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M.A./M.Sc. (First Semester)
EXAMINATION, 2024-25

MATHEMATICS
Paper Third
(Numerical Methods)
[MATH-003]

Time : Two Hours] [*Maximum Marks : 60*

Note : *Attempt any four questions. All questions carry equal marks.*

1. (a) If a function $f(x)$ is continuous in the interval $[a, b]$ such that $f(a) . f(b) < 0$, then there exist at least one $x_0 \in [a, b]$ such that $f(x_0) = 0$

(b) Using the bisection method, find the approximate root of the equation $x \sin x = 1$ that lie between $[1, 1.5]$

(P. T. O.)

2. (a) Using Newton's method find the root of equation

$$3x + \sin x - e^x = 0$$

(b) How many iterations of bisection method will be required to attain an accuracy of 10^{-5}. If the starting interval is $[a, b]$

3. (a) Show that :

$$\Delta\left[\frac{1}{f(x)}\right] = \frac{-\Delta f(x)}{f(x) \cdot f(x+1)}$$

(b) Express $u = x^4 - 12x^3 + 24x^2 - 30x + 9$ and its successive differences in factorial notation.

4. (a) Show that :

$$(E^{1/2} + E^{-1/2}) \cdot (1 + \Delta)^{1/2} = 2 + \Delta.$$

(b) Solve :

$$y_{n+2} - 4y_{n+1} + 3y_n = 5^n.$$

5. (a) Using Gauss's backward formula, estimate the number of persons earning wages between Rs. 60 and Rs. 70 from the following data :

Wages	below 40	40-60	60-80	80-100	100-120
No. of Persons	250	120	100	70	50

6. (a) Find the missing term in the table :

x	2	3	4	5	6
y	45	41.2	54.1	–	67.4

(b) Find the cubic polynomial which takes the following value :

x	0	1	2	3
p(x)	1	2	1	10

7. (a) Solve the TVP; $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ using Euller's method to find y (0.1).

(b) Find the value of cos(1.75) from the table :

x	1.7	1.74	1.78
sin x	0.9916	0.9857	0.9781

8. (a) Calculate the value of $\int_0^{\pi} \sin x \, dx$ using Simpeson's $\frac{1}{3}rd$ rule.

(b) Using Trapezoidal rule evaluate the following integral :

$$\int_0^6 \frac{1}{1+x^2}\,dx$$