  is an ideal current source. The transistors  $M_1$  and  $M_2$  are assumed to be biased in saturation, wherein  $V_{in}$  is the input signal and  $V_{DC}$  is fixed DC voltage. Both transistors have a small signal resistance of  $r_{ds}$  and trans-conductance of  $g_m$ . The small signal output impedance of this circuit is



**Ans.**  $(2r_{ds} + g_m r_{ds}^2)$   
AC Analysis :



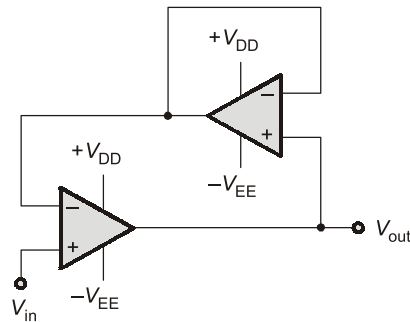
To calculate  $Z_0$   $V_{in} = 0$   
Replace  $M_1$  transistor as active load



$$\begin{aligned}
 Z_0 &= r_{ds} + r_{ds} + g_m r_{ds} r_{ds} \\
 &= 2r_{ds} + g_m r_{ds}^2
 \end{aligned}$$

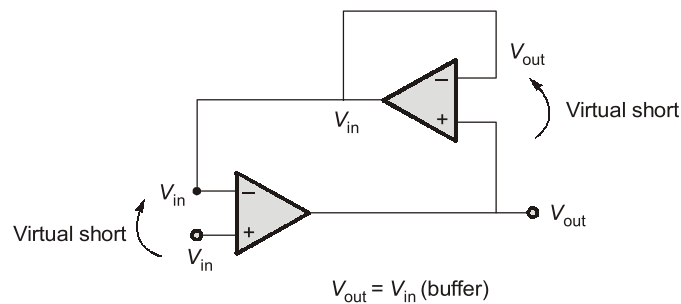
**End of Solution**

**Q.8** Assuming ideal op-smps, the circuit represents is



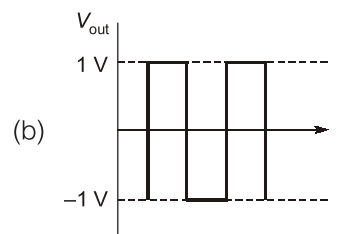
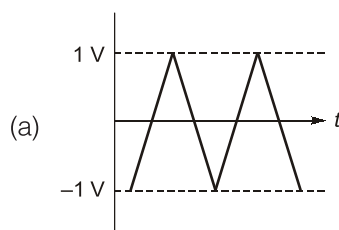
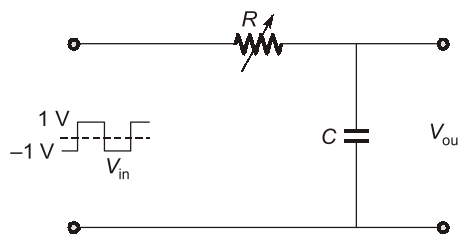
- (a) Summing amplifier  
(b) buffer  
(c) logarithmic amplifier  
(d) difference amplifier

**Ans.** (b)



End of Solution

**Q.9** In the circuit, shown below, if the values of  $R$  and  $C$  are very large, the form of the output voltage for a very high frequency square wave input, is best represented by





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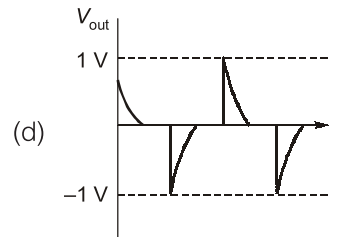
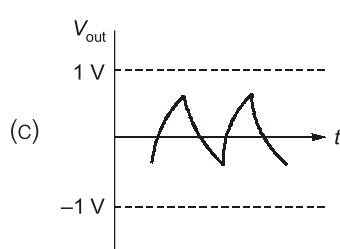


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**Ans. (c)**

$$V_0 = \frac{1}{RC} \int_0^{T/2} V_i dt = \frac{1}{RC} \int_0^{T/2} 1 \cdot dt = \frac{1}{RC} (t) \Big|_0^{T/2} = \frac{T}{2RC}$$

$\therefore$   
So,  $V_0 < 1$  Volt

$RC \gg T$

**End of Solution**

## CONTROL SYSTEMS

**Q.10** Selected data points of the step response of a stable first-order linear time-invariant (LTI) system are given below. The closest value of the time-constant, in sec, of the system is

Time (sec)	0.6	1.6	2.6	10	$\infty$
Output	0.78		2.8	2.98	3

- (a) 1  
(c) 4

- (b) 3  
(d) 2

**Ans. (d)**

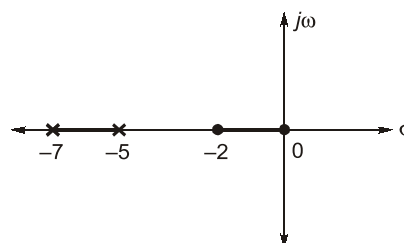
**End of Solution**

**Q.11** The open-loop transfer function of the system shown in the figure, is

$$G(s) = \frac{Ks(s+2)}{(s+5)(s+7)}$$

For  $K \geq 0$ , which of the following real axis point(s) is/are on the root locus?

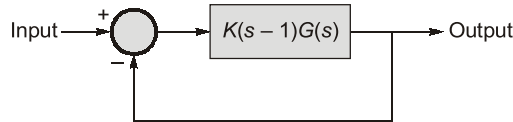
**Ans. (-7 to -5 and -2 to 0)**  
-7 to -5 and -2 to 0



Root locus exist between -7 to -5 and -2 to 0.

**End of Solution**

**Q.12** Let  $G(s) = \frac{1}{(s+1)(s+2)}$ . Then the closed-loop system shown in the figure below,



Find the values of  $K$  for stability.

**Ans.**  $(-3 < K < 2)$

$$G(s)H(s) = \frac{K(s-1)}{s^2 + 3s + 2}$$

Characteristics equation of the system is

$$q(s) = s^2 + s(K+3) + (2-K) = 0$$

The system to be stable

$$-3 < K < 2$$

**End of Solution**

**Q.13** Consider the state-space model

$$\dot{x}(t) = Ax(t) + Bu(t)$$

$$y(t) = Cx(t)$$

$$A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, C = [1 \quad 0]$$

The sum of the magnitudes of the poles is \_\_\_\_.

**Ans.** **(3)**

Characteristics equation of the system is

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

$$\begin{vmatrix} s & -1 \\ 2 & s+3 \end{vmatrix} = 0$$

$$q(s) = s^2 + 3s + 2 = 0$$

Roots of the equation is  $-1, -2$

Sum of the magnitudes of the poles

$$= |-1| + |-2| = 1 + 2 = 3$$

**End of Solution**

**Q.14** A controller  $(1 + K_D s)$  is to be designed for the plant  $G(s) = \frac{1000\sqrt{2}}{s(s+10)^2}$  as shown in the

figure. The value of  $K_D$  that yields a phase margin of  $45^\circ$  at the gain cross-over frequency of 10 rad/sec is \_\_\_\_\_ (round off to one decimal place).

**Ans. (0.1)**

Given compensated system has

$$PM = 180^\circ + \left[ -90^\circ - 2 \tan^{-1} \left( \frac{10}{10} \right) \right] = 0^\circ$$

But required  $45^\circ$  phase margin has to be provided by compensator

$$\tan^{-1} [K_D \omega]_{\text{at } \omega=10 \text{ rad/sec}} = 45^\circ$$

$$\therefore K_D = 0.1$$

End of Solution

**Q.15**

$$\dot{X}_1 = 2X_2$$

$$\dot{X}_2 = U(t)$$

$U(t)$  is step.

Find  $X_1(1)$

**Ans. (1)**

$$sX_1 = 2X_2$$

$$sX_2 = \frac{1}{s}$$

$$X_2 = \frac{1}{s^2}$$

$$X_1 = \frac{2}{s^3}$$

$$X_1(t) = t^2 U(t)$$

$$X_1(1) = 1$$

End of Solution

**Q.16** Open loop system is stable. Nyquist plot encircles  $(-1, 0)$  once in anti-clockwise direction. Find closed loop system stability.

**Ans. (#)**

$$P = 0, \quad N = +1$$

$$N \neq P$$

$\therefore$  Closed loop system is unstable.

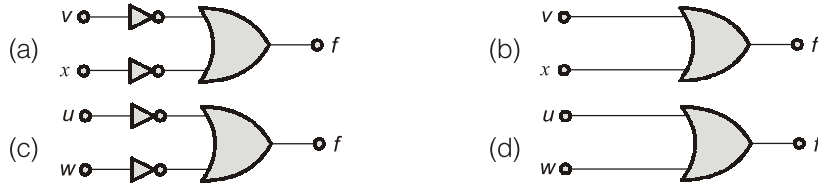
End of Solution

### DIGITAL ELECTRONICS

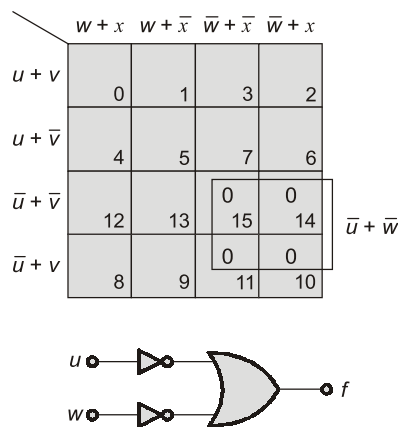
**Q.17** A Boolean function is given as

$$f = (\bar{u} + \bar{v} + \bar{w} + \bar{x}) \cdot (\bar{u} + \bar{v} + \bar{w} + x) \cdot (\bar{u} + v + \bar{w} + \bar{x}) \cdot (\bar{u} + v + \bar{w} + x)$$

The simplified form of this function is represented by



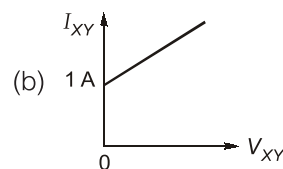
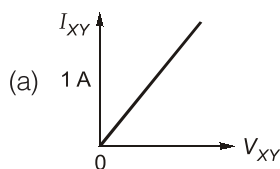
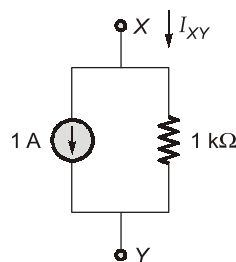
**Ans. (c)**



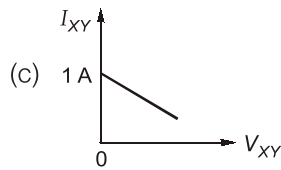
End of Solution

### ELECTRIC CIRCUITS

**Q.18** The I-V characteristics of the elements between the nodes X and Y is best depicted

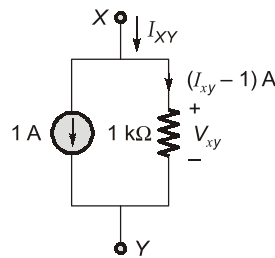






(d)

Ans. (b)



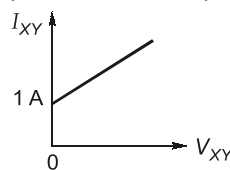
$$V_{xy} = 0$$

$$V_{xy} = 1 \text{ kV}$$

$$V_{xy} = (I_{xy} - 1)1k$$

$$0 = (I_{xy} - 1)1k \Rightarrow I_{xy} = 1$$

$$1k = (I_{xy} - 1)1k \Rightarrow I_{xy} = 2$$

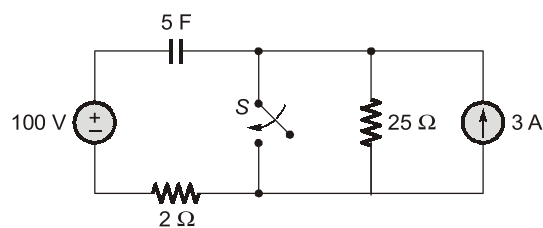


$$V_{xy} = 5 \text{ kV}$$

$$5k = (I_{xy} - 1)1k \Rightarrow I_{xy} = 6$$

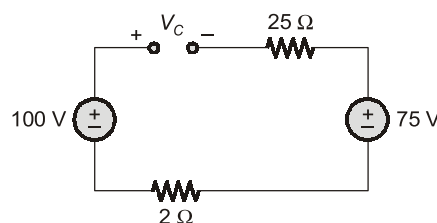
End of Solution

**Q.19** The switch (S) closes at  $t = 0$  sec. The time, in sec the capacitor takes to charge to 50 V is \_\_\_\_\_. (Round off to one decimal places)



Ans. (4.05)

$$t = 0^-$$



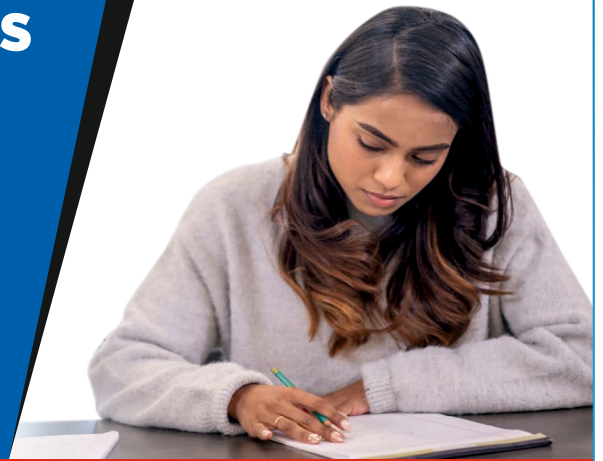


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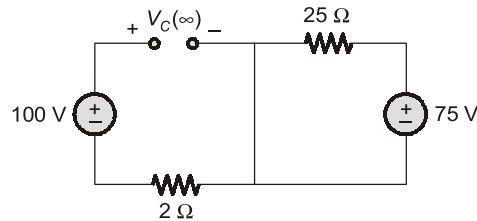
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$$V_C(0^-) = 100 - 75$$

$$V_C(0^-) = 25 \text{ V}$$

$$V_C(0^+) = 25 \text{ V}$$

$$t \rightarrow \infty$$



$$V_C(\infty) = 100 \text{ V}$$

$$T = 2 \times 5 = 10 \text{ sec}$$

$$V_C(t) = V_C(\infty) + (V_C(0^+) - V_C(\infty))e^{-t/T}$$

$$V_C(t) = 100 + (25 - 100)e^{-t/10}$$

$$50 = 100 - 75e^{-t/10}$$

$$+50 = +75e^{-t/10}$$

$$e^{-t/10} = \frac{50}{75}$$

$$t = 4.05 \text{ sec}$$

**End of Solution**

**Q.20** Consider two coupled circuits having self inductances  $L_1$  and  $L_2$  that carry non-zero currents  $I_1$  and  $I_2$  respectively. The mutual inductance between the circuit is  $M$  with unity coupling coefficient. The stored magnetic energy of the coupled circuit is minimum at which of the following value(s) of  $I_1/I_2$ ?

(a)  $-\frac{M}{L_2}$

(b)  $-\frac{L_2}{M}$

(c)  $-\frac{M}{L_1}$

(d)  $-\frac{L_1}{M}$

**Ans. (b, c)**

$$\omega = \frac{1}{2}L_1I_1^2 + \frac{1}{2}L_2I_2^2 + MI_1I_2$$

$$\frac{d\omega}{dI_1} = 0$$

$$\frac{d\omega}{dI_1} = 2I_1\left(\frac{1}{2}L_1\right) + 0 + MI_2$$

$$0 = L_1I_1 + MI_2$$

$$\frac{I_1}{I_2} = -\frac{M}{L_1}$$

$$\frac{d\omega}{dI_2} = 0$$

$$\frac{d\omega}{dI_2} = 0 + \frac{1}{2}L_2(2I_2) + MI_1$$

$$0 = L_2I_2 + MI_1$$

$$\frac{I_1}{I_2} = -\frac{L_2}{M}$$

End of Solution

## ELECTRICAL MACHINES

**Q.21** A DC series motor with negligible series resistance is running at a certain speed driving a load, where the load torque varies as cube of the speed. The motor is fed from a 400 V DC source and draws 40 A armature current. Assume linear magnetic circuit. The external resistance, in  $\Omega$ , that must be connected in series with the armature to reduced the speed of the motor by half, is closed to

- (a) 0 (b) 23.28  
(c) 4.82 (d) 46.7

**Ans. (b)**

$$T \propto N^3 \text{ (given)}$$

$$I_a = 40 \text{ A, } 400 \text{ V}$$

$$R_{\text{ext}} = ?, \text{ if speed has to reduce half}$$

$$400 \propto 40 \text{ N} \quad \dots(1)$$

$$400 - I_a R_{\text{ext}} \propto I_a \left(\frac{N}{2}\right) \quad \dots(2)$$

as  $T \propto N^3 \text{ (given)}$   
and  $T \propto I_a^2 \text{ (series motor)}$   
So,  $I_a^2 \propto N^3$

$$\frac{40^2}{I_a^2} = \frac{N^3}{\left(\frac{N}{2}\right)^3}$$

$$\frac{40^2}{I_a^2} = 8 \Rightarrow I_a = 10\sqrt{2} \text{ A}$$

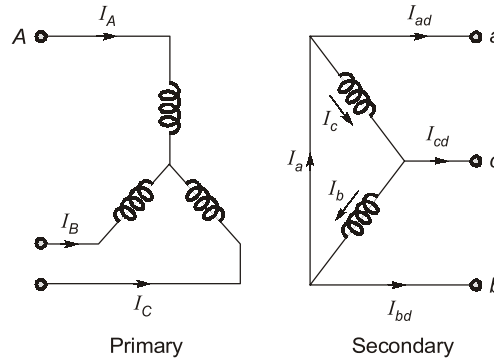
From (1) and (2)

$$\frac{400}{400 - 10\sqrt{2}(R_{\text{ext}})} \propto \frac{40N}{10\sqrt{2}\left(\frac{N}{2}\right)}$$

$$R_{\text{ext}} = 23.28 \Omega$$

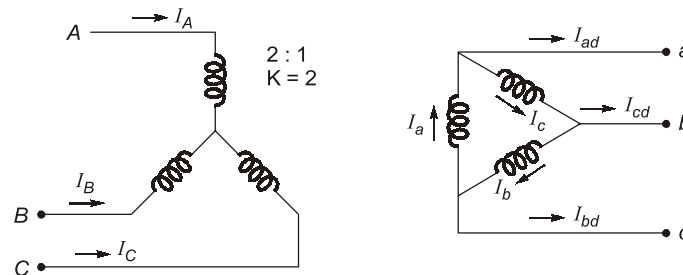
End of Solution

- Q.22** The transformer connection given in the figure is part of a balanced 3-phase circuit where the phase sequence is "abc". The primary to secondary turns ratio is 2 : 1. If  $(I_a + I_b + I_c = 0)$ , then the relationship between  $I_A$  and  $I_{ad}$  will be



- (a)  $\frac{|I_A|}{|I_{ad}|} = \frac{1}{2\sqrt{3}}$  and  $I_{ad}$  lags  $I_A$  by  $30^\circ$   
 (b)  $\frac{|I_A|}{|I_{ad}|} = \frac{1}{2\sqrt{3}}$  and  $I_{ad}$  leads  $I_A$  by  $30^\circ$   
 (c)  $\frac{|I_A|}{|I_{ad}|} = 2\sqrt{3}$  and  $I_{ad}$  lags  $I_A$  by  $30^\circ$   
 (d)  $\frac{|I_A|}{|I_{ad}|} = 2\sqrt{3}$  and  $I_{ad}$  leads  $I_A$  by  $30^\circ$

**Ans. (a)**



$$I_a = 2I_A$$

$$I_{ad} = \sqrt{3}I_a = 2\sqrt{3}I_A$$

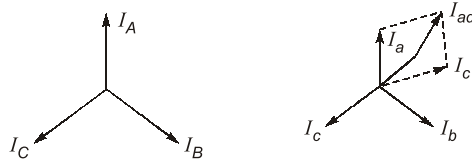
$$\frac{I_A}{I_{ad}} = \frac{1}{2\sqrt{3}}$$

Applying KCL,

$$\bar{I}_a = \bar{I}_c + \bar{I}_{ad}$$

$$\bar{I}_{ad} = \bar{I}_a - \bar{I}_c$$

$$\bar{I}_{ad} = \bar{I}_a - (-\bar{I}_c)$$



$I_{ad}$  lags  $I_a$  by  $30^\circ$ .  
 $\therefore I_{ad}$  lags  $I_A$  by  $30^\circ$ .  
 $\therefore I_A$  and  $I_a$  in phase.

**End of Solution**

**Q.23** A 3-phase, 400 V, 4 pole, 50 Hz star connected induction motor has the following parameters referred to the stator :

$$R'_r = 1 \, \Omega, \, X_S = X'_r = 2 \, \Omega$$

Stator resistance, magnetizing reactance and core loss of the motor are neglected. The motor is run with constant V/f control from a drive. For maximum starting torque, the voltage and frequency output, respectively, from the drive, is closest to,

- (a) 400 V and 50 Hz                      (b) 300 V and 37.5 Hz  
 (c) 200 V and 25 Hz                      (d) 100 V and 12.5 Hz

**Ans. (d)**

Given :  $X_S = X'_r = 2 \, \Omega$   
 $X_1 = X'_2 = 2 \, \Omega$

Condition for maximum starting torque :

$$R'_2 = X_1 + X'_2$$

Let a frequency  $F_m$  be the frequency.

Corresponding to maximum  $T_{st}$ ,

$$2\pi f_m L_1 + 2\pi f_m L'_2 = 1$$

$$2\pi f_m (L_1 + L'_2) = 1$$

$$f_m = \frac{1}{2\pi(L_1 + L'_2)}$$

From given data :

$$X_1 = 2\pi f L_1 = 2 \, \Omega$$

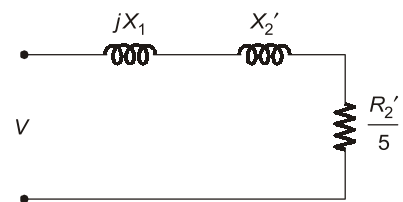
$$X_2 = 2\pi f L'_2 = 2 \, \Omega$$

$$L_1 = L'_2 = \frac{2}{2\pi(50)} = 6.369 \times 10^{-3} \, \text{H}$$

$$\therefore f_m = \frac{1}{2\pi(2 \times 6.369 \times 10^{-3})} = 12.5 \, \text{Hz}$$

V/F Control : V/F Ratio must remain same.

$$\therefore \frac{V_2}{f_2} = \frac{V_1}{f_1} \Rightarrow V_2 = \frac{400}{50} \times 12.5 = 100 \, \text{V}$$



**End of Solution**



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**Q.24** Instruments required to synchronize an alternator to the grid is/are

- |                  |                 |
|------------------|-----------------|
| (a) Wattmeter    | (b) Voltmeter   |
| (c) Synchroscope | (d) Stroboscope |

**Ans. (c, b)**

To synchronise alternator to grid, synchroscope and voltmeter are used.

**End of Solution**

**Q.25** The induced emf in a 3.3 kV, 4-pole, 3-phase, Y-connected synchronous motor is considered to be equal and in phase with the terminal voltage under no load condition. On application of a load (mechanical), the induced emf phasor is deflected by an angle of  $2^\circ$  (mechanical) with respect to the terminal voltage phasor. If the isochronous reactance is  $2 \Omega$  and series resistance is negligible than the motor armature current magnitude, an ampere during loaded condition, is closest to \_\_\_\_\_. (round off two decimal places)

**Ans. (66.49)**

$$(E_f)_{NL} = |V| = \frac{3.3 \times 10^3}{\sqrt{3}}, X_s = 2 \Omega$$

$$\delta = 2^\circ \text{ mechanical} = 2^\circ \times \frac{4}{2} = 4^\circ \text{ electrical}$$

$$\frac{3.3 \times 10^3}{\sqrt{3}} \angle -4^\circ = \frac{3.3 \times 10^3}{\sqrt{3}} \angle 0^\circ - j\vec{I}_a(2)$$

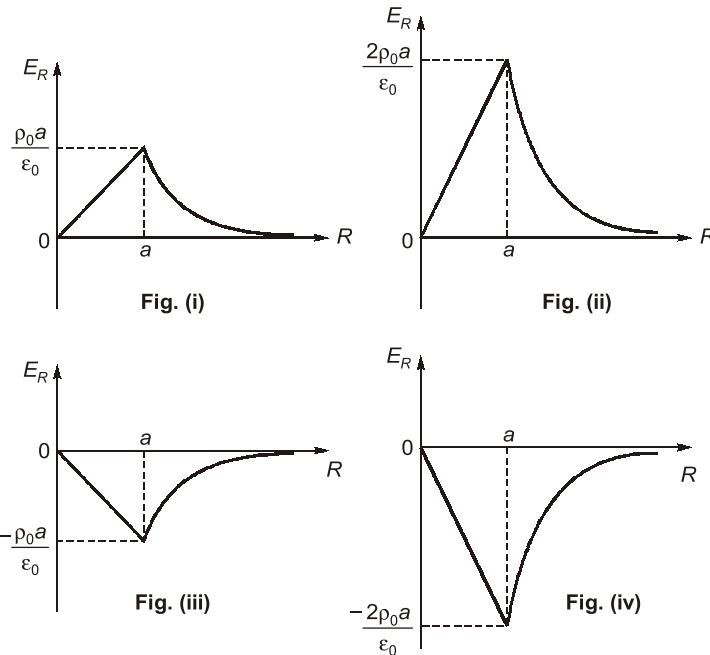
$$\begin{aligned} \vec{I}_a &= \frac{\frac{3.3 \times 10^3}{\sqrt{3}} \angle 0^\circ - \frac{3.3 \times 10^3}{\sqrt{3}} \angle -4^\circ}{j2} \\ &= 66.49 \angle -2^\circ \end{aligned}$$

**End of Solution**



## EMT

- Q.26** Which one of the following figures represents the radial electric field distribution  $E_R$  caused by a spherical cloud of electrons with a volume charge density.  $\rho = -3\rho_0$  for  $0 \leq R \leq a$  (both  $\rho_0, a$  are positive and  $R$  is the radial distance) and  $\rho = 0$  for  $R > a$ ?



Ans. (c)

Given :

$$\rho_V = \begin{cases} -3\rho_0 \text{ C/m}^3 & 0 \leq R \leq a \\ 0 & R > a \end{cases}$$

Case (i) :  $R \leq a$  :

$$\oint \vec{D} \cdot d\vec{S} = Q_{\text{enc}} = \int \rho_V dv$$

$$Q_{\text{enc}} = \int \rho_V dv = -\int 3\rho_0 R^2 \sin\theta d\theta d\phi dR$$

$$\Rightarrow Q_{\text{enc}} = -3\rho_0 \int_{R=0}^R R^2 dR \int_{\theta=0}^{\pi} \sin\theta d\theta \int_{\phi=0}^{2\pi} d\phi$$

$$\Rightarrow Q_{\text{enc}} = -3\rho_0 \cdot \frac{R^3}{3} \Big|_0^R - \cos\theta \Big|_0^{\pi} \cdot \phi \Big|_0^{2\pi}$$

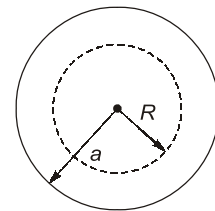
$$\Rightarrow Q_{\text{enc}} = -\rho_0 \cdot a^3 \cdot 2 \cdot 2\pi = -(4\pi R^3)\rho_0$$

$$\oint \vec{D} \cdot d\vec{S} = D \times 4\pi R^2$$

$$= D \cdot 4\pi R^2 = -4\pi R^3 \rho_0$$

$$\Rightarrow D = -\rho_0 R$$

$$\Rightarrow E = -\frac{\rho_0 R}{\epsilon_0}$$



$$\Rightarrow \bar{E} = -\frac{\rho_0 R}{\epsilon_0} \hat{a}_r$$

Case (ii) :  $R > a$

$$\oint \bar{D} \cdot d\bar{S} = Q_{\text{enc}} = \int \rho_v dv$$

$$Q_{\text{enc}} = \int -3\rho_0 \cdot R^2 \sin\theta d\theta d\phi dR$$

$$\Rightarrow Q_{\text{enc}} = -3\rho_0 \int_{R=0}^a R^2 dR \int_{\theta=0}^{\pi} \sin\theta d\theta \int_{\phi=0}^{2\pi} d\phi$$

$$\Rightarrow Q_{\text{enc}} = -3\rho_0 \cdot \frac{R^3}{3} \Big|_0^a - \cos\theta \Big|_0^{\pi} \cdot \phi \Big|_0^{2\pi} = -\rho_0 a^3 \pi \cdot 2\pi = -4\pi a^3 \rho_0$$

$$\oint \bar{D} \cdot d\bar{S} = D \times 4\pi R^2$$

$$\therefore D \cdot 4\pi R^2 = -4\pi a^3 \rho_0$$

$$\Rightarrow D = -\frac{\rho_0 a^3}{R^2}$$

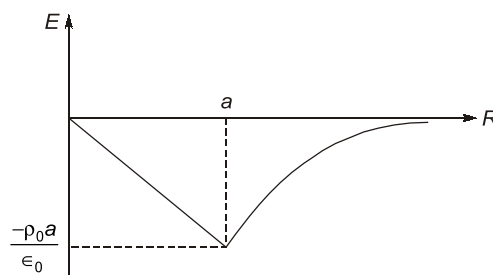
$$\Rightarrow E = -\frac{\rho_0 a^3}{\epsilon_0 R^2}$$

$$\Rightarrow \bar{E} = \frac{-\rho_0 a^3}{\epsilon_0 R^2} \hat{a}_R$$

Hence,

$$\bar{E} = \begin{cases} \frac{-\rho_0 R}{\epsilon_0} \hat{a}_r, & 0 \leq R \leq a \\ \frac{-\rho_0 a^3}{\epsilon_0 R^2} \hat{a}_r, & R > a \end{cases}$$

Graph :

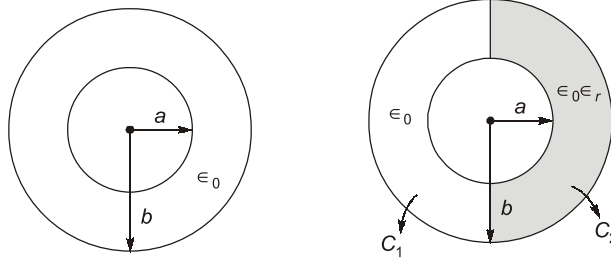


End of Solution

**Q.27** Let  $\hat{a}_R$  be the unit radial vector in the spherical co-ordinate system. For which of the following value(s) of  $n$ , the divergence of the radial vector field  $f(R) = \hat{a}_R \frac{1}{R^n}$  is independent of  $R$ ?



Ans. (d)



Capacitance,  $C_0 = \frac{2\pi\epsilon_0 l}{\ln\left(\frac{b}{a}\right)}$

Now, capacitance,  $C_{eq} = C_1 + C_2$

$$C_1 = \frac{2\pi\epsilon_0 l}{\ln\left(\frac{b}{a}\right)} \times \frac{1}{2} = \frac{\pi\epsilon_0 l}{\ln\left(\frac{b}{a}\right)}$$

$$C_2 = \frac{2\pi\epsilon_0\epsilon_r l}{\ln\left(\frac{b}{a}\right)} \times \frac{1}{2} = \frac{\pi\epsilon_0\epsilon_r l}{\ln\left(\frac{b}{a}\right)}$$

$$\therefore C_{eq} = \frac{\pi\epsilon_0 l}{\ln\left(\frac{b}{a}\right)} [1 + \epsilon_r]$$

According to question,

$$C_{eq} = 5C_0$$

$$\Rightarrow \frac{\pi\epsilon_0 l}{\ln\left(\frac{b}{a}\right)} [1 + \epsilon_r] = 5 \times \frac{2\pi\epsilon_0 l}{\ln\left(\frac{b}{a}\right)}$$

$$1 + \epsilon_r = 10$$

$$\Rightarrow \epsilon_r = 9$$

End of Solution

## MATHEMATICS

**Q.29** Let  $A = \begin{bmatrix} 1 & 1 & 1 \\ -1 & -1 & -1 \\ 0 & 1 & -1 \end{bmatrix}$  and  $b = \begin{bmatrix} 1/3 \\ -1/3 \\ 0 \end{bmatrix}$ , then the system of linear equations  $Ax = b$  has

- |                                  |                       |
|----------------------------------|-----------------------|
| (a) infinitely many solutions    | (b) no solution       |
| (c) a finite number of solutions | (d) a unique solution |

Ans. (a)

$$AX = B$$



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$$\begin{bmatrix} 1 & 1 & 1 \\ -1 & -1 & -1 \\ 0 & 1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \frac{1}{3} \\ -\frac{1}{3} \\ 0 \end{bmatrix}$$

$$C = [A : B] = \begin{bmatrix} 1 & 1 & 1 & : & \frac{1}{3} \\ -1 & -1 & -1 & : & -\frac{1}{3} \\ 0 & 1 & -1 & : & 0 \end{bmatrix}$$

$$R_2 \rightarrow R_2 + R_1 \quad \begin{bmatrix} 1 & 1 & 1 & : & \frac{1}{3} \\ 0 & 0 & 0 & : & 0 \\ 0 & 1 & -1 & : & 0 \end{bmatrix}$$

$$R_2 \leftrightarrow R_3 \quad \begin{bmatrix} 1 & 1 & 1 & : & \frac{1}{3} \\ 0 & 1 & -1 & : & 0 \\ 0 & 0 & 0 & : & 0 \end{bmatrix}$$

$\Rightarrow \quad \rho(A) = 2 = \rho(A | B) < n = 3$   
System has infinite solutions.

**End of Solution**

**Q.30** Consider the set  $S$  of points  $(x, y) \in \mathbb{R}^2$  which minimize the real valued function  

$$f(x, y) = (x + y - 1)^2 + (x + y)^2$$

Which of the following statements is true about the set  $S$ ?

- (a) The number of elements in the set  $S$  is exactly one.
- (b) The set  $S$  is empty.
- (c) The number of elements in the set  $S$  is infinite.
- (d) The number of elements in the set  $S$  is finite and more than one

**Ans. (c)**

$$\begin{aligned} f(x, y) &= (x + y - 1)^2 + (x + y)^2 \\ &= x^2 + (y - 1)^2 + 2(x)(y - 1) + x^2 + y^2 + 2xy \\ &= 2x^2 + 2y^2 + 4xy - 2x - 2y + 1 \end{aligned}$$

Finding stationary points :

$$\frac{\partial f}{\partial x} = 4x + 4y - 2 = 0$$

$$\frac{\partial f}{\partial y} = 4y + 4x - 2 = 0$$

⇒

$$x + y = 2$$

$$r = f_{xx} = 4 > 0$$

$$S = f_{xy} = 0, \quad t = f_{yy} = 4$$

$$rt - S^2 = (4)(4) - 0^2 = 16 > 0$$

$$\therefore rt - S^2 > 0, \quad r > 0 \text{ at all}$$

The infinite stationary points.

∴ It is minimum at infinite points.

Solving we get infinite points  $P(x, y)$

**End of Solution**

**Q.31** Let  $v_1$  and  $v_2$  be the two eigen vectors corresponding to distinct eigen values of a  $3 \times 3$  real symmetric matrix. Which one of the following statements is true?

(a)  $v_1^T v_2 \neq 0$

(b)  $v_1 + v_2 = 0$

(c)  $v_1 - v_2 = 0$

(d)  $v_1^T v_2 = 0$

**Ans. (d)**

Eigen vectors of symmetric matrix of  $3 \times 3$ .

Corresponding to distinct  $\lambda$  are orthogonal to each other.

$$\therefore v_1^T v_2 = 0$$

**End of Solution**

**Q.32** Consider discrete random variable  $X$  and  $Y$  with probabilities as follows:

$$P(X = 0 \text{ and } Y = 0) = \frac{1}{4}$$

$$P(X = 1 \text{ and } Y = 1) = \frac{1}{8}$$

$$P(X = 0 \text{ and } Y = 1) = \frac{1}{2}$$

$$P(X = 1 \text{ and } Y = 1) = \frac{1}{8}$$

Given  $X = 1$ , the expected value of  $Y$  is

(a)  $\frac{1}{3}$

(b)  $\frac{1}{4}$

(c)  $\frac{1}{8}$

(d)  $\frac{1}{2}$

Ans. (c)

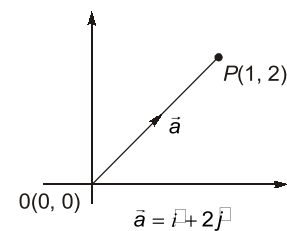
$$\begin{aligned}
 P(X = 1, Y = 0) &= \frac{1}{8}, \quad P(X = 1, Y = 1) = \frac{1}{8}, \\
 \left( \frac{Y}{X=1} \right) &= \sum y_i P(x=1, y=1) \\
 &= 0 \times P(X = 1, Y = 0) + 1 \times P(X = 1, Y = 1) \\
 &= 0 \times \frac{1}{8} + 1 \times \frac{1}{8} \\
 &= \frac{1}{8}
 \end{aligned}$$

End of Solution

**Q.33** Let  $(x, y) \in \mathbb{R}^2$ . The rate of change of the real valued function,  $V(x, y) = x^2 + x + y^2 + 1$  at the origin in the direction of the point  $(1, 2)$  is \_\_\_\_\_ (round off to the nearest integer)

Ans. (0)

$$\begin{aligned}
 DD &= \nabla V \cdot \frac{\vec{a}}{|\vec{a}|} \\
 \nabla V &= \langle V_x, V_y \rangle \\
 &= \langle 2x + 1, 2y \rangle \\
 (\nabla V)_{(0,0)} &= \langle 1, 0 \rangle
 \end{aligned}$$



$$\begin{aligned}
 \therefore DD &= (\hat{i} + 0\hat{j}) \cdot \frac{(\hat{i} + 2\hat{j})}{\sqrt{1^2 + 2^2}} \\
 &= \frac{1}{\sqrt{5}} = 0.447
 \end{aligned}$$

Nearest integer = 0

End of Solution

**Q.34** Let  $X$  and  $Y$  be continuous random variables with probability density functions  $P_X(x)$  and  $P_Y(y)$ , respectively. Further, let  $Y = X^2$  and  $P_X(x) = \begin{cases} 1, & x \in (0, 1] \\ 0, & \text{otherwise} \end{cases}$ .

Which one of the following options is correct?

- (a)  $P_Y(y) = \begin{cases} \frac{1}{2\sqrt{y}}, & y \in (0, 1] \\ 0, & \text{otherwise} \end{cases}$

(c)  $P_Y(y) = \begin{cases} 1.5\sqrt{y}, & y \in (0, 1] \\ 0, & \text{otherwise} \end{cases}$

(b)  $P_Y(y) = \begin{cases} 2y, & y \in (0, 1] \\ 0, & \text{otherwise} \end{cases}$

(d)  $P_Y(y) = \begin{cases} 1, & y \in (0, 1] \\ 0, & \text{otherwise} \end{cases}$



Ans. (a)

$$Y = X^2$$

$$dy = 2Xdx \Rightarrow \frac{dx}{dy} = \frac{1}{2x}$$

$$g_Y(Y) = 1 \cdot \frac{1}{2x} = \frac{1}{2\sqrt{y}}$$

$$g(Y) = \begin{cases} \frac{1}{2\sqrt{y}}, & y \in (0,1) \\ 0, & \text{otherwise} \end{cases}$$

End of Solution

**Q.35** Let  $C$  be a clockwise oriented closed curve in the complex plane defined by  $|z| = 1$ . Further, let  $f(z) = jz$  be a complex function, where  $j = \sqrt{-1}$ . Then,  $\int_C f(z)dz = \underline{\hspace{2cm}}$ .

Ans. (0)

$$f(z) = iz \text{ is analytic in } C : |z| = 1$$

$$\oint_C izdz = 0 \text{ by C.I.T.}$$

End of Solution

## MEASUREMENT

**Q.36** The maximum percentage error in the equivalent resistance of two parallel connected resistors of  $100 \Omega$  and  $900 \Omega$  with each having a maximum 5% error is            %. (Round off to nearest integer value)

Ans. (5)

Given resistors :

$$R_1 = 100 \pm 5\% = (100 \pm 5) \Omega$$

$$R_2 = 900 \pm 5\% = (900 \pm 45) \Omega$$

$$R_{eq} = R_1 \parallel R_2 = 100 \parallel 900 = 90 \Omega$$

For parallel combination,

$$\frac{\delta R_{eq}}{R_{eq}} = \pm \left[ \frac{R_{eq}}{R_1} \times \frac{\delta R_1}{R_1} + \frac{R_{eq}}{R_2} \times \frac{\delta R_2}{R_2} \right]$$

$$= \pm \left[ \frac{90}{100} \times 5\% + \frac{90}{900} \times 5\% \right]$$

$$= \pm 5\%$$

End of Solution



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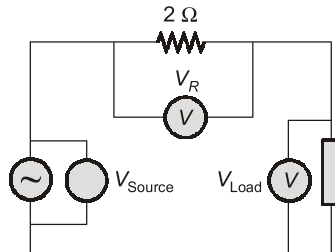
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- Q.37** In an experiment to measure the active power drawn by a single-phase RL Load connected to an AC source through a  $2\ \Omega$  resistor, three voltmeters are connected as shown in the figure below. The voltmeter readings are as follows :  $V_{\text{source}} = 200\ \text{V}$ ,  $V_R = 9\ \text{V}$ ,  $V_{\text{Load}} = 199\ \text{V}$ . Assuming perfect resistors and ideal voltmeters, the Load-active power measured in this experiment, in  $\text{W}$ , is \_\_\_\_.



**Ans. (79.43)**

$$I_L = \frac{V_R}{2} = \frac{9}{2} = 4.5\ \text{A}$$

$$\cos \phi = \frac{V_S^2 - V_R^2 - V_L^2}{2V_R V_L}$$

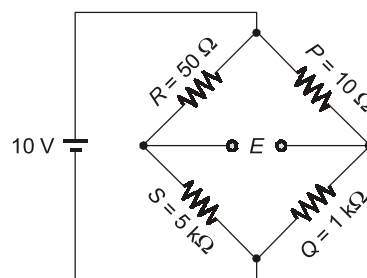
Substitution all the values, we get

$$\cos \phi = 0.0887$$

$$\therefore P_L = 199 \times 4.5 \times 0.0887 = 79.43\ \text{W}$$

End of Solution

- Q.38** In the Wheatstone bridge shown below, the sensitivity of the bridge in terms of change in balancing voltage  $E$  for unit change in the resistance  $R$ , in  $\text{mV}/\Omega$ , is \_\_\_\_\_. (round off to two decimal places)



**Ans. (1.96)**

$$E = 10 \left[ \frac{1000}{1000 + 10} - \frac{5000}{5000 + 51} \right]$$

$$= 1.96\ \text{mV}$$

$$\therefore S = 1.96\ \text{mV}/\Omega$$

End of Solution



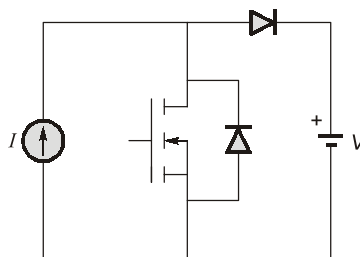
$$I_{RMS} = \sqrt{\frac{1}{2}(10^2 + 2^2 + 1^2)} = 7.245$$

$$S = V_{RMS} \cdot I_{RMS} = \frac{300}{\sqrt{2}} \times 7.245 = 1537.27 \text{ V}$$

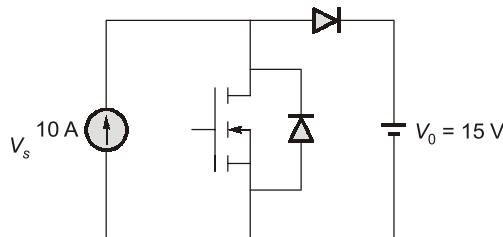
$$\text{PF} = \frac{P}{S} = \frac{P_1}{S} = \frac{1299}{1537.27} = 0.845$$

**End of Solution**

- Q.41** In the circuit with ideal devices, the power MOSFET is operated with a duty cycle of 0.4 in a switching cycle with  $I = 10 \text{ A}$  and  $V = 15 \text{ V}$ . The power delivered by the current source in W is \_\_\_\_\_. (round off to the nearest integer)



**Ans. (90)**



**Boost Converter:** Continuous condition.

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

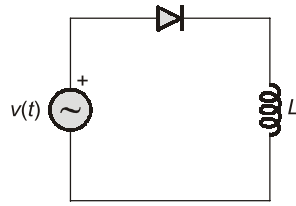
$$\frac{V_0}{V_s} = \frac{I_s}{I_0} = \frac{1}{1-\alpha}$$

$$I_0 = (1-\alpha)I_s = (1-0.4)10 = 6 \text{ A}$$

$$P_0 = V_0 I_0 = 15 \times 6 = 90 \text{ W}$$

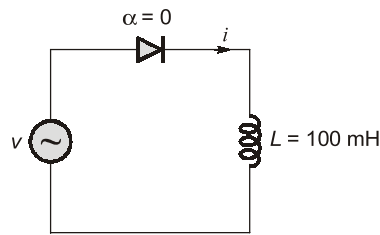
**End of Solution**

- Q.42** An ideal sinusoidal voltage source  $v(t) = 230\sqrt{2}\sin(2\pi \times 50t) \text{ V}$  feeds an ideal inductor  $L$  through an ideal SCR with firing angle  $\alpha = 0^\circ$ . If  $L = 100 \text{ mH}$ , then the peak of the inductor current, in ampere, is closest to



- (a) 10.35                      (b) 0  
(c) 7.32                      (d) 20.71

**Ans. (d)**



$$v = 230\sqrt{2} \sin(2\pi \cdot 50)$$

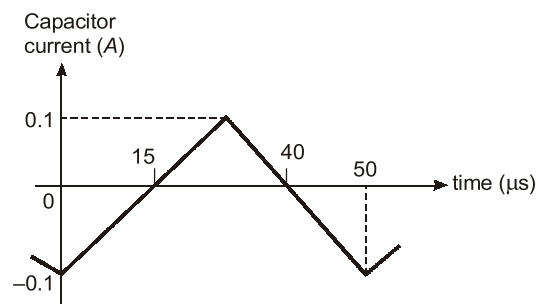
$$i = \frac{V_M}{\omega L} [1 - \cos \omega t]$$

$$i_{\text{peak}} = \frac{2V_m}{\omega L} = \frac{2 \times 230\sqrt{2}}{2\pi \times 50 \times 100 \times 10^{-3}} = 20.7 \text{ A}$$

at  $\omega t = \pi$

**End of Solution**

**Q.43** The steady state capacitor current of a conventional DC-DC buck converter, working in CCM, is shown in one switching cycle. If the input voltage is 30 V, the value of the inductor used, in mH, is \_\_\_\_ (round off to one decimal place).



**Ans. (1.8)**

DC-DC Buck Converter:

$$\Delta I_L = \Delta I_C = 0.2 \text{ A}$$

$$f = \frac{1}{T} = \frac{1}{50 \cdot 10^{-6}}$$



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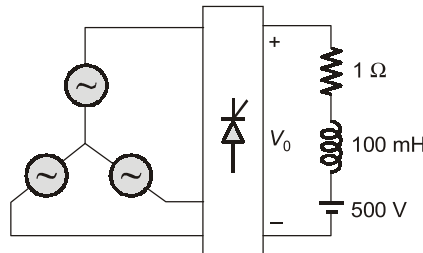




**Q.45** In the following circuit, the average voltage

$$V_0 = 400 \left( 1 + \frac{\cos \alpha}{3} \right) \text{ V}$$

where  $\alpha$  is the firing angle. If the power dissipated in the resistor is 64 W, then the closest value of  $\alpha$  in degrees is



(a) 35.9

(b) 46.4

(c) 41.4

(d) 0

**Ans. (a)**

$$P_R = I_{or}^2 R = 64 \text{ W}$$

$$I_{or}^2 \times 1 = 64$$

$$I_{or} = 8 \text{ A} = I_0$$

$$V_0 = E + I_0 R$$

( $\because$  Current is ripple free)

$$400 \left[ 1 + \frac{\cos \alpha}{3} \right] = 500 + 8 \times 1 = 508$$

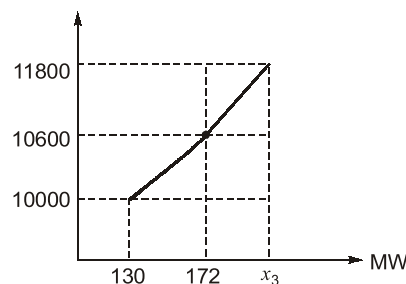
$$\alpha = 35.9^\circ$$

**End of Solution**

## POWER SYSTEMS

**Q.46** Two units, rated at 100 MW and 150 MW, are enabled for economic load dispatch. When the overall incremental cost is 10,000 Rs./MWh, the units are dispatched to 50 MW and 80 MW respectively. At an overall incremental cost of 10,600 Rs./MWh, the power output of the units are 80 MW and 92 MW, respectively. The total plant MW-output (without overloading any unit) at an overall incremental cost of 11,800 Rs./MWh is \_\_\_\_\_ (round off to the nearest integer)

**Ans. (250)**



**ESE 2025**  
**Prelims**

**Offline**  
**Test Series**



Commencing from  
**9 Mar 2025**

**Total 22 Tests**

**Paper-I : 11 Tests**  
**GS & Engineering Aptitude**

- 8 Multiple Subject Tests of 50 Questions (**400 Ques**)  
Time : 60 minutes
- +
- 1 Full Syllabus Test of 100 Questions (**300 Ques**)  
Time : 120 minutes
- +
- **2 Anubhav Tests**  
Full Syllabus

**Paper-II : 11 Tests**  
**Engineering Discipline**

- 8 Multiple Subject Tests of 75 Questions (**600 Ques**)  
Time : 90 minutes
- +
- 1 Full Syllabus Test of 150 Questions (**450 Ques**)  
Time : 180 minutes
- +
- **2 Anubhav Tests**  
Full Syllabus

**Each question carries 2 marks**

**Negative marking = 2/3 marks**



**Latest Pattern**

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$$\frac{10600 - 10000}{172 - 130} = \frac{11800 - 10600}{x_3 - 172}$$

$$x_3 = 250 \text{ MW (Limited to max)}$$

$$\text{Proof} = 150 + 100 = 250 \text{ MW}$$

**End of Solution**

**Q.47** A 3-bus system (in pu) has bus impedance matrix

$$Z_{\text{bus}} = \begin{bmatrix} j0.059 & j0.061 & j0.038 \\ j0.061 & j0.093 & j0.066 \\ j0.038 & j0.066 & j0.110 \end{bmatrix}$$

A symmetrical fault (through a fault impedance of  $j0.007$  p.u.) occurs at bus-2. Neglecting pre-fault loading conditions, the voltage at bus-1, during the fault is \_\_\_\_\_ p.u.

**Ans. (0.39)**

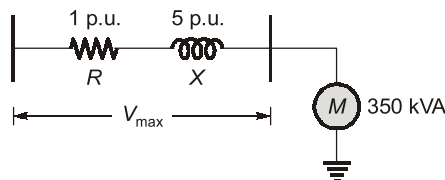
$$V_2 = V_1 - I_f Z_{12} = V_1 - \frac{1}{(Z_{22} + Z_f)} \times Z_{12}$$

$$= 1 \angle 0^\circ - \frac{1}{j(0.007 + 0.93)} \times j0.061 = 0.39$$

**End of Solution**

**Q.48** Consider a feeder, with  $R/X$  ratio of 5. Connected with a load of 300 kVA at receiving end. The maximum voltage drop will occur from the sending end to the receiving end, when the power factor of the load is \_\_\_\_\_.

**Ans. (0.9805)**



$$R \cos \phi + \sin \phi = -R \sin \phi + \cos \phi = 0$$

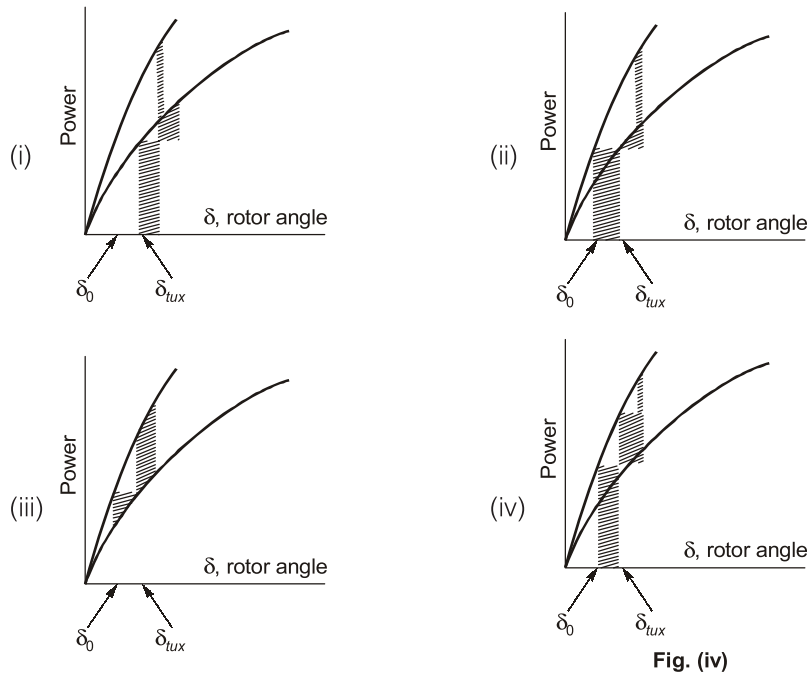
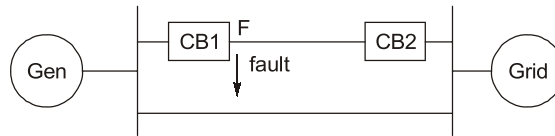
$$\tan \phi = \frac{X}{R}$$

$$\phi = \tan^{-1} \left( \frac{X}{R} \right) = \tan^{-1} \left[ \frac{1}{5} \right] = 11.31^\circ$$

$$\cos \phi = \cos \left[ \tan^{-1} \left( \frac{X}{R} \right) \right] = 0.9805$$

**End of Solution**

**Q.49** The generator was initially supplying power to the grid. A temporary LLLG bolted fault occurs at F very close to circuit breaker auto reclosed. The circuit breakers open to isolate the line. The fault self-clears. The circuit breakers reclose and restore the line. The rotor accelerating and decelerating areas?



- (a) Fig. (iii)  
(b) Fig. (ii)  
(c) Fig. (iv)  
(d) Fig. (i)

Ans. (b)

End of Solution

**Q.50** During a power failure, a domestic household uninterruptible power supply (UPS) supplies AC power to a limited number of lights and fans in various rooms. As per a Newton-Raphson load-flow formulation, the UPS would be represented as a

- (a) PQ bus  
(b) Slack bus  
(c) PQV bus  
(d) PV bus

Ans. (b)

End of Solution



**UPPSC-AE**  
**2024** Preliminary  
Examination

**Online  
Test Series**

Commencing from  
**20<sup>th</sup> FEB'25**

**Total 10 Tests** (Total 1125 Questions)

5 Part Syllabus Tests + 5 Full Syllabus Tests

**Paper Pattern:**

- Each question carries 2 Marks
- There is a penalty of 0.66 Mark for every wrong answer.

**Test Series Features:**

- Quality questions as per UPPSC-AE standard and pattern.
- Step by step detailed solutions for tough questions.
- Detailed performance analysis report.

**Stream : CE, ME, EE**

**Test Series Schedule**

Test No.	Activate Date	Total Questions	Total Time	Test Type	Syllabus Covered
1	20 <sup>th</sup> Feb 2025	75 Qs	1 Hour	Part Syllabus Test	General Principles of Design and Drawing, Industrial Safety and Safety Standards, Engineering Materials, Quality Control, Types of Machinery and Maintenance, Production and Construction, Handling and Storage of Products
2	27 <sup>th</sup> Feb 2025	75 Qs	1 Hour	Part Syllabus Test	Basics of project Management, Information and communication technologies, Ethics and values in engineering profession, intellectual property rights, Role of science and technology in daily life, recent developments in applied sciences, basics of artificial intelligence and robotics
3	6 <sup>th</sup> Mar 2025	75 Qs	1 Hour	Part Syllabus Test	Green Energy, Energy conversion principles, Climate change, Disaster Management, Basics of thermodynamics, Water resources and conservation processes, Basics of measurement and instrumentation, Human health and sanitation
4	13 <sup>th</sup> Mar 2025	75 Qs	1 Hour	Part Syllabus Test	General Hindi
5	20 <sup>th</sup> Mar 2025	75 Qs	1 Hour	Part Syllabus Test	Indian History, Indian Polity, Geography, GK & Miscellaneous and Current Affairs
6	27 <sup>th</sup> Mar 2025	150 Qs	2 Hours	Full Syllabus Test	Full Syllabus Test (100 Qs. Engineering Aptitude + 25 Hindi + 25 General Studies)
7	3 <sup>rd</sup> Apr 2025	150 Qs	2 Hours	Full Syllabus Test	Full Syllabus Test (100 Qs. Engineering Aptitude + 25 Hindi + 25 General Studies)
8	5 <sup>th</sup> Apr 2025	150 Qs	2 Hours	Full Syllabus Test	Full Syllabus Test (100 Qs. Engineering Aptitude + 25 Hindi + 25 General Studies)
9	8 <sup>th</sup> Apr 2025	150 Qs	2 Hours	Full Syllabus Test	Full Syllabus Test (100 Qs. Engineering Aptitude + 25 Hindi + 25 General Studies)
10	11 <sup>th</sup> Apr 2025	150 Qs	2 Hours	Full Syllabus Test	Full Syllabus Test (100 Qs. Engineering Aptitude + 25 Hindi + 25 General Studies)

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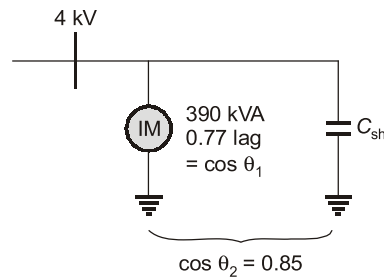
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**Q.51** Using shunt capacitors, the power factor of a 3-phase, 4 kV induction motor (drawing 390 kVA at 0.77 pf lag) is to be improved to 0.85 pf lag. The line current of the capacitor bank, in A, which is connected in parallel to load is \_\_\_\_\_.

**Ans.** (9.054 A)



$$\cos\theta_1 = 0.77, \theta_1 = 39.64^\circ$$

$$\cos\theta = 0.85, \theta_2 = 31.79^\circ$$

$$Q_c = P_1 [\tan\theta_1 - \tan\theta_2]$$

$$= 390 \times 10^3 \times 0.77 [\tan \cos^{-1} 0.77 - \tan \cos^{-1} 0.85]$$

$$= 62.73 \text{ KVAR} = 3 V_{ph} I_{ph} \sin\theta_2$$

$$I_{ph} = \frac{62.73 \times 10^3}{3 \times \frac{4 \times 10^3}{\sqrt{3}}} = 9.054 \text{ A}$$

**End of Solution**

## SIGNAL AND SYSTEMS

**Q.52** A continuous time periodic signal  $x(t)$  is

$$x(t) = 1 + 2 \cos 2\pi t + 2 \cos 4\pi t + 2 \cos 6\pi t$$

If  $T$  is the period of  $x(t)$ , then  $\frac{1}{T} \int_0^T |x(t)|^2 dt = \underline{\hspace{2cm}}$  (round off to the nearest integer).

**Ans.** (7)

$$\frac{1}{T} \int_0^T |x(t)|^2 dt = \text{Power of } x(t)$$

$$= 1 + \frac{2^2}{2} + \frac{2^2}{2} + \frac{2^2}{2}$$

$$= 1 + 2 + 2 + 2 = 7$$

**End of Solution**

**Q.53** Consider the LTI system 'S' where  $y(n) = S[x(n)]$ . Let  $S\{\delta[n]\} = \begin{cases} 1, & n \in \{0, 1, 2\} \\ 0, & \text{otherwise} \end{cases}$

where  $\delta[n]$  is the discrete-time unit impulse function. For an input signal  $x[n]$ , the output  $y[n]$  is

- (a)  $x[n] + x[n + 1] + x[n + 2]$
- (b)  $x[n] + x[n - 1] + x[n - 2]$
- (c)  $x[n + 1] + x[n + 2] + x[n + 3]$
- (d)  $x[n - 1] + x[n] + x[n + 1]$

**Ans. (b)**

Given that the system is LTI and for i/p  $\delta(n) \xrightarrow{\text{system}}$  O/P = {1, 1, 1}

i.e.,  $h(n)$  = impulse response of system  
 $= \delta(n) + \delta(n - 1) + \delta(n - 2)$

As we know,  $y(n) = x(n) * h(n)$   
 $= x(n) * [\delta(n) + \delta(n - 1) + \delta(n - 2)]$   
 $= x(n) + x(n - 1) + x(n - 2)$

**End of Solution**

**Q.54** Consider a continuous-time signal

$$x(t) = -t^2 \{u(t + 4) - u(t - 4)\}$$

where  $u(t)$  is the continuous-time unit step function. Let  $\delta(t)$  be the continuous-time unit impulse function. The value of

$$\int_{-\infty}^{\infty} x(t) \delta(t + 3) dt$$

is

- (a) 9
- (b) 3
- (c) -9
- (d) -3

**Ans. (c)**

$$\begin{aligned} I &= \int_{-\infty}^{\infty} x(t) \delta(t + 3) dt = x(-3) \\ &= \{-t^2 [u(t + 4) - u(t - 4)]\}_{t=-3} \\ &= -(-3)^2 [u(1) - u(-7)] \\ &= -9[1 - 0] = -9 \end{aligned}$$

**End of Solution**

# RRB-JE

## CBT-2 | 2024 Exam

### Online Test Series



Launching

## 10 Full Syllabus Tests (Total 1500 Questions)

Commencing from **11<sup>th</sup> FEB 2025** | Stream : **CE, ME, EE, EC**

#### Paper Pattern:

- ➔ Each question carries 1 Mark.
- ➔ There will be a negative marking of 1/3<sup>rd</sup> Mark for every wrong answer.

#### Test Series Features:

- ➔ Questions crafted to align with the RRB-JE syllabus and exam format.
- ➔ Comprehensive, step-by-step solutions for tough questions.
- ➔ Detailed performance analysis report to track your progress.

RRB JE CBT 2 Exam Pattern 2024	Subject	No. of Questions	Marks	Duration
	General Awareness	15	15	120 Mins
	Physics & Chemistry	15	15	
	Basics of Computers and Applications	10	10	
	Basics of Environment and Pollution Control	10	10	
	<b>Technical Abilities (CE/ME/EE/EC)</b>	<b>100</b>	<b>100</b>	
	<b>Total</b>	<b>150</b>	<b>150</b>	

Test Series Schedule	Test No.	Activate Date	Total Marks	Total Questions	Total Time
	1	11 <sup>th</sup> Feb 2025	150 Marks	150 Qs	2 Hours
	2	14 <sup>th</sup> Feb 2025	150 Marks	150 Qs	2 Hours
	3	18 <sup>th</sup> Feb 2025	150 Marks	150 Qs	2 Hours
	4	21 <sup>st</sup> Feb 2025	150 Marks	150 Qs	2 Hours
	5	25 <sup>th</sup> Feb 2025	150 Marks	150 Qs	2 Hours
	6	28 <sup>th</sup> Feb 2025	150 Marks	150 Qs	2 Hours
	7	4 <sup>th</sup> Mar 2025	150 Marks	150 Qs	2 Hours
	8	7 <sup>th</sup> Mar 2025	150 Marks	150 Qs	2 Hours
	9	11 <sup>th</sup> Mar 2025	150 Marks	150 Qs	2 Hours
	10	14 <sup>th</sup> Mar 2025	150 Marks	150 Qs	2 Hours

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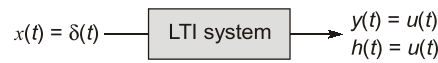
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Ans. (b)



End of Solution

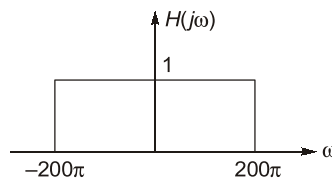
**Q.57** An ideal low pass filter has frequency response given by

$$H(j\omega) = \begin{cases} 1, & |\omega| \leq 200\pi \\ 0, & \text{otherwise} \end{cases}$$

Let  $h(t)$  be its time domain representation. Then  $h(0) = \underline{\hspace{2cm}}$  (round off to the nearest integer)

Ans. (200)

1<sup>st</sup> Method :



$$H(j\omega) = \text{rec}\left(\frac{\omega}{400\pi}\right)$$

$$h(t) = \frac{\sin(200\pi t)}{\pi t} = \frac{200\sin(200\pi t)}{200\pi t}$$

$$h(t)|_{t=0} = 200$$

2<sup>nd</sup> Method :

$$h(0) = \frac{1}{2\pi} \int_{-\infty}^{+\infty} H(j\omega) d\omega$$

$$h(0) = \frac{1}{2\pi} \int_{-200\pi}^{200\pi} 1 d\omega = \frac{1}{2\pi} [400\pi] = 200$$

End of Solution



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