

Roll No. 5610027

Total Pages : 4

8458

BT-4/M-12

MATHEMATICS

(Computational Techniques)

Paper-MAT-204-E

Time Allowed : 3 Hours]

[Maximum Marks : 100

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. (a) Evaluate :
- (i) $\Delta (e^x \log 2x)$
 - (ii) $\Delta^2 \cos 2x$,
- with interval of differencing h . 10

- (b) From the following table, estimate the Number of Students, who obtained marks between 40 and 45 :

Marks	: 30-40	40-50	50-60	60-70	70-80
No. of Students	: 31	42	51	35	31

10

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2. (a) Given that :

x: 1.0 1.1 1.2 1.3 1.4 1.5 1.6

y: 7.989 8.403 8.781 9.129 9.451 9.750 10.031

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.6$. 10

- (b) Calculate the value of $\int_0^{\pi/2} \sin x \, dx$ by Simpson's 1/3rd rule, using 11 ordinates. 10

UNIT-II

3. (a) Form the differential equations generated by

- (i) $y_x = ax + b2^x$
- (ii) $y_x = (a + bx)3^x$. 10

- (b) Solve the differential equation :

$$y_{n-2} - 3y_{n-1} + 2y_n = n^2 + 2n - 1. \quad 10$$

4. (a) Using Gauss-Jordan method, find the inverse of the

matrix $\begin{bmatrix} 8 & 4 & 3 \\ 2 & 1 & 1 \\ 1 & 2 & 1 \end{bmatrix}$. 10

- (b) Apply the escalator method to obtain the inverse of the

matrix $\begin{bmatrix} 1 & 3 & 3 & 2 \\ 1 & 4 & 3 & 4 \\ 1 & 3 & 4 & 5 \\ 2 & 5 & 3 & 2 \end{bmatrix}$. 10

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2

UNIT-III

5. (a) Find the root of the equation $xe^x = \cos x$ using the regula-folsi method correct to four decimal places. 10
- (b) Using Newton's interactive method, find the real root of $x \log_{10} x = 1.2$ correct to five decimal places. 10
6. (a) Apply Gauss-Seidel interaction method to solve :
- $$\begin{aligned} 10x + y + z &= 12 \\ 2x + 10y + z &= 13 \\ 2x + 2y + 10z &= 14. \end{aligned} \quad 10$$
- (b) Solve $x^2 + y = 11$, $y^2 + x = 7$, using Newton-Raphson method, by taking the initial approximation (3.5, -1.8). 10

UNIT-IV

7. (a) Given $\frac{dy}{dx} = \frac{y-x}{y+x}$ with initial condition $y = 1$ at $x = 0$. Find y for $x = 0.1$ by Euler's method. 10
- (b) Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2, 0.4$. 10
8. (a) If P is the pull required to lift a load W by means of a pulley block, find a linear law of the form $P = mW + C$

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connecting P and W , using the folloiwing data :

P	=	12	15	21	25
W	=	50	70	100	120

where P and W are taken in kg-wt. Compute P , when $W = 150$ kg. 10

- (b) Apply the method of least squares to fit the curve

$y = ax^2 + \frac{b}{x}$ to the following data :

x	:	1	2	3	4
y	:	-1.51	0.99	3.88	7.66

10