Q.6 Attempt any two:

i Two Judges in a beauty contest rank the ten competitors in the following order: **5**

First judge opinion	6	4	3	1	2	7	9	8	10	5
Second judge opinion	4	1	6	7	5	8	10	9	3	2

Find the correlation between their judgements.

ii Fit a second-degree parabola to the following data regarding x as an independent variable: **5**

x	0	1	2	3	4
y	1	5	10	22	38

iii 200 digits were chosen at random from a set of tables. The frequencies of the digits were: **5**

Digit :	0	1	2	3	4	5	6	7	8	9
Frequency:	18	19	23	21	16	25	22	20	21	15

Use the χ^2 test to assess the correctness of the hypothesis that the digits were distributed in equal numbers in the tables from which these were chosen. The 5% value of χ^2 for 9 d.f. is 16.919.

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Total No. of Questions: 6 *Total No. of Printed Pages:4*

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

Faculty of Engineering

End Sem (Even) Examination May-2022

EN3BS03 Engineering Mathematics -III

Programme: B.Tech. Branch/Specialisation: AU/ME/CE/FT/RA

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. $f(z) = \left|\bar{z}\right|^2$ is **1**

(a) Differentiable and analytic everywhere
(b) Not differentiable and not analytic at $z=0$
(c) Differentiable at $z=0$ but not analytic at $z=0$
(d) None of these

ii. A point at which a function ceases to be analytic is called a **1**

(a) Singular point (b) Non-singular point
(c) Regular point (d) None of these

iii. Order of convergence of Regula-Falsi method is **1**

(a) 1.321 (b) 1.618 (c) 2.231 (d) None of these

iv. Jacobi's method is also known as **1**

(a) Simultaneous method
(b) Displacement method
(c) Simultaneous displacement method
(d) None of these

v. Let h be the finite difference, then forward difference of $f(x)$ is **1**

(a) $\Delta f(x) = f(x+h) - f(x)$ (b) $\Delta f(x) = f(x-h) - f(x)$
(c) $\Delta f(x) = f(x+h)$ (d) None of these

vi. The Bessel's interpolation formula gives best interpolate values of y for u when **1**

(a) $\frac{1}{4} < u < \frac{3}{4}$ (b) $-\frac{1}{4} < u < \frac{1}{4}$
(c) $-1 < u < 0$ (d) None of these

vii. In trapezoidal rule, the curve $y = f(x)$ is assumed to be **1**

(a) Straight line (b) Circle
(c) Parabola (d) None of these

viii. Picard's method is applicable to find the solution of **1**

(a) Transcendental equation only
(b) System of linear equations
(c) Ordinary differential equation of first order
(d) None of these

ix. If the value of any regression coefficient is zero, then two variables are **1**

(a) Dependent (b) Independent
(c) Correlated (d) None of these

x. If the correlation coefficient have positive value, then the slope of the regression line **1**

(a) Must also be positive (b) Can be either negative or positive
(c) Can be zero (d) None of these

Q.2 Attempt any two:

i. Find the imaginary part of the analytic function whose real part is $x^3 - 3xy^2 + 3x^2 - 3y^2$ **5**

ii. Using Cauchy's integral formula, prove that $\int_C \frac{e^{2z}}{(z+1)^4} dz = \frac{8\pi e^{-2}}{3} i$, where C is the circle $|z| = 3$. **5**

iii. Find the poles, order of poles and residues at it for the function $f(z) = \frac{1}{z^4+1}$. **5**

Q.3 Attempt any two:

i. Find the cube root of 2 approximately by Newton Raphson method correct to five decimal places. **5**

ii. Solve the following simultaneous equations by Gauss seidel iteration method **5**

$10x + y + z = 12; 2x + 10y + z = 13; 2x + 2y + 10z = 14$

iii. Solve the following simultaneous equations by Gauss elimination method $10x + y + 2z = 13; 3x + 10y + z = 14; 2x + 3y + 10z = 15$ **5**

Q.4 Attempt any two:

i. Using Newton's Gregory Backward Difference formula, find the cubic polynomial which takes the following values **5**

x:	0	1	2	3
y:	1	2	1	10

ii. Using Newton's Divided Difference Formula find the value of $f(6)$ from the following data **5**

x:	1	2	7	8
y:	4	5	5	4

iii. Using Stirling formula, find y_{28}; given **5**

x:	20	25	30	35	40
y:	49225	48316	47326	45926	44306

Q.5 Attempt any two:

i. A river is 80 metres wide. The depth d (in metres) of the river at a distance x from the bank is given by the following table **5**

x:	0	10	20	30	40	50	60	70	80
y:	0	4	7	9	12	15	14	8	3

Find approximately the area of cross section of the river using Simpson's three-eight rule.

ii. Employ Taylor's series methods to obtain approximate value of y at $x = 0.2$ for the differential equation $\frac{dy}{dx} = 2y + 3e^x$, $y(0) = 0$ .Compare the numerical solution with exact solution **5**

iii. Using Runge-Kutta method, solve **5**

$\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, $y(0) = 1$ at $x = 0.2$ and 0.4 $(h = 0.2)$

Medi Caps University 10/05

End sem (Even) Examination May 2022 (1)

Solution of EN3BS03 (Engg. Mathematics - III)

Q.1 (i) c) Differentiable at $z=0$ but not analytic at $z=0$ +1

(ii) a) singular point +1

(iii) b) 1.618 +1

(iv) c) simultaneous displacement method +1

(v) a) $\Delta f(x) = f(x+h) - f(x)$ +1

(vi) a) $\frac{1}{4} < u < \frac{3}{4}$ +1

vii) a) straight line +1

viii) c) ordinary differential eqn +1

ix) b) Independent +1

x) a) must also be positive +1

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Q.2 (i) given
$$u(x,y) = x^3 - 3xy^2 + 3x^2 - 3y^2 \quad (1)$$

First we note that $u(x,y)$ is harmonic and hence it is feasible to construct an analytic function $f(z) = u(x,y) + iv(x,y)$. Since $f(z)$ is analytic, the first order partial derivative of u & v satisfy the C-R eq^n, i.e.
$$u_x = v_y \quad \text{and} \quad u_y = -v_x$$

from (1) $\quad u_x = 3x^2 - 3y^2 + 6x$
i.e. $\quad v_y = 3x^2 - 3y^2 + 6x \quad (2) \quad +1$

integrating (2) w.r.to y

$$V = 3x^2y - y^3 + 6xy + \phi(x) \quad (3) \quad +1$$
where $\phi(x)$ is a fuc^n of x
Now, differentiating (3) w.r.to x
$$V_x = 6xy + 6y + \phi'(x)$$
since
$$u_y = -V_x$$
Hence from (1)

$$-6xy - 6y = -6xy \mp 6y - \phi'(x)$$

$$\phi'(x) = 0 \quad +1$$

and
$$\phi(x) = C \quad \{\text{where } C \quad +1$$
is some real constant}

Now put in (3)

$V = 3x^2y - y^3 + 6xy \cancel{-6y^2} + c$

$\boxed{V = 3x^2y + 6xy - y^3 + c}$ Ans. +1

OR

(i) By Milne Thomson

Given $u(x,y) = x^3 - 3xy^2 + 3x^2 - 3y^2$

By C-R eq^n we have

$u_x = V_y$ and $u_y = -V_x$ +1

Consider $f'(z) = u_x + iV_x$

$f'(z) = u_x - iu_y$ +1

$= 3x^2 - 3y^2 + 6x - i(-6xy - 6y)$

$= 3x^2 - 3y^2 + 6x + i6xy + i6y.$

Put $x = z$ and $y = 0$

$f'(z) = 3z^2 + 6z$ +1

integrating w.r.to z

$f(z) = z^3 + 3z^2$

$= (x+iy)^3 + 3(x+iy)^2$ +1

$= x^3 + (iy)^3 + 3ixy(x+iy) + 3(x^2 + i^2y^2 + 2ixy)$

$$= x^3 + i^3y^3 + 3ix^2y + 3x^2 + 3i^2y^2 + 6ixy + 3i^2xy^2$$

$$= x^3 - iy^3 + 3ix^2y + 3x^2 - 3y^2 - 3xy^2 + 6ixy$$

$$\cancel{= x^3 + 3x^2 - 3y^2 - i(y^3 + 9xy)}$$

$$= (x^3 + 3x^2 - 3xy^2 - 3y^2) + i(3x^2y + 6xy - y^3)$$

Hence

$$\boxed{v = 3x^2y + 6xy - y^3} \quad \text{Ans.} \qquad +1$$

Q.2 (ii) given

$$\int_C \frac{e^{2z}}{(z+1)^4}\,dz$$

By Cauchy's Integral formula

$$f^n(a) = \frac{n!}{2\pi i}\int_C \frac{f(z)}{(z-a)^{n+1}}\,dz \quad \text{—— (1)} \qquad +1$$

Put
$a = -1$, $n = 3$, then

$$f'''(-1) = \frac{3!}{2\pi i}\int_C \frac{f(z)}{(z+1)^4}\,dz \quad \text{—— (2)} \qquad +2$$

Now take $f(z) = e^{2z}$

$$f'''(z) = 8e^{2z}$$

$$f'''(-1) = 8e^{-2} \qquad +1$$

Put in (2)

$$8e^{-2} = \frac{3!}{2\pi i}\int_c \frac{e^{2z}}{(z+1)^4}dz$$

or $$\int_c \frac{e^{2z}}{(z+1)^4}dz = \frac{8\pi e^{-2}}{3} i$$ +1

Proved

Q. 2 (iii) $f(z) = \frac{1}{z^4+1}$

Poles of $f(z)$ are given by $z^4+1=0$

$z^4 = -1 = e^{(2n+1)i\pi/4}$

where

$n = 0, 1, 2, 3$

$z = e^{i\pi/4}, e^{3i\pi/4}, e^{5i\pi/4}, e^{7i\pi/4}$ + 1

All the four poles are simple poles.

$\text{Res}_{z=e^{i\pi/4}} f(z) = -\frac{1}{4}\left(\frac{1+i}{\sqrt{2}}\right)$ +1

$\text{Res}_{z=e^{3i\pi/4}} f(z) = -\frac{1}{4}\left(\frac{-1+i}{\sqrt{2}}\right)$ +1

$\text{Res}_{z=e^{5i\pi/4}} f(z) = -\frac{1}{4}\left(\frac{-1-i}{\sqrt{2}}\right)$ +1

$\text{Res}_{z=e^{7i\pi/4}} f(z) = -\frac{1}{4}\left(\frac{1-i}{\sqrt{2}}\right)$ +1

$\left\{ f(z) = -\frac{1}{4} z \right\}$

Q. 3 (i) Let $x = 2^{1/3}$

So that $x^3 = 2$

Hence the eq^n

$x^3 - 2 = 0$

Let $f(x) = x^3 - 2$

and $f'(x) = 3x^2$

Now $f(1) = -1$ and $f(2) = 6$

So that

roots of $x^3 - 2 = 0$ lies b/w 1 and 2 +1

By Newton Raphson method.

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$ +1

$$= x_n - \frac{x_n^3 - 2}{3x_n^2}$$

$$= \frac{2}{3}\left(x_n + \frac{1}{x_n^2}\right)$$

taking $x_0 = 1.5$ +1

first approximation x_1 is

$$x_1 = \frac{2}{3}\left(1.5 + \frac{1}{(1.5)^2}\right) = 1.29630$$

Similarly, successive approximation are

7

$x_2 = 1.26093$

$x_3 = 1.25992$

$x_4 = 1.25992$ +1

Since $x_3 = x_4$

$2^{1/3} = 1.25992$ Ans. +1

Q.3 (ii) Given

$10x + y + z = 12$;
$2x + 10y + z = 13$
$2x + 2y + 10z = 14$

$|a_{11}| \geq |a_{12}| + |a_{13}|$

$|a_{22}| \geq |a_{21}| + |a_{23}|$

$|a_{33}| \geq |a_{31}| + |a_{32}|$ +1

above condition is satisfied. Now system of eq^n can be written as

$$\left.\begin{aligned} x &= \frac{1}{10}(12 - y - z) \\ y &= \frac{1}{10}(13 - 2x - z) \\ z &= \frac{1}{10}(14 - 2x - 2y) \end{aligned}\right\} \text{—(1)}$$ +1

Starting with initial approximation

$x=0,\ y=0,\ z=0$

For first approximation

Putting $y=0,\ z=0$ in (1) we have

$x^{(1)} = 1.2$

Putting $x=1.2,\ z=0$ in (1) for finding y

$y^{(1)} = 1.06$

Putting $x=1.2,\ y=1.06$ in (1) for finding z

$z^{(1)} = 0.948$ +1

For second iteration

$x^{(2)} = 0.999$ $\{$taking $y = 1.06,\ z=0.948\}$

$y^{(2)} = 1.005$ $\{$since $x = 0.999,\ z=0.948$

$z^{(2)} = 0.999$ +1

For third iteration

$x^{(3)} = 1.000$

$y^{(3)} = 1.000$

$z^{(3)} = 1.000$

for fourth

$x^{(4)} = 1.000$ $y^{(4)} = 1.000$, $z^{(4)} = 1.000$ +1

Hence $x=y=z=1$ Ans.

Q. 3
(iii) Given

$$10x + y + 2z = 13$$
$$3x + 10y + z = 14$$
$$2x + 3y + 10z = 15$$

By Gauss elimination Method

~~Given eq^n is~~
Given eq^n is written in matrix form

$$\left[\begin{array}{ccc:c} 10 & 1 & 2 & 13 \\ 3 & 10 & 1 & 14 \\ 2 & 3 & 10 & 15 \end{array}\right]$$

$R_1 \to R_1 - 3R_2$

$$\left[\begin{array}{ccc:c} 1 & -29 & -1 & -29 \\ 3 & 10 & 1 & 14 \\ 2 & 3 & 10 & 15 \end{array}\right]$$

$R_2 \to R_2 - 3R_1$
$R_3 \to R_3 - 2R_1$

+1

$$\left[\begin{array}{ccc:c} 1 & -29 & -1 & -29 \\ 0 & 97 & 4 & 101 \\ 0 & 61 & 12 & 73 \end{array}\right]$$

$R_2 \to R_2 - R_3$

$$\left[\begin{array}{ccc|c} 1 & -29 & -1 & -29 \\ 0 & 36 & -8 & 28 \\ 0 & 61 & 12 & 73 \end{array}\right]$$

$$R_2 \to \frac{1}{4} R_2$$

$$\left[\begin{array}{ccc|c} 1 & -29 & -1 & -29 \\ 0 & 9 & -2 & 7 \\ 0 & 61 & 12 & 73 \end{array}\right]$$

$$R_2 \to \frac{1}{9} R_2$$ +1

$$\left[\begin{array}{ccc|c} 1 & -29 & -1 & -29 \\ 0 & 1 & -2/9 & 7/9 \\ 0 & 61 & 12 & 73 \end{array}\right]$$

$$R_3 \to R_3 - 61 R_2$$ +1

$$\left[\begin{array}{ccc|c} 1 & -29 & -1 & -29 \\ 0 & 1 & -2/9 & 7/9 \\ 0 & 0 & \frac{230}{9} & \frac{230}{9} \end{array}\right]$$

$$R_3 \to \frac{9}{230} R_3$$ +1

$$\left[\begin{array}{ccc|c} 1 & -29 & -1 & -29 \\ 0 & 1 & -2/9 & 7/9 \\ 0 & 0 & 1 & 1 \end{array}\right]$$

$x - 29y - z = -29$

$y - {}^{2}/_{9}\, z = {}^{7}/_{9}$

$z = 1$

$y = 1 \quad , \quad x = 1$ +1

Ans

Q.4 (i) Given

$x: 0 \quad 1 \quad 2 \quad 3$
$y: 1 \quad 2 \quad 1 \quad 10$

Newton Gregory Backward difference formula

$$y = y_n + u\nabla y_n + \frac{u(u+1)}{2!}\nabla^2 y_n + \cdots\cdots$$
$$+ \frac{u(u+1)(u+2)\cdots(u+n-1)}{n!}\nabla^n y_n$$ +2

Here $a = 0$, $n = 3$, $h = 1$, $x = x$,

$$u = \frac{x-(a+nh)}{h} = x-3$$ +1

we have

$$y = 10 + (x-3)9 + \frac{(x-3)(x-2)}{2\times 1}(10) + \frac{(x-3)(x-2)}{3\times 2\times 1}(x-1)(12)$$ +1

$= 2x^3 - 7x^2 + 6x + 1$ +1

Ans.

Q.4 (ii) Given

$x: 1 \quad 2 \quad 7 \quad 8$

$y: 4 \quad 5 \quad 5 \quad 4$

find $f(6) = ?$

By Divided Difference formula

$$f(x) = f(1) + (x-1)\underset{2}{\Delta} f(1) + (x-1)(x-2) \underset{2,7}{\Delta^2} f(1) + (x-1)(x-2)(x-7)\underset{2,7,8}{\Delta^3} f(1)$$ +1

Difference Table

x	$f(x)$	$\Delta f(x)$	$\Delta^2 f(x)$	$\Delta^3 f(x)$
1	4			
		$\frac{5-4}{2-1} = 1$		
2	5		$-1/6$	
		0		0
7	5		$-1/6$	
		-1		
8	4			

+2

Putting the values

$$f(x) = \frac{1}{6}(-x^2 + 9x + 16)$$ +1

taking $x = 6$

$$f(6) = 5.667$$ +1

Ans.

Q.4 (iii) Given

x:	20	25	30	35	40
y:	49225	48316	47326	45926	44306

$y_{28} = ?$

Taking $a = 30$ as origin and $h = 5$ the required value of y is for $x = 28$ i.e. for

$$u = \frac{x-a}{h} = \frac{28-30}{5} = 0.4$$

Difference table

x	u	y_u	Δy_u	$\Delta^2 y_u$	$\Delta^3 y_u$	$\Delta^4 y_u$
20	-2	49225				
			-909			
25	-1	48316		-171		
			-1080		-59	
30	0	47236		-230		-21
			-1310		-80	
35	1	45926		-310		
			-1620			
40	2	44306				

+2

Stirling formula

$$y_u = y_0 + u\left(\frac{\Delta y_0 + \Delta y_{-1}}{2}\right) + \frac{u^2}{2!}\Delta^2 y_{-1} + \frac{u(u^2-1^2)}{3!} + 1 \left(\frac{\Delta^3 y_{-1} + \Delta^3 y_{-2}}{2}\right) + \frac{u^2(u^2-1)}{4!}\Delta^4 y_{-2}$$

$u = -0.4$ we get-

$y_{28} = \cancel{47692}$ Ans.

$= 47236 + (-0.4)\left(\frac{-1310-1080}{2}\right) + \frac{0.16}{2}(-230)$

$+ \frac{(-0.4)(-0.84)}{6}\left(\frac{-80-59}{2}\right) +$ +1

$\frac{0.16(-0.84)(-21)}{24}$

$= 47692$ Ans. +1

Q.5 (i) By simpson's 3/8 rule

$$\int_{x_0}^{x_0+nh} y\,dx = \frac{3h}{8}\left[(y_0+y_n) + 3(y_1+y_2+y_4 + \ldots + y_{n-2}+y_{n-1}) + 2(y_3+y_6+\ldots+y_{n-3})\right]$$ +2

Given

x:	0	10	20	30	40	50	60	70	80
y:	0	4	7	9	12	15	14	8	3

$\int_0^{80} f(x)\,dx = \int_0^{80} y\,dx = \frac{3h}{8}\left[(y_0+y_{80}) + 3(y_{10}+y_{20}+ y_{40}+y_{50}+y_{70}) + 2(y_{30}+y_{60})\right]$ +1

$= \frac{3}{8}\times 10\left[(0+3) + 3(4+7+12+15+8) + 2(9+14)\right]$ +1

$= 701.25$ sq meter Ans +1

Q.5

(ii) Here $\frac{dy}{dx} = 2y + 3e^x$ — (1)

$y' = 2y + 3e^x$ given $x=0, y_0=0$

$y'_0 = 3$

diffn w.r.to (1)

$y'' = 2y' + 3e^x$, $y''_0 = 9$

$y''' = 2y'' + 3e^x$, $y'''_0 = 21$

$y^{iv} = 2y''' + 3e^x$, $y^{iv}_0 = 45$ +1

$y^{v} = 2y^{iv} + 3e^x$ $y^{v}_0 = 93$

By ~~taylor's~~ Series

$y(x) = y_0 + (x-x_0)y'_0 + \frac{(x-x_0)^2}{2!}y''_0 +$ +1

$\frac{(x-x_0)^3}{3!}y'''_0 + ---$

here $x_0=0$

$= 0 + 3x + \frac{9x^2}{2!} + \frac{21x^3}{3!} + \frac{45x^4}{4!} + \frac{93x^5}{5!}$

find approximate value of y at $x=0.2$

putting $x=0.2$, we have

$y(0.2) = 3(0.2) + \frac{9}{2}(0.2)^2 + \frac{7}{2}(0.2)^3 +$ +1

$\frac{15}{8}(0.2)^4 + \frac{31}{40}(0.2)^5 + ----$

$y(0.2) = 0.81125$

Now exact sol^n

$$\frac{dy}{dx} - 2y = 3e^x$$

which L.D.E

so

$$I.F. \; e^{-\int 2dx} = e^{-2x}$$

$$sol^n \quad y e^{-2x} = \int 3e^x e^{-2x} dx + C \qquad +2$$

$$= -3e^{-x} + C$$

$$y = -3e^x + Ce^{2x}$$

since $y = 0$ when $x = 0$ so $C = 3$

$$y = 3e^{2x} - 3e^x$$

$$y(0.2) = 0.81126 \quad \underline{Ans.}$$

Q.5 (iii) Here $f(x,y) = \dfrac{y^2 - x^2}{y^2 + x^2}$, $x_0 = 0, y_0 = 1$ taking $h = 0.2$

find value of y at $x = 0.2$

we have

$$S_1 = h f(x_0, y_0) = 0.2 f(0,1) = 0.2$$

$$S_2 = h f\left(x_0 + \frac{h}{2}, y_0 + \frac{S_1}{2}\right) = 0.2\left[\frac{(1.1)^2 - (0.1)^2}{(1.1)^2 + (0.1)^2}\right] +1$$

$$= 0.19672$$

$S_3 = hf\left(x_0 + \frac{h}{2}, y_0 + \frac{S_2}{2}\right)$

$= 0.2\left[\frac{(1.09836)^2 - (0.1)^2}{(1.09836)^2 + (0.1)^2}\right] = 0.1967,$

$S_4 = hf(x_0 + h, y_0 + S_3)$ +1

$= 0.2\left[\frac{(1.19671)^2 - (0.2)^2}{(1.19671)^2 + (0.2)^2}\right] = 0.18913$

$y_1 = y_0 + \frac{1}{6}(S_1 + 2S_2 + 2S_3 + S_4)$ +1

$y_1 = 1.19600$ at $x = 0.2$

Now find y at $x = 0.4$
taking $x_1 = 0.2$, $y_1 = 1.196$

$S_1 = hf(x_1, y_1) = (0.2)f(0.2, 1.196)$
$= 0.18912$

$S_2 = hf\left(x_1 + \frac{h}{2}, y_1 + \frac{S_1}{2}\right) = 0.17949$ +1

$S_3 = hf\left(x_1 + \frac{h}{2}, y_1 + \frac{S_2}{2}\right) = 0.17935$

$S_4 = hf(x_1 + h, y_1 + S_3) = 0.16880$

Hence +1
$y_2 = 1.37527$ at $x = 0.4$

Ans.

Friends PAGE NO.: DATE:

Q.6 (i)

First Judge opinion X	Seond Judge opinion y	Rank diff $X-Y=d$	d^2
6	4	2	4
4	1	3	9
3	6	−3	9
1	7	−6	36
2	5	−3	9
7	8	−1	1
9	10	−1	1
8	9	−1	1
10	3	7	49
5	2	3	9
			$\Sigma d^2 = 128$

+2

Here $n=10$

The required correlation coeff. is given by

$$r = 1 - \frac{6\Sigma d^2}{n(n^2-1)} = 1 - \frac{6 \times 128}{10(100-1)}$$ +2

$$r = 0.224$$ +1

Ans.

Q.6 (ii) Given

x	0	1	2	3	4
y	1	5	10	22	38

let the eq^n of second degree parabola to be fitted to the given data

$$y = a + bx + cx^2$$

then, its normal eq^{n}s are

$$\Sigma y = ma + b\Sigma x + c\Sigma x^2$$

$$\Sigma xy = a\Sigma x + b\Sigma x^2 + c\Sigma x^3$$

$$\Sigma x^2 y = a\Sigma x^2 + b\Sigma x^3 + c\Sigma x^4$$ +1

x	y	x^2	x^3	x^4	xy	x^2y
0	1	0	0	0	0	0
1	5	1	1	1	5	5
2	10	4	8	16	20	40
3	22	9	27	81	66	198
4	38	16	64	256	152	608
$\Sigma x = 10$	$\Sigma y = 76$	$\Sigma x^2 = 30$	$\Sigma x^3 = 100$	$\Sigma x^4 = 354$	$\Sigma xy = 243$	$\Sigma x^2 y = 851$

+2

substituting these values in normal eq^n

$$76 = 5a + 10b + 30c$$

$$243 = 10a + 30b + 100c$$ +1

$$851 = 30a + 100b + 354c$$

On solving

$a = 1.43, \quad b = 0.24, \quad c = 2.21$

So the required eq^n of second degree parabola

$$y = 1.43 + 0.24x + 2.21x^2$$ +1

Q.6 (iii) Here ~~total~~ frequency = 200

The theortical frequency for each digit $= 200/10$ [individual fe may be Calculated]

$= 20$

By def^n, of χ^2

$$\chi^2 = \Sigma \frac{(fo - fe)^2}{fe}$$ +1

$$= \frac{(18-20)^2}{20} + \frac{(19-20)^2}{20} + \frac{(23-20)^2}{20} + \frac{(21-20)^2}{20} + \frac{(16-20)^2}{20} + \frac{(25-20)^2}{20} + \frac{(22-20)^2}{20} + \frac{(20-20)^2}{20} + \frac{(21-20)^2}{20} + \frac{(15-20)^2}{20}$$ +2

$$= \frac{1}{20}[4 + 1 + 9 + 16 + 25 + 4 + 0 + 1 + 25]$$

$$= 4.30$$

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$d.f\ (v) = 10-1 = 9$

Since calculate value (4.30) of $\chi^2 <$ the tabulated value (16.919) of χ^2 at 5% level for 9 d.f. Hence the calculated value is significant and consequently the hypotheis is correct +2