Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No......................................

Faculty of Engineering

End Sem (Even) Examination May-2019

EN3BS02 Engineering Mathematics-II

Programme: B.Tech. Branch/Specialisation: All

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1

i. The value of the integral $\int_0^\infty e^{-3t}\sin t\,dt$ is **1**

(a) $9/10$ (b) $1/10$ (c) $3/10$ (d) $7/10$

ii. The inverse Laplace transform of the function $\frac{1}{s(s+1)}$ is **1**

(a) $1+e^{-t}$ (b) $1-e^{t}$ (c) e^{-t} (d) $1-e^{-t}$

iii. The constant term in Fourier series of $f(x)=x^3$ in the interval $(-l, l)$ **1**

(a) $l/2$ (b) l (c) 0 (d) None of these

iv. If $\overline{f}(s)$ is the complex Fourier transform of $f(x)$, then the complex Fourier transform of $f(x-a)$ is **1**

(a) $e^{isa}\overline{f}(s)$ (b) $e^{-isa}\overline{f}(s)$

(c) $e^{-isa}\overline{f}(s/a)$ (d) $e^{isa}\overline{f}(s/a)$

v. The partial differential equation from the relation $z=ax+by$, where a and b are arbitrary constants is **1**

(a) $px+qy=0$ (b) $z=p+qy$

(c) $z=px+qy$ (d) $z=pq$

vi. The complete solution of partial differential equation $pq=5$ is **1**

(a) $z=ax+(5/a)y+b$ (b) $z=ax+5ay+b$

(c) $z=ax+(a/5)y+b$ (d) None of these

vii. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, then $curl\vec{r}$ is **1**

(a) $3i+4j$ (b) $\vec{0}$ (c) $8i-9j+11k$ (d) None of these

viii. If $\phi(x, y, z) = xyz$, then $grad\phi$ at (1, 1, 1) is **1**

(a) $\hat{i}+\hat{j}-\hat{k}$ (b) $\hat{i}-\hat{j}+\hat{k}$ (c) $\hat{i}+\hat{j}+\hat{k}$ (d) None of these

ix. Which of the following is continuous random variable? **1**

(a) Age (b) Weight (c) Height (d) All of these

x. Which of the following is discrete theoretical distribution? **1**

(a) Binomial distribution (b) Normal distribution
(c) Exponential distribution (d) None of these

Q.2 i. Write the existence and uniqueness condition for the Laplace transform. **3**

ii. Find the Laplace transform of $\left(\frac{1-\cos t}{t^2}\right)$. **7**

OR iii. Solve by Laplace transform $(D^2+9)y = \cos 2t;\ y(0)=1,\ y(\pi/2) = -1$. **7**

Q.3 i. State Dirichlet's conditions for the uniform convergence of Fourier Series. **3**

ii. Find the Fourier series to represent the function, if **7**

$$f(x) = \begin{cases} -\pi, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$$

OR iii. Find the Fourier transform of $f(x) = \begin{cases} 1, & \text{for } |x| < a \\ 0, & \text{for } |x| > a \end{cases}$. **7**

Hence Evaluate

(a) $\int_0^\infty \frac{\sin x}{x} dx$ (b) $\int_{-\infty}^{\infty} \frac{\sin as \cos sx}{s} ds$

Q.4 i. Find the complete integral of $p^2 + q^2 = x + y$. **3**

ii. Solve : $p + 3q = 5z + \tan(y - 3x)$. **7**

OR iii. Solve $\frac{\partial^3 z}{\partial x^3} - 4\frac{\partial^3 z}{\partial x^2 \partial y} + 5\frac{\partial^3 z}{\partial x \partial y^2} - 2\frac{\partial^3 z}{\partial y^3} = e^{2x+y}$. **7**

Q.5 i. If vector $\vec{F} = (x+3y)\hat{i} + (y-2z)\hat{j} + (x+az)\hat{k}$ is a solenoidal vector, then find the value of a. **3**

ii. Find the value of $\int_C \vec{F}\cdot d\vec{r}$, where $\vec{F} = e^x \sin y\hat{i} + e^x \cos y\hat{j}$. The vertices of the rectangle C are (0, 0), (1, 0), (1, $\pi/2$), (0, $\pi/2$). **7**

OR iii. Verify the Gauss divergence theorem for $\vec{F} = x^2\hat{i} + z\hat{j} + yz\hat{k}$ taken over the cube bounded by the planes $x=0, y=0, z=0, x=1, y=1, z=1$. **7**

Q.6 i. In a Binomial distribution the mean and standard deviation are 12 and 2 respectively. Find n and p. **3**

ii. In a book of 300 pages, a proof reader finds no error in 200 pages, in 75 pages one error on each page, in 20 pages two errors on each page and in 5 pages 3 errors on each page. Fit Poisson's distribution to this data and calculate theoretical frequencies. **7**

OR iii. The mean height of 500 students is 151 cm, and the standard deviation is 15 cm. Assuming that the heights are normally distributed, find how many students have heights between 120 and 155 cm.? Given $P(0 \le z \le 2.07) = 0.4808, P(0 \le z \le .27) = 0.1085$. **7**

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classmate

Date

Page 01

MEDI-CAPS UNIVERSITY, INDORE

SUBJECT CODE - EN3BS02

SUB. NAME - ENGINEERING MATHEMATICS-

BRANCH/SPECIALISATION - ALL

PROGRAMME: B. Tech.

Q.1

(i) (b) 1/10. +1

(ii) (d) $1-e^{-t}$. +1

(iii) (c) 0. +1

(iv) (a) $e^{isa}\bar{f}(s)$ +1

(v) (c) $z = px + qy$. +1

(vi) (a) $z = ax + (5/a)y + b$. +1

(vii) (b) $\vec{0}$. +1

(viii) (c) $\hat{i} + \hat{j} + \hat{k}$. +1

(ix) (d) All of these. +1

(x) (a) Binomial distribution. +1

Q.2 (i) Let $F(t)$ be a piecewise continuous on every finite interval in the range $t \geq 0$ and satisfies.

$$|F(t)| \leq M e^{at}, \quad \text{for all } t \geq 0.$$ +1

and for some constant 'a' and M. Then the Laplace transform of $F(t)$ exist for all $s > a$. +1

If the Laplace transform of a given function exists, it is uniquely determined, i.e., if two continuous function have the same transformation, then they are identical. +1

(ii) Since $L\{1-\cos t\} = \frac{1}{s} - \frac{s}{s^2+1}$. +1

$$\therefore L\left\{\frac{1-\cos t}{t}\right\} = \int_{s=s}^{\infty} \left\{\frac{1}{s} - \frac{s}{s^2+1}\right\} ds$$

$$= -\frac{1}{2} \log\left(\frac{s^2}{s^2+1}\right)$$ +2

Now, $L\left\{\frac{1-\cos t}{t^2}\right\} = L\left\{\frac{(1-\cos t)/t}{t}\right\} = L\left\{\frac{F(t)}{t}\right\}$ —(1)

where $F(t) = \frac{1-\cos t}{t}$

$$\because L\{F(t)\} = -\frac{1}{2}\log\left(\frac{s^2}{s^2+1}\right) = f(s)$$

equation (1) becomes.

$$L\left\{\frac{1-\cos t}{t^2}\right\} = \int_{x=s}^{\infty} f(s)\, ds = -\frac{1}{2}\int_{x=s}^{\infty} \log\left(\frac{s^2}{s^2+1}\right) ds$$ +1

on integration by parts

$$= -\frac{1}{2}\left[\log\left(\frac{s^2}{s^2+1}\right).s - \int \frac{1}{s^2/s^2+1}.\left(\frac{(s^2+1)\cdot 2s - 2s^3}{(s^2+1)^2}\right).s\,ds\right]_s^\infty \quad +1$$

$$= \cot^{-1}s + \frac{s}{2}\log\left(\frac{s^2}{s^2+1}\right).$$

$$\Rightarrow \boxed{L\left\{\frac{1-\cos t}{t^2}\right\} = \cot^{-1}s + \frac{s}{2}\log\left(\frac{s^2}{s^2+1}\right)}. \quad +2$$

(iii) Given Differential Equat.

$(D^2+9)y = \cos 2t, \quad y(0)=1, \; y(\frac{\pi}{2}) = -1$

Rewrite:

$D^2y(t) + 9y(t) = \cos 2t$

$\Rightarrow \; y''(t) + 9y(t) = \cos 2t$

Taking the Laplace transform on both sides and using:

1. $L\{y''(t)\} = s^2 L\{y(t)\} - s\,y(0) - y'(0)$
2. $L\{\cos 2t\} = \frac{s}{s^2+4}$,

We get

$$\boxed{(s^2+9)L\{y(t)\} - s - y'(0) = \frac{s}{s^2+4}} \quad +2$$

$$L\{y(t)\} = \frac{s+A}{s^2+9} + \frac{s}{(s^2+9)(s^2+4)}$$

where $y'(0) = A$

$$\Rightarrow \boxed{L\{y(t)\} = \frac{s}{s^2+9} + \frac{A}{s^2+9} + \frac{s}{5(s^2+4)} - \frac{s}{5(s^2+9)}} \quad +2$$

—(1)

Taking the inverse Laplace transform on both sides, we get

$$\boxed{y(t) = \frac{4}{5}\cos 3t + \frac{1}{3}A\sin 3t + \frac{1}{5}\cos 2t} \quad —② \quad +1$$

Now given that $y(\frac{\pi}{2}) = -1$, so putting $t = \frac{\pi}{2}$, and $y = -1$ in (2), we get

$$\boxed{A = \frac{12}{5}} \quad +1$$

Putting $A = \frac{12}{5}$ in (2), the required solution is

$$\boxed{y(t) = \frac{4}{5}\cos 3t + \frac{4}{5}\sin 3t + \frac{1}{5}\cos 2t} \quad +1$$

Q. 3(i) Any functions $f(x)$ can be expressed as a Fourier series $\frac{a_0}{2} + \sum_{n=1}^{\infty}[a_n\cos nx + b_n\sin nx]$

in the interval $(0, 2\pi)$ or $(-\pi, \pi)$, where a_0, a_n, and b_n are constants, provided:

(i) $f(x)$ is periodic, single valued and finite +1
(ii) $f(x)$ has a finite number of discontinuities in any one period. +1
(iii) $f(x)$ has a finite number of maxima and minima +1

(ii) The Fourier Series of $f(x)$ over the interval $(-\pi, \pi)$:

$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty}[a_n\cos nx + b_n\sin nx] \quad — (1)$$

Where

$$a_0 = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\,dx, \quad a_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\cos nx\,dx,$$

$$b_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\sin nx\,dx$$ +1

Now $a_0 = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\,dx = \frac{1}{\pi}\left[\int_{-\pi}^{0} -\pi\,dx + \int_{0}^{\pi} x\,dx\right] = -\frac{\pi}{2}$ +1

&

$$a_n = \frac{1}{\pi}\left[\int_{-\pi}^{0} -\pi\cos nx\,dx + \int_{0}^{\pi} x\cos nx\,dx\right]$$

$$\Rightarrow a_n = \frac{1}{\pi}\left[\frac{(-1)^n - 1}{n^2}\right] = \begin{cases} 0, & n \text{ is even} \\ -\frac{2}{\pi n^2}, & n \text{ is odd} \end{cases}$$ +2

Finally,

$$b_n = \frac{1}{\pi}\left[\int_{-\pi}^{0} \pi\sin nx\,dx + \int_{0}^{\pi} x\sin nx\,dx\right]$$

$$\Rightarrow b_n = \frac{1}{n}\left[1 - 2(-1)^n\right] = \begin{cases} -\frac{1}{n}, & n \text{ is even} \\ \frac{3}{n}, & n \text{ is odd} \end{cases}$$ +2

Hence, eq. (1) becomes

$$f(x) = -\frac{\pi}{4} + \sum_{n=1}^{\infty} \frac{1}{\pi}\left\{\frac{(-1)^n - 1}{n^2}\right\}\cos nx + \sum_{n=1}^{\infty} \frac{1}{n}\left[1 - 2(-1)^n\right]\sin nx$$

OR. +1

$$f(x) = -\frac{\pi}{4} - \frac{2}{\pi}\left[\cos x + \frac{\cos 3x}{3^2} + \frac{\cos 5x}{5^2} + \cdots\right] + \left[3\sin x - \frac{\sin 2x}{2} + \frac{3\sin 3x}{3} - \frac{\sin 4x}{4} + \cdots\right]$$

(iii) By definition of Fourier transform of f(x):

$$F\{f(x)\} = \bar{f}(s) = \int_{-\infty}^{\infty} f(x)\, e^{isx}\, dx$$

Since $f(x) = \begin{cases} 1 & \text{for } |x| < a, \text{ i.e. } -a < x < a \\ 0, & \text{otherwise} \end{cases}$

$$\therefore \bar{f}(s) = \int_{-a}^{a} f(x) \cdot e^{isx}\, dx = \int_{-a}^{a} 1 \cdot e^{isx}\, dx$$

$$\boxed{F\{f(x)\} = \bar{f}(s) = \frac{2\sin sa}{s}} \quad \text{—— 1} \qquad +3$$

(a)

By the inverse Fourier transform of $\bar{f}(s)$

$$f(x) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \bar{f}(s)\, e^{-isx}\, ds \qquad +1$$

$$\Rightarrow \frac{1}{2\pi} \int_{-\infty}^{\infty} \frac{2\sin sa}{s}\, e^{isx}\, ds = \begin{cases} 1, & \text{for } |x| < a \\ 0, & \text{for } |x| > a \end{cases} \quad \text{—— 2}$$

Put $x = 0$ in (2), we get

$$\frac{1}{2\pi} \int_{-\infty}^{\infty} \frac{2\sin sa}{s}\, ds = 1 \Rightarrow \frac{2}{2\pi} \int_{0}^{\infty} \frac{2\sin sa}{s}\, ds = 1$$

$$\Rightarrow \int_{0}^{\infty} \frac{\sin sa}{s}\, ds = \frac{\pi}{2} \Rightarrow \boxed{\int_{0}^{\infty} \frac{\sin x}{x}\, dx = \frac{\pi}{2}} \qquad +1$$

[Take $a=1$]

(b) From eq. (2)

$$\Rightarrow \frac{1}{2\pi}\int_{-\infty}^{\infty} \frac{2\sin as}{s}\{\cos sx + i\sin sx\}ds = \begin{cases} 1, & \text{for } |x| < a \\ 0, & \text{for } |x| > a \end{cases}$$

On Equating

$$\frac{1}{2\pi}\cdot 2 \cdot \int_{-\infty}^{\infty} \frac{\sin as}{s}\cos sx\, ds = \begin{cases} 1 & \text{for } |x| < a \\ 0, & \text{for } |x| > a, \end{cases}$$

and $\frac{2}{2\pi}\int_{-\infty}^{\infty} \frac{\sin as}{s}\sin sx\, ds = 0$

$$\Rightarrow \int_{-\infty}^{\infty} \frac{\sin as}{s}\cos sx\, ds = \begin{cases} \pi & \text{for } |x| < a \\ 0, & \text{for } |x| > a \end{cases}$$ +1

4(i) Given equation becomes

$p^2 - x = y - q^2.$ +1

Putting $p^2 - x = a$, $y - q^2 = a$

$\Rightarrow p = \sqrt{(x+a)}$, $q = \sqrt{(y-a)}$ +1

Putting these values of p and q in $dz = p\,dx + q\,dy$, We get

$$\boxed{(z+b) = \frac{2}{3}(x+a)^{3/2} + \frac{2}{3}(y-a)^{3/2}}$$ +1

(ii) The subsidiary equations are

$$\frac{dx}{1} = \frac{dy}{3} = \frac{dz}{5z + \tan(y-3x)} \quad \text{——(1)}$$ +1

Taking first two fractions of (1) and integrating, we get

$$y = 3x + a \quad \text{—— (2)}$$ +2

Taking first and third fractions of (1), we get

$$\frac{dx}{1} = \frac{dz}{5z + \tan(y-3x)}$$

$$\Rightarrow \frac{dx}{1} = \frac{dz}{5z + \tan a}$$ +1

$$\Rightarrow \frac{dz}{dx} - 5z = \tan a$$

which is linear in z, therefore its solution is

$$z e^{-5x} = \tan a \cdot \frac{e^{-5x}}{-5} + \frac{b}{5}$$

$$\Rightarrow b = e^{-5x}[5z + \tan(y-3x)] \quad \text{—— (3)}$$ +2

Hence the required general solution is

$$\phi(y-3x,\ e^{-5x}(5z + \tan(y-3x))) = 0$$

OR +1

$$e^{-5x}[5z + \tan(y-3x)] = \phi(y-3x)$$

OR

$$y - 3x = \phi(e^{-5x}(5z + \tan(y-3x)))$$

(iii) Given : $(D^3 - 4D^2D' + 5DD'^2 - 2D'^3)z = e^{2x+y}$

For C.F. : Its A.E. is $m^3 - 4m^2 + 5m - 2 = 0$ +1

$\therefore\ m = 1, 1, 2$ +1

$\therefore$ C.F. $= \phi_1(y+x) + x\phi_2(y+x) + \phi_3(y+2x)$ +1

where ϕ_1, ϕ_2, ϕ_3 are arbitrary functions

Now

$$P.I. = \frac{1}{D^3 - 4D^2D' + 5DD'^2 - 2D'^3}\left[e^{2x+y}\right]$$

$$= \frac{1}{(D-D')(D-D')(D-2D')}\left[e^{2x+y}\right]$$

[Putting $D \to 2$, $D' \to 1$, $\therefore \frac{1}{D-2D'}\,\cancel{[e}\ \frac{2-2}{0}$ i.e. fails

$$\boxed{P.I. = \frac{1}{(2-1)^2}\cdot\frac{1}{(D-2D')}\left[e^{2x+y}\right]}$$ +1

Using $\frac{1}{(bD-aD')^n}\left[\phi(ax+by)\right] = \frac{x^n}{b^n n!}\phi(ax+by)$

$$= \frac{1}{(1\cdot D-2D')}\left[e^{2x+y}\right] = \frac{x^1}{1^1 \cdot 1!}e^{2x+y}$$

$$\boxed{P.I. = x\cdot e^{2x+y}}$$ +2

$\therefore$ The general solution is,
$z = C.F. + P.I.$

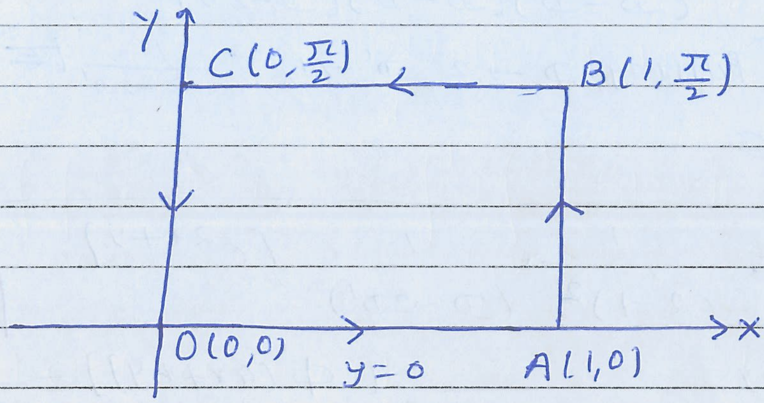
$$\Rightarrow \boxed{z = \phi_1(y+x) + x\,\phi_2(y+x) + \phi_3(y+2x) + x\,e^{2x+y}}$$ +1

5(i) If $\vec{F}$ is a solenoidal vector, then
$\operatorname{div}\vec{F} = 0$ +1
$\Rightarrow 1+1+a=0$ +1
$\Rightarrow a=-2$ +1

4(ii) Here $\vec{r} = x\hat{i} + y\hat{j} \Rightarrow d\vec{r} = dx\,\hat{i} + dy\,\hat{j}$

$\therefore \quad \vec{F}\cdot d\vec{r} = e^{x}\sin y\,dx + e^{x}\cos y\,dy$ —— ① +1

Draw the rectangle C as in figure.



+1

$$\therefore \int_C \vec{F}\cdot d\vec{r} = \int_{OA} \vec{F}\cdot d\vec{r} + \int_{AB} \vec{F}\cdot d\vec{r} + \int_{BC} \vec{F}\cdot d\vec{r} +$$

$$\int_{CO} \vec{F}\cdot d\vec{r} \quad —— ②$$

1. Along OA: $y = 0 \Rightarrow dy = 0$

$$\therefore \int_{OA} \vec{F}\cdot d\vec{r} = \int_0^1 [e^{x}.\sin 0.\,dx + 0] = 0$$ +1

2. Along AB: $x = 1 \Rightarrow dx = 0$

$$\therefore \int_{AB} \vec{F}\cdot d\vec{r} = \int_0^{\pi/2} [e^{1}.\sin y.0 + e^{1}.\cos y\,dy]$$

$$= e$$ +1

3. Along BC: $y = \pi/2 \Rightarrow dy = 0$

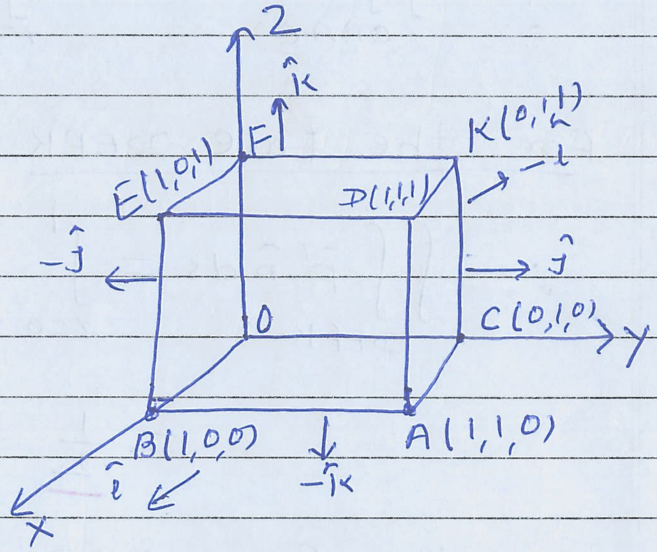
$$\therefore \int_{BC} \vec{F}\cdot d\vec{r} = 1 - e$$ +1

4. Along CO : $x=0 \Rightarrow dx=0$

$$\therefore \int_{CO} \vec{F}\cdot d\vec{r} = \int_{\pi/2}^{0} \cos y \, dy = -1$$ +1

$$\therefore \boxed{\int_C \vec{F}\cdot d\vec{r} = 0+e+(1-e)+(-1) = 0}$$ +1

4(iii)



+1

By Gauss-divergence theorem

$$\iint_S \vec{F}\cdot\hat{n}\,ds = \iiint_V \operatorname{div}\vec{F}\,dV \quad \text{——(i)}$$ +1

Given $\vec{F} = x^2\hat{i} + z\hat{j} + yz\hat{k}$

$\operatorname{div}\vec{F} = 2x + y$

$$\therefore \text{R.H.S.} = \iiint_V (2x+y)\,dV = \int_0^1\int_0^1\int_0^1 (2x+y)\,dx\,dy\,dz$$

$$= \frac{3}{2} \quad \text{——②}$$ +1

To evaluate $\iint_S \vec{F}\cdot\hat{n}\,ds$, where S consists of six planes surfaces

For the face ~~ABCO~~ OBAC: $\hat{n} = -\hat{k}$, $z=0$, $ds = \dfrac{dx\,dy}{|\hat{n}\cdot\hat{k}|}$

$$\Rightarrow ds = \frac{dx\,dy}{1} = dx\,dy$$

$$\therefore \iint_{OBAC} \vec{F}\cdot\hat{n}\,ds = -\int_{x=0}^{1}\int_{y=0}^{1} yz\,dx\,dy = \underline{0} \quad [\because z=0]$$

For the face DEFK: $\hat{n} = \hat{k}$, $z=1$, $ds = dx\,dy$

$$\therefore \iint_{DEFK} \vec{F}\cdot\hat{n}\,ds = \int_{x=0}^{1}\int_{y=0}^{1} yz\,dx\,dy = \int_{x=0}^{1}\int_{y=0}^{1} y\,dx\,dy$$

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

For the face ABED: $\hat{n} = \hat{i}$, $x=1$, $ds = \dfrac{dy\,dz}{|\hat{n}\cdot\hat{i}|}$

$$ds = dy\,dz$$

$$\therefore \iint_{ABED} \vec{F}\cdot\hat{n}\,ds = \int_{y=0}^{1}\int_{z=0}^{1} x^2\,dy\,dz = \underline{1} \quad [\because x=1]$$

For the face OCKF: $\hat{n} = -\hat{i}$, $x=0$, $ds = dy\,dz$

$$\therefore \iint_{OCKF} \vec{F}\cdot\hat{n}\,ds = \underline{0}$$ +1

For the face ACKD: $\hat{n} = \hat{j}$, $y=1$, $ds = \dfrac{dx\,dz}{|\hat{n}\cdot\hat{j}|}$

$$\iint_{ACKD} \vec{F}\cdot\hat{n}\,ds = \int_{x=0}^{1}\int_{z=0}^{1} z\,dx\,dz = \underline{\frac{1}{2}}$$ +1

For the face OBEF: $\hat{n} = -\hat{j}$, $y = 0$, $ds = dx\,dz$

$\therefore \iint_{OBEF} \vec{F}\cdot\hat{n}\,ds = -\frac{1}{2}$ +1

Hence $L.H.S. = \iint_S \vec{F}\cdot\hat{n}\,ds = 0 + \frac{1}{2} + 1 + 0 + \frac{1}{2} - \frac{1}{2}$

$= \frac{3}{2}$ —— (3) +1

from (2) and (3), we get
Hence verified Gauss's divergence theorem

6(i) Given: mean $= np = 12$ —— (1)

Standard deviation $= 2$

$\Rightarrow \sqrt{npq} = 2 \Rightarrow npq = 4$ —— (2) +1

We have

$\frac{npq}{np} = \frac{4}{12}$ [by (1) and (2)]

$\Rightarrow q = \frac{1}{3}$

Since $p + q = 1 \Rightarrow p = 1 - q \Rightarrow p = 2/3$ +1

Now, from (1) $np = 12 \Rightarrow n = 18.$ +1

6(ii) Given:

x :	0	1	2	3
f :	200	75	20	5

Mean $= \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{0\times200 + 1\times75 + 2\times20 + 3\times5}{300} = \frac{130}{300}$ +2

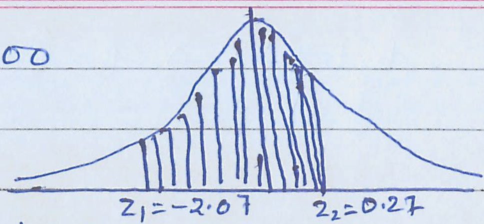
$\Rightarrow$ mean (m) $= 0.43.$

The probability of r successes in a Poisson distribution is given by

6(iii) Number of students = 5,00

$\therefore$ N = 5,00

$x_1 = 120, \quad x_2 = 155$



Mean μ = 151 c.m., and S.D. $\sigma = 15$ +1

By standard normal variable $z = \dfrac{x-\mu}{\sigma}$

When $x_1 = 120$

Standard normal variable $z_1 = \dfrac{x_1-\mu}{\sigma}$

$$z_1 = \frac{120-151}{15} = -2.07 \qquad +1$$

When $x_2 = 155$ c.m.

Standard normal variable $z_2 = \dfrac{x_2-\mu}{\sigma}$

$$z_2 = \frac{155-151}{15} = 0.27 \qquad +1$$

$\therefore$ $P(120 < x < 155) = P(-2.07 < Z < 0.27)$ +1

$= P(-2.07 \le Z < 0) + P(0 \le Z \le 0.27)$ +1

$= P(0 \le Z \le 2.07) + P(0 \le Z \le 0.27)$ +1

$= 0.4808 + 0.1085$

$= 0.5892$ +1