

Harsh Anand
Course: GATE+ESE
Electrical Engineering (EE)

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ADVANCE : MICROPROCESSORS, EMT - REPORTS

OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(33) | CORRECT(0) | INCORRECT(0) | SKIPPED(33)

Q. 1

A infinite length line charge described by $x = 2$ m and y = −4 m, having uniform charge density ρ_L = 20 nC/m. The electric field at point (−2, −1, 4) m is given by

FAQ | Solution Video | Have any Doubt ?

A $(-43.2\hat{a}_x + 57.6\hat{a}_y)$ V/m

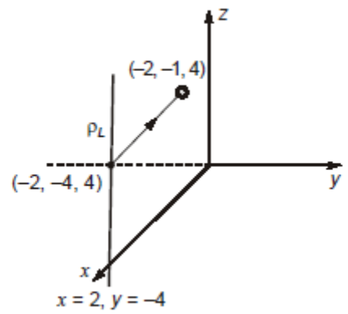
B $(43.2\hat{a}_x - 57.6\hat{a}_y)$ V/m

C $(-57.6\hat{a}_x + 43.2\hat{a}_y)$ V/m — Correct Option

Solution :

(c)

Consider the diagram shown below:



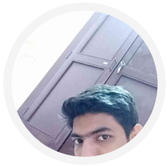
Since line charge is parallel to *z*-axis. The foot of perpendicular from (–2, –1, 4) to the line is at (2, –4, 4). Required vector and unit vector is,

$$\bar{R} = -4\hat{a}_x + 3\hat{a}_y ;$$

$$\vec{a}_R = \frac{-4\hat{a}_x + 3\hat{a}_y}{5}$$

The electric field intensity $\bar{E}$ due to infinite line charge is;

$$\bar{E} = \frac{\rho_L}{2\pi\varepsilon_0 R}\hat{a}_R = \frac{20\times10^{-9}}{2\pi\times\frac{10^{-9}}{}\times 5}\left(\frac{-4\hat{a}_x + 3\hat{a}_y}{5}\right)$$



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D $(57.6\dot{a}_x - 42.5\dot{a}_y)$ V/m

QUESTION ANALYTICS

Q. 2

Given the general vector $\vec{A} = (\sin 2\phi)\dot{a}_\phi$ in cylindrical co-ordinate system, then the curl of vector $\vec{A}$ at $(2, \pi/4, 0)$ is

FAQ | Solution Video | Have any Doubt ?

A $0.8\dot{a}_z$

B $-0.5\dot{a}_z$

C $1.5\dot{a}_z$

D $0.5\dot{a}_z$ Correct Option

Solution :
(d)
In cylindrical coordinate system:

$$\nabla \times \vec{A} = \frac{1}{\rho}\begin{vmatrix} \dot{a}_\rho & \rho\dot{a}_\phi & \dot{a}_z \\ \frac{\partial}{\partial\rho} & \frac{\partial}{\partial\phi} & \frac{\partial}{\partial z} \\ A_\rho & A_\phi & A_z \end{vmatrix} = \frac{1}{\rho}\begin{vmatrix} \dot{a}_\rho & \rho\dot{a}_\phi & \dot{a}_z \\ \frac{\partial}{\partial\rho} & \frac{\partial}{\partial\phi} & \frac{\partial}{\partial z} \\ 0 & \rho\sin 2\phi & 0 \end{vmatrix}$$

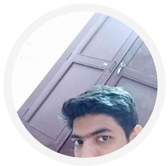
$$= \frac{1}{\rho}\left[\dot{a}_\rho(0) - \rho\dot{a}_\phi(0) + \dot{a}_z\frac{\partial}{\partial\rho}(\rho\sin 2\phi)\right] = \frac{1}{\rho}(\sin 2\phi)\dot{a}_z$$

at point $P(2, \pi/4, 0)$,

$$\nabla \times \vec{A} = \frac{1}{2}\sin\left(2\times\frac{\pi}{4}\right)\dot{a}_z = 0.5\dot{a}_z$$

QUESTION ANALYTICS

Q. 3



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A $x\hat{a}_x + y\hat{a}_y + z\hat{a}_z$

B $x\hat{a}_x - y\hat{a}_y + z\hat{a}_z$

C $y\hat{a}_x + x\hat{a}_y + z\hat{a}_z$

D $y\hat{a}_x - x\hat{a}_y + z\hat{a}_z$ **Correct Option**

Solution :
(d)

Let vector $\vec{B}$ in Cartesian system be;

$$\vec{B} = B_x\hat{a}_x + B_y\hat{a}_y + B_z\hat{a}_z$$

Where,

$$B_x = \vec{B}\cdot\hat{a}_x = \left(-\rho\hat{a}_\phi + z\hat{a}_z\right)\cdot\hat{a}_x$$
$$= +\rho\sin\phi$$
$$B_y = \vec{B}\cdot\hat{a}_y = (-\rho a_\phi + z\hat{a}_z)\cdot\hat{a}_y$$
$$= -\rho\cos\phi$$
$$B_z = \vec{B}\cdot\hat{a}_z = z$$

As we use the relation,

$$x = \rho\cos\phi$$

and

$$y = \rho\sin\phi$$

then,

$$B_x = \rho\times\frac{y}{\rho} = y$$

$$B_y = -\rho\times\frac{x}{\rho} = -x$$

$$B_z = z$$

then the vector,

$$\vec{B} = y\hat{a}_x - x\hat{a}_y + z\hat{a}_z$$

QUESTION ANALYTICS

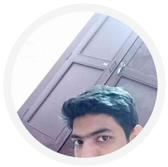
Q. 4

The given vector field $\vec{A} = yz\hat{a}_x + z_x\hat{a}_y + xy\hat{a}_z$ is,

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A irrotational and solenoidal **Correct Option**

Solution :
(a)



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$$\nabla \times \vec{A} = \begin{vmatrix} \dot{a}_x & \dot{a}_y & \dot{a}_z \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ yz & zx & xy \end{vmatrix}$$

$$= \dot{a}_x\left[\frac{\partial}{\partial y}(xy) - \frac{\partial}{\partial z}(zx)\right] - \dot{a}_y\left[\frac{\partial}{\partial x}(xy) - \frac{\partial}{\partial z}(yz)\right] + \dot{a}_z\left[\frac{\partial}{\partial x}(zx) - \frac{\partial}{\partial y}(yz)\right]$$

$$\nabla \times \vec{A} = 0 + 0 + 0 = 0$$

For vector $\vec{A}$ to be solenoidal, its divergence must be zero

$$\nabla \times \vec{A} = 0$$

$$\nabla \times \vec{A} = \frac{\partial}{\partial x}(yz) + \frac{\partial}{\partial y}(zx) + \frac{\partial}{\partial z}(xy) = 0$$

Therefore option (a) is correct.

B rotational and non solenoidal

C rotational and solenoidal

D irrotational and non solenoidal

QUESTION ANALYTICS

Q. 5

An 8085 microprocessor is to operate at 4.5 MHz clock frequency. The required crystal frequency will be

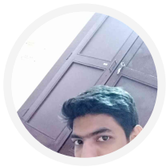
FAQ | Solution Video | Have any Doubt ?

A 4.5 MHz

B 2.25 MHz

C 9 MHz — Correct Option

Solution :
(c)
Crystal frequency will be twice the operating frequency of 8085 microprocessor.
i.e., $f_{crystal} = 2f = 2 \times 4.5\ \text{MHz} = 9\ \text{MHz}$



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Q. 6

Consider the following 8085 assembly language program:

```
MVI A, 09 H
RLC
MOV B, A
RLC
RLC
ADD B
HLT
```

The content in Accumulator after execution of the above program will be

FAQ | Solution Video | Have any Doubt ?

A 4A H

B 90 H

C $(83)_{10}$

D $(90)_{10}$ **Correct Option**

Solution :
(d)

MVI A, 09 H

RLC → 00001001 → 00010010

MOV B, A → B: 12 H

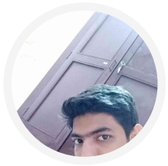
RLC → 00010010 → 00100100

RLC → 00100100 → 01001000

ADD B → 01001000 + 00010010 = 01011010 → 5A H

∴ A = 5A H = $(90)_{10}$

QUESTION ANALYTICS



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Consider the following 8085 assembly language program:

```
MVI A, 8F H
MVI B, 68 H
SUB B
ANI 0F H
STA 2070 H
HLT
```

After executing the above program, the value stored in the memory location 2070 H is

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A 27 H

B 07 H — Correct Option

Solution :
(b)

```
MVI A, 8F H      →   A = 8F H
MVI B, 68 H      →   B = 68 H
SUB B            →   A = 8F H – 68 H = 27 H
ANI 0F H         →   A = 07 H
STA 2070 H       →   2070 H | 07 H
HLT
```

C 17 H

D 18 H

QUESTION ANALYTICS

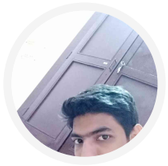
Q. 8

How many times the loop will be executed in the following program?

```
        LXI B, 0007 H
LOOP :  DCX B
        JNZ LOOP
        HLT
```

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A 7 times



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C 8 times

D infinite times — Correct Option

Solution :
(d)
Since 'DCX' instruction will not effect any flags, LOOP will be executed for infinite times.

QUESTION ANALYTICS

Q. 9

Identify the contents of accumulator and status of Carry flag after executing the following set of instructions:

```
MVI A, 7F H
ORA A
CPI A2 H
```

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A A = DD H ; Carry flag = 0

B A = 7F H ; Carry flag = 0

C A = DD H ; Carry flag = 1

D A = 7F H ; Carry flag = 1 — Correct Option

Solution :
(d)

MVI A, 7F H → A = 7F H

ORA A → A (OR) A = $\overset{A}{\boxed{7F\ H}}$

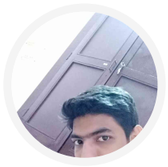
CPI A2 H → 7F H – A2 H = DD H and CY = 1

After compare instruction, A = 7F H, Carry flag = 1

QUESTION ANALYTICS

Q. 10

Consider the following statements regarding interrupts:



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A only (i) — Correct Option

Solution :
(a)
DI disable all interrupts except TRAP.

B only (ii)

C Both (i) and (ii)

D Neither (i) nor (ii)

QUESTION ANALYTICS

Q. 11

The divergence of the vector $\vec{A}$ which is given as follow,

$\vec{A} = 2r\cos\theta \cdot \cos\phi \hat{a}_r + r^{1/2}\hat{a}_\phi$ at point $\left(1, \frac{\pi}{6}, \frac{\pi}{3}\right)$ is _____ .

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2.60 (2.50 - 2.70) — Correct Option

Solution :
2.60 (2.50 - 2.70)

The given vector $\vec{A}$ is in spherical coordinates

$$\vec{A} = 2r\cos\theta \cdot \cos\phi \hat{a}_r + r^{1/2}\hat{a}_\phi$$

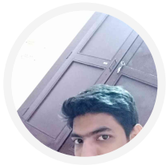
$$div.\vec{A} = \frac{1}{r^2}\frac{\partial}{\partial r}(r^2 \cdot A_r) + \frac{1}{r\sin\theta} \cdot \frac{\partial}{\partial \theta}(\sin\theta \cdot A_\theta) + \frac{1}{r\sin\theta}\frac{\partial A_\phi}{\partial \phi}$$

$$= \frac{1}{r^2}\frac{\partial}{\partial r}\left(2r^3\cos\theta\cos\phi\right) + 0 + \frac{1}{r\sin\theta}(0)$$

$$= 6\cos\theta\cos\phi$$

at point $\left(1, \frac{\pi}{6}, \frac{\pi}{3}\right)$;

$$\nabla \cdot \vec{A} = 6\cos\left(\frac{\pi}{6}\right)\cos\left(\frac{\pi}{3}\right) = 2.598 \approx 2.6$$



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Q. 12

Given points $A\ (x = 2, y = 3, z = -1)$ and $B\ (\rho = 4, \phi = -60°, z = 2)$. The distance between points A and B is _____ m.

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7.13 (7.00 - 7.30) — Correct Option

Solution :
7.13 (7.00 - 7.30)
The point A is given in Cartesian whereas point B is given is cylindrical coordinates.
Now converting point B in Cartesian coordinates

$$x = \rho \cos\phi = 4\cos(-60°) = 4 \times \frac{1}{2} = 2$$

$$y = \rho \sin\phi = 4\sin(-60°) = -4 \times \frac{\sqrt{3}}{2} = -3.464$$

$$z = z = 2$$

The distance between point A and B is,

$$= \sqrt{(2-2)^2 + (3+3.464)^2 + (-1-2)^2}$$

$$= \sqrt{41.785 + 9} = 7.13 \text{ m}$$

QUESTION ANALYTICS

Q. 13

The value of electric field $\vec{E}$ at $(\rho = 2, \phi = 40°, z = 3)$ is given as; $\vec{E} = 100\hat{a}_\rho - 200\hat{a}_\phi + 300\hat{a}_z$ V/m. The incremental work done required to move a 20 μC charge a distance of 6 μm in the direction of $\hat{a}_\phi$ is _____ nJ.

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24 — Correct Option

Solution :
24
The incremental work is given by:

$$dW = -Q \cdot \bar{E} \cdot dl$$

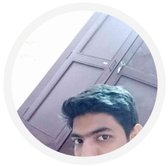
Now dl in the direction of $\hat{a}_\phi$;

$$d\bar{l} = r\,d\phi\,\hat{a}_\phi$$

$$= 6 \times 10^{-6}\hat{a}_\phi$$

Thus $\vec{E} \cdot d\bar{l} = -200 \times 6 \times 10^{-6} = -1200 \times 10^{-6}$

$dW = -20 \times 10^{-6} \times (-1200 \times 10^{-6})$



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QUESTION ANALYTICS

Q. 14

For a line charge $\rho_L = 10^{-9}$ C/m on the z-axis, the potential V_{AB} = _____ volt; where A is $\left(2, \frac{\pi}{2}, 0\right)$ m and B is $(4, \pi, 5)$ in cylindrical coordinates.

FAQ | Solution Video | Have any Doubt ?

12.48 (12.20 - 12.70) — Correct Option

Solution :
12.48 (12.20 - 12.70)
The potential is given by:

$$V_{AB} = -\int_B^A \bar{E} \cdot d\bar{l}$$

Now, we know that $\vec{E} = \frac{\rho_L}{2\pi\varepsilon_0\rho}\hat{a}_\rho$ for infinite line charge

$$\vec{E} = \frac{10^{-9}}{2\pi\left(\frac{10^{-9}}{36\pi}\right)\rho}\hat{a}_\rho = \frac{18}{\rho}\hat{a}_\rho \text{ V/m}$$

$$d\bar{l} = d\rho \cdot \hat{a}_\rho + \rho d\phi \hat{a}_\phi + dz\,\hat{a}_z$$

$$\bar{E} \cdot d\bar{l} = \frac{18}{\rho}d\rho$$

$$V_{AB} = -\int_4^2 \frac{18}{\rho}d\rho = [-18 ln\rho]_4^2 = -18[ln 2 - ln 4]$$

$$= 18\, ln\, 2 = 12.48 \text{ volts}$$

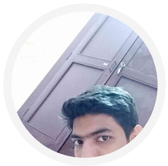
QUESTION ANALYTICS

Q. 15

The electric field intensity in polystyrenes $(\varepsilon_r = 2.55)$ filling the space between the plates of a parallel plate capacitor is 10 kV/m. The distance between the plates is 1.5 mm. The surface charge density of free charge on the plates is _____ ($\mu C/m^2$).

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0.23 (0.21 - 0.25) — Correct Option



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$$E_n = E = 10 \text{ kV/m}$$

The electric flux density;

$$D_n = \varepsilon E_n = \varepsilon_0 \varepsilon_r E$$

$$= \left(\frac{10^{-9}}{36\pi}\right) \times 2.55 \times 10 \times 10^3 = 0.23 \,\mu\text{C/m}^2$$

The charge density on the plates is,

$$\rho_s = D_n = 0.23 \,\mu\text{C/m}^2$$

QUESTION ANALYTICS

Q. 16

Consider the following 8085 microprocessor program :

```
MVI A, 5E H
ADI A2 H
MOV C, A
HLT
```

After execution of the above program, the number of flags set in the flag register of 8085 microprocessor is _____.

FAQ | Solution Video | Have any Doubt ?

4 — Correct Option

Solution :

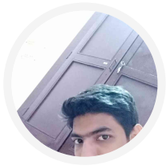
4

```
MVI A, 5E H          ;   A = 5E H
ADI A2 H             ;   [A] + A2 H = 5E H + A2 H
MOV C, A             ;   0 1 0 1 1 1 1 0
                         1 0 1 0 0 0 1 0
                         0 0 0 0 0 0 0 0
HLT
Carry flag ;          CY = 1  Set
Zero flag ;            Z = 1  Set
Parity flag ;          P = 1  Set
Auxiliary Carry flag ; AC = 1  Set
Sign flag ;            S = 0  Reset
```

QUESTION ANALYTICS

Q. 17

Point charges 1 mC and −2 mC are located at (3, 2, −1) and (−1, −1, 4) respectively. The electric force on a 10 nC charge located at (0, 3, 1)



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B $(8.82\hat{a}_x - 6.23\hat{a}_y + 8.64\hat{a}_z)$ mN

C $(-6.5\hat{a}_x - 3.72\hat{a}_y + 7.52\hat{a}_z)$ mN — Correct Option

Solution :

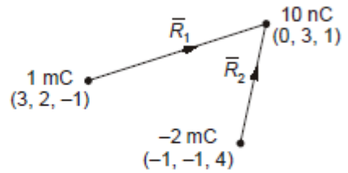
(c)

From the diagram shown below,

Required vectors are

$$\bar{R}_1 = -3\hat{a}_x + \hat{a}_y + 2\hat{a}_z$$

$$\hat{a}_{R1} = \frac{-3\hat{a}_x + \hat{a}_y + 2\hat{a}_z}{\sqrt{14}}$$



and $\bar{R}_2 = \hat{a}_x + 4\hat{a}_y - 3\hat{a}_z$

$$\hat{a}_{R2} = \frac{\hat{a}_x + 4\hat{a}_y - 3\hat{a}_z}{\sqrt{26}}$$

Force on 10 nC due to 1 mC charge is,

$$\bar{F}_1 = \frac{(10\times10^{-9})(1\times10^{-3})}{4\pi\varepsilon_0\left(\sqrt{14}\right)^2}\times\frac{-3\hat{a}_x + \hat{a}_y + 2\hat{a}_z}{\sqrt{14}}$$

$$= 1.72\left(-3\hat{a}_x + \hat{a}_y + 2\hat{a}_z\right)\times10^{-3}$$

$$\bar{F}_1 = -5.16\hat{a}_x + 1.72\hat{a}_y + 3.44\hat{a}_z \text{ (mN)}$$

Force on 10 nC due to –2 mC charge is,

$$\bar{F}_2 = 7\frac{(10\times10^{-9})\times(-2\times10^{-3})}{4\pi\varepsilon_0(\sqrt{26})^2}\times\frac{\hat{a}_x + 4\hat{a}_y - 3\hat{a}_z}{(\sqrt{26})}$$

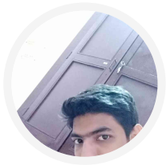
$$= -1.36\left(\hat{a}_x + 4\hat{a}_y - 3\hat{a}_z\right)\times10^{-3}$$

The force is obtained by superposition;

$$\bar{F} = \bar{F}_1 + \bar{F}_2 = \left(-6.52\hat{a}_x - 3.72\hat{a}_y + 7.52\hat{a}_z\right) \text{ mN}$$

D $(2.3\hat{a}_x + 3.6\hat{a}_y + 4.7\hat{a}_z)$ mN

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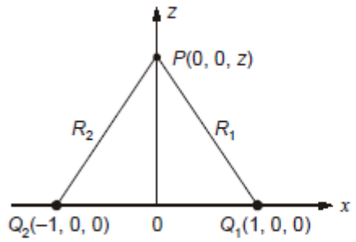
A $\dfrac{54z}{(z^2+1)^{1/2}}$

B $\dfrac{108z}{(z^2+1)^{3/2}}$ **Correct Option**

Solution :

(b)

Consider the diagram shown below:



Distance of Q_1 and Q_2 from point P are:

$$R_1 = R_2 = \sqrt{z^2+1}$$

Since, $Q_1 = Q_2$

and $R_1 = R_2$

Now, potential at P is twice that of single charge

$$V = 2\times\frac{Q}{4\pi\varepsilon_0 R_1}$$

$$= 2\times\frac{6\times10^{-9}}{4\pi\times\left(\frac{10^{-9}}{36\pi}\right)\sqrt{z^2+1}} = \frac{108}{\sqrt{z^2+1}} \text{ Volts}$$

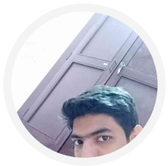
$$\frac{dV}{dz} = \frac{d}{dz}\left(\frac{108}{(z^2+1)^{1/2}}\right)$$

$$= 108\times\left[-\frac{1}{2}(z^2+1)^{-3/2}\right]\times 2z$$

$$\frac{dV}{dz} = \frac{-108z}{(z^2+1)^{3/2}};$$

$$\left|\frac{dV}{dz}\right| = \frac{108z}{(z^2+1)^{3/2}} \text{ V/m}$$

C $\dfrac{108z}{(z^2+1)^{1/2}}$



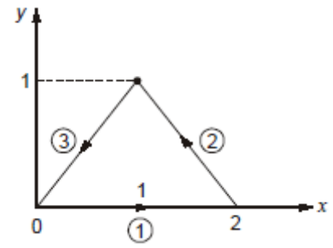
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QUESTION ANALYTICS

Q. 19

The conducting triangular loop shown in figure carries a current of 10 A. The magnetic field $\vec{H}$ at point (0, 0, 5) due to side 1 of the loop is,



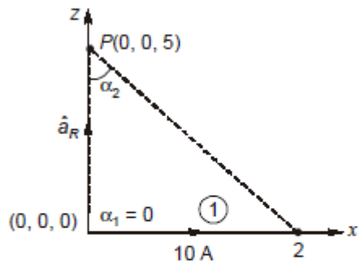
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A $+65.17\dot{a}_y$ (mA/m)

B $-59.11\dot{a}_y$ (mA/m) Correct Option

Solution :
(b)

Note here that the point of intrest is on z-axis and the side-1 of the triangular is on x-axis. So no need to consider other sides.



The perpendicular from point P on the current filament is at (0, 0, 0). The vector and unit vector in the direction of perpendicular towards point P is,

$$\bar{R} = 5\dot{a}_z$$

and $$\dot{a}_R = \dot{a}_z$$

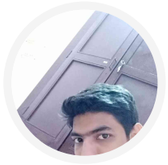
The angles made by ends of the filament with the perpendicular are (dotted line),

$$\alpha_1 = 0;$$

$$\alpha_2 = \tan^{-1}\left(\frac{2}{5}\right) = 21.80°$$

The current filament along x-axis gives

$$\dot{a}_l = \dot{a}_x$$



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$$\bar{H} = \frac{I}{4\pi R}[\sin\alpha_2 - \sin\alpha_1]\hat{a}_\phi$$

$$= \frac{10}{4\pi \times (5)}[\sin(21.80) - \sin(0)](-\hat{a}_y)$$

$$\bar{H} = -59.11\hat{a}_y \text{ (mA/m)}$$

C $-65.17\hat{a}_y$ (mA/m)

D $+79.13\hat{a}_y$ (mA/m)

QUESTION ANALYTICS

Q. 20

If $V = \frac{20\sin\theta}{r^3}$ Volts in spherical coordinates system then; volume charge density ρ_v at point $P(r = 2, \theta = 30°, \Phi = 0°)$ is;

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A 42.1 pC/m^3

B −20.2 pC/m^3

C −22.1 pC/m^3 **Correct Option**

Solution :
(c)

The Poisson's equation is,

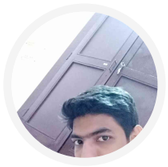
$$\nabla^2 V = -\frac{\rho_v}{\varepsilon_0}$$

Since V is not a function of ϕ, $\nabla^2 V$ in spherical coordinates reduces to;

$$\nabla^2 V = \frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial V}{\partial r}\right) + \frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial V}{\partial\theta}\right)$$

$$\nabla^2 V = \frac{1}{r^2}\frac{\partial}{\partial r}\left(-r^2 \times \frac{60\sin\theta}{r^4}\right) + \frac{1}{r^2\sin\theta}\cdot\frac{\partial}{\partial\theta}\left(\sin\theta\cdot\frac{20\cos\theta}{r^3}\right)$$

$$= \frac{1}{r^2}\frac{\partial}{\partial r}\left(-\frac{60\sin\theta}{r^2}\right) + \frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(\frac{10\sin 2\theta}{r^3}\right)$$



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$$\frac{}{r^5} + \frac{}{r^5 \sin\theta} - \frac{}{r^5 \sin\theta}$$

Now, $\nabla^2 V = -\frac{\rho_v}{\varepsilon_0}$

Then, $\rho_v = -\varepsilon_0 \left[\frac{20(4\sin^2\theta + 1)}{r^5 \sin\theta}\right]$

$$\rho_v|_{at\,p} = -\varepsilon_0 \left[\frac{20(4\sin^2 30° + 1)}{2^5 \sin 30°}\right]$$

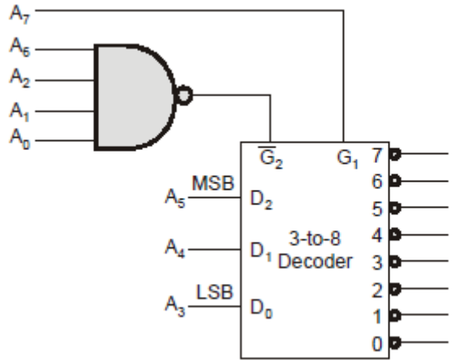
$$= -2.5\,\varepsilon_0 = -22.1\ \text{pC/m}^3$$

D $28.3\ \text{pC/m}^3$

QUESTION ANALYTICS

Q. 21

In the 3-to-8 decoder shown below, the output line that goes low when the input (A_7 A_6 .... A_0) to the decoder is (11110111) will be



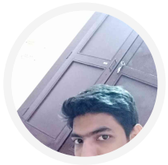
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A 6 **Correct Option**

Solution :
(a)
Since, the NAND gate have inputs A_0 A_1 A_2 A_6 all are 1s, output of NAND GATE is logic - 0.
Hence the 3 × 8 decoder is ON.
Inputs to decoder "A_5 A_4 A_3" are given as "110". Hence output line '6' is selected.

B 4

C 3



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QUESTION ANALYTICS

Q. 22

Consider the following set of instructions of an 8085 microprocessor:

MVI A, 09 H
ANI 0F H
RAR

After executing the above instructions, the status of Carry flag and Auxiliary carry flag is

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A Carry flag = 0 and Auxiliary carry flag = 0

B Carry flag = 0 and Auxiliary carry flag = 1

C Carry flag = 1 and Auxiliary carry flag = 0

D Carry flag = 1 and Auxiliary carry flag = 1 **Correct Option**

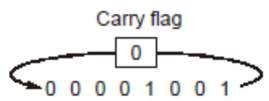
Solution :
(d)

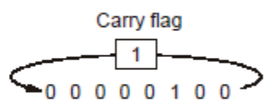
MVI A, 09 H → A: 09 H

ANI 0F H →
$$\begin{array}{r} 00001001 \\ 00001111 \\ \hline 00001001 \end{array}$$
; CY = 0 and AC = 1

After ANI 0F H instruction the Carry flag and Auxiliary Carry flag are 0 and 1 by default.

RAR →

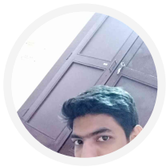




∴ Carry flag = 1

After RAR instruction, Carry flag = 1, Auxiliary Carry flag = 1.

QUESTION ANALYTICS



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Consider the following 8085 microprocessor program :

```
XRA A
MVI B, 4A H
SUI 4F H
ANA B
HLT
```

After execution of the above program, the content stored in register 'A' is

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A B1 H

B 4F H

C 00 H — Correct Option

Solution :
(c)

```
XRA A          ;   A = 00 H
MVI B, 4A H    ;   B = 4A H
SUI 4F H       ;   A – 4F H ⇒ A = B1 H
ANA B          ;   A (AND) B → A = 00 H
HLT
```

D 10 H

QUESTION ANALYTICS

Q. 24

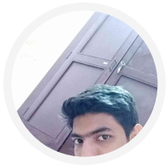
Consider an 8085 assembly language program :

```
MVI A, FF H
RAR
MOV B, A
RLC
RAL
XRI 0F H
RAR
HLT
```

The content of the accumulator after execution of the above program is
(Assume initially carry flag is cleared)

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A F9 H



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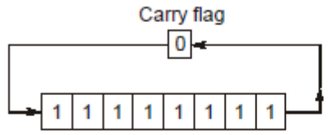
C 79 H

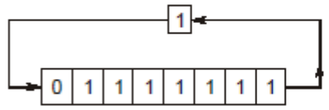
Correct Option

Solution :
(c)

MVI A, FF H ⇒ A = FF H

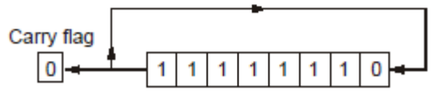
RAR



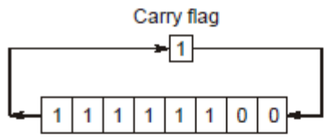


MOV B, A ⇒ B = 7F H

RLC

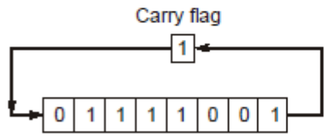


RAL



1 1 1 1 1 1 0 0
XRI 0F H ⇒ A → 0 0 0 0 1 1 1 1 ; CY = 0
1 1 1 1 0 0 1 1

RAR



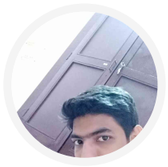
HLT
∴ A = 79 H

D 9F H

QUESTION ANALYTICS

Q. 25

Consider the following 8085 assembly language program:
LXI B, 8538 H



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```
MOV A, B
SBB D
MOV B, A
HLT
```

After execution of the above program, the content of BC pair is

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A 8538 H

B 6225 H

C 1323 H

D 2313 H — Correct Option

Solution :
(d)

```
LXI B, 8538 H        ;   BC = 8538 H
LXI D, 6225 H        ;   DE = 6225 H
MOV A, C             ;   A = 38 H
SUB E                ;   A – E = 38 – 25 = 13 H
MOV C, A             ;   C = 13 H
MOV A, B             ;   A = 85 H
SBB D                ;   A – D = 85 H – 62 H = 23 H
MOV B, A             ;   B = 23 H
HLT
```

QUESTION ANALYTICS

Q. 26

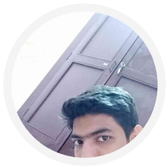
Consider the following 8085 microprocessor program:

```
LXI SP, 209F H
MVI C, 00 H
PUSH B
POP PSW
RET
```

After execution of the above program

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A Accumulator contains 20 H



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D Flag register contains 00 H — Correct Option

Solution :
(d)

```
LXI SP, 209F H      ;   SP = 209F H
MVI C, 00 H         ;   C = 00 H
PUSH B              ;   [B] → [209E H], [C] → [209D H]
POP PSW             ;   [209E H] → [A] and [209D H] → Flag register
RET
```

∴ Accumulator contains the contents of (209E H) and flag register contains the contents of (209D H) which is 00 H.

QUESTION ANALYTICS

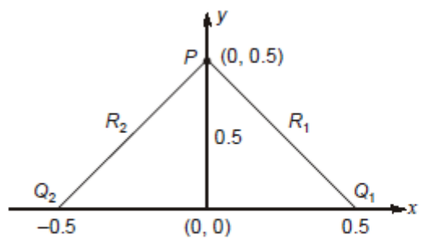
Q. 27

Two charges of same sign and magnitude of 1 μC are located 1 m apart. The potential at a point located midway between the two charges and 50 cm from the line connecting charges is, _____ k Volts.

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25.46 (25.30 - 25.70) — Correct Option

Solution :
25.46 (25.30 - 25.70)
Let the charges be placed in coordinate system as shown below,



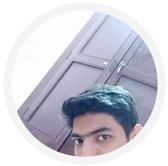
Here, $R_1 = R_2 = \sqrt{(0.5)^2 + (0.5)^2}$

$= 0.707$ m

and, $Q_1 = Q_2 = 1\ \mu C$

Potential at point P due to changes Q_1 is,

$$V_1 = \frac{Q_1}{4\pi\varepsilon_0 R_1} = \frac{1\times10^{-6}}{4\pi\left(\frac{10^{-9}}{36\pi}\right)\times0.707} = 12.73\ \text{kV}$$



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$$= 2 \times 12.73 = 25.46 \text{ kV}$$

QUESTION ANALYTICS

Q. 28

A pair of 200 mm long cocentric cylindrical conductors of radii 50 mm and 100 mm is filled with a dielectric of $\varepsilon = 10\,\varepsilon_0$. A voltage is applied between the conductors to establish an electric field $\bar{E} = \left(\frac{10}{\rho}\right)^2 \hat{a}_\rho$ V/m between the cylinder. The total energy stored in the cylinder is _____ $\times 10^{-6}$ Joules.

FAQ | Solution Video | Have any Doubt ?

83.33 (83.00 - 83.60) — Correct Option

Solution :
83.33 (83.00 - 83.60)
We have expression for energy stored as:

$$W_E = \frac{1}{2}\int_{vol} \varepsilon E^2 \cdot dV$$

Given data; $\varepsilon = 10\,\varepsilon_0$;

$$\vec{E} = \left(\frac{10}{\rho}\right)^2 \hat{a}_\rho \text{ V/m}$$

therefore, $$W_E = \frac{1}{2}(10\varepsilon_0)\iiint\left(\frac{10}{\rho}\right)^4 \rho d\rho d\phi dz$$

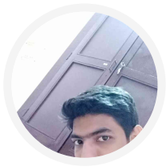
Cylinders dimensions are;

$$\rho_1 = 50 \times 10^{-3} \text{ m},$$
$$\rho_2 = 100 \times 10^{-3} \text{ m}$$
$$z = 200 \times 10^{-3}$$

$$W_E = \frac{1}{2}(10\varepsilon_0)\int_{\rho=0.05}^{0.1}\int_{\phi=0}^{2\pi}\int_{z=0}^{0.2}\left(\frac{10}{\rho}\right)^4 \rho \cdot d\rho d\phi dz$$

$$W_E = 5 \times \varepsilon_0 \times \int_{\rho=0.05}^{0.1}\frac{10^4}{\rho^3}d\rho \int_{\phi=0}^{2\pi} d\phi \int_{z=0}^{0.2} dz$$

$$= \frac{5 \times 10^4 \times 10^{-9}}{36\pi}\left[-\frac{\rho^{-2}}{2}\right]_{}^{0.1} \times 2\pi \times 0.2$$



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$$= \frac{300}{36} \times 10^{-5} = 83.33\ \mu J$$

QUESTION ANALYTICS

Q. 29

The vector current density is given by;

$$\bar{J} = \left(\frac{4}{r^2}\right)\cos\theta \hat{a}_r + 20e^{-2r}\sin\theta \hat{a}_\theta - r\sin\theta\cos\phi \hat{a}_\phi \ \text{A/m}$$

The total current passing through the spherical capacitor $(r = 3, 0° < 30°, 0 < \phi < 2\pi)$ is _____ Amp.

FAQ | Solution Video | Have any Doubt ?

3.14 (3.00 - 3.40) — Correct Option

Solution :
3.14 (3.00 - 3.40)

To the surface, $r = 3$; $\hat{a}_r$ is perpendicular

Hence, $\overline{ds} = r^2 \sin\theta d\theta d\phi \cdot \hat{a}_r$

Now, $\bar{J} \cdot \overline{ds} = \left(\frac{4}{r^2}\right)\cos\theta \times r^2 \sin\theta d\theta d\phi$

$= 4 \sin\theta \cdot \cos\theta \cdot d\theta d\phi$

$= 2 \sin 2\theta\ d\theta\ d\phi$

Total current $= \oint \bar{J} \cdot \overline{ds}$

$$I = \int_{\theta=0}^{30°} \int_{\phi=0}^{2\pi} 2\sin 2\theta d\theta d\phi$$

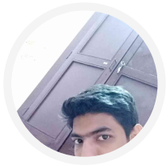
$$I = 2\left[-\frac{\cos 2\theta}{2}\right]_{0°}^{30°} \times [2\pi - 0]$$

$$= [-\cos 60° + \cos 0°] \times 2\pi$$

$$= \left[-\frac{1}{2} + 1\right] \times 2\pi = 3.14 \text{ Amp}$$

QUESTION ANALYTICS

Q. 30



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-41.41 (-42.50 - -40.50)

Correct Option

Solution :
-41.41 (-42.50 - -40.50)

Given, $V = 6\rho\phi z$

Poisson's equation, $\nabla^2 V = -\frac{\rho_v}{\varepsilon_0}$

In cylindrical system;

$$\nabla^2 V = \frac{1}{\rho}\cdot\frac{\partial}{\partial\rho}\left(\rho\frac{\partial V}{\partial\rho}\right)+\frac{1}{\rho^2}\frac{\partial^2 V}{\partial\phi^2}+\frac{\partial^2 V}{\partial z^2} \quad ...(i)$$

Differentiating the given V to obtain each term;

$$\frac{\partial V}{\partial\rho} = 6\phi z;$$

$$\frac{\partial}{\partial\rho}\left(\rho\frac{\partial V}{\partial\rho}\right) = \frac{\partial}{\partial\rho}(6\rho\phi z) = 6\phi z$$

$$\frac{\partial V}{\partial\phi} = 6\rho z; \qquad \frac{\partial^2 V}{\partial\phi^2} = 0$$

$$\frac{\partial V}{\partial z} = 6\rho\phi; \qquad \frac{\partial^2 V}{\partial z^2} = 0$$

Putting these values to the equation (i), we get

$$\frac{6\phi z}{\rho}+0+0 = -\frac{\rho_v}{\varepsilon_0}$$

$$\rho_v = -\varepsilon_0\left(\frac{6\phi z}{\rho}\right)$$

$$\rho_v\big|_{at\,P} = \left(-\frac{10^{-9}}{36\pi}\right)\times\frac{6\times1.249\times1}{1.6}$$

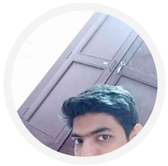
$$= -41.41\ \text{pC/m}^3$$

QUESTION ANALYTICS

Q. 31

Consider the following assembly language program of an 8085 microprocessor:

```
        LXI B, 1001 H
LOOP :  DCX B
        MOV A, C
        ORA B
        JNZ LOOP
```



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4097 Correct Option

Solution :
4097

```
        LXI B, 1001 H      ;    BC = 1001 H
LOOP :  DCX B              ;    BC = 1000 H
        MOV A, C           ;    A = 00 H
        ORA B              ;    A (or) 10 H = 10 H
        JNZ LOOP           ;    Zero flag, Z = 0 ⇒ Z will be 1 when both B and C has 00 H
        HLT
```

To set the zero flag (Z), the loop will execute 1001 H (or) 4097 times.

QUESTION ANALYTICS

Q. 32

Consider the following 8085 microprocessor program:

```
        MVI A, 17 H
LOOP :  ORA A
        RRC
        JNC LOOP
        HLT
```

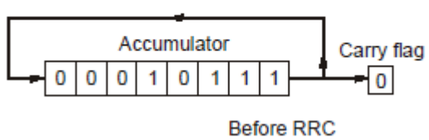
In the above program, the "LOOP" will execute for _____ times.

FAQ | Solution Video | Have any Doubt ?

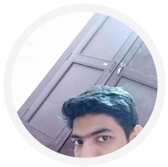
1 Correct Option

Solution :
1

```
        MVI A, 17 H        ;    A = 17 H
LOOP :  ORA A              ;    A (or) A = A = 17 H ; Carry flag = 0
        RRC                ;
        JNC LOOP           ;    CY = 1 (Condition not satisfied)
        HLT
```



Hence, the LOOP will execute only one time.



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Q. 33

In an 8085 microprocessor program, the following set of instructions are executed:

```
        XRA A
LOOP :  MVI B, 64 H
        NOP
        DCR B
        JNZ LOOP
        HLT
```

The LOOP will execute for _____ times.

FAQ | Solution Video | Have any Doubt ?

100

Correct Option

Solution :
100
$B = 64\ H = (100)_{10}$
Hence for 100 times the LOOP will execute.

QUESTION ANALYTICS