EYS-313

B. Tech. (IT) (New Scheme) Examination, 2024

(Fourth Semester)

NUMERICAL ANALYSIS

IT-401

Time : 3 Hours] **[Maximum Marks : 60**

Note : Attempt any *two* parts from each question. All questions carry equal marks. Use of normal table is permissible.

1. (a) Find a real root of the equation $x \log_{10} x = 1.2$ by Regula-Falsi method correct to four decimal places.

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

x	$f(x)$
0	1

1	2
2	1
3	10

Hence or otherwise evaluate $f(4)$.

(c) Using Newton's divided difference formula, evaluate $f(9)$ from the following data :

x	$f(x)$
5	150
7	392
11	1452
13	2366
17	5202

2. (a) Find $\frac{dy}{dx}, \frac{d^2y}{dx^2}$ at $n = 2$ from the following data :

x	y
2	105
4	42.7
6	25.3
8	16.7
10	13

(b) Evaluate $\int_0^{\pi/2} \sin x\,dx$ by :

(i) Simpson's 1/3 rule

(ii) Simpson's 3/8 rule.

(c) Apply Crout's (or LU-factorisation) method to solve the equations :

$$3x+2y+7z=4,$$
$$2x+3y+z=5,$$
$$3x+4y+z=7.$$

3. (a) Using Euler's method, find an approximate value of y corresponding to $x = 1$, given that :

$$\frac{dy}{dx}=x+y,\quad y(0)=1.$$

(b) Using Runge-Kutta method of fourth order, solve

$$\frac{dy}{dx}=\frac{y^2-x^2}{y^2+x^2},\ \text{with}\ y(0)=1\ \text{at}\ x=0.2.$$

(c) Find an approximate value of y at $x = 0.3$ from

$$\frac{dy}{dx}=2y+3e^x,\quad y(0)=0$$ using Taylor's series method.

4. (a) (i) Find $L\left\{\frac{\sin t}{t}\right\}$.

(ii) Find $L^{-1}\left\{\frac{s+2}{s^2-4s+13}\right\}$.

(b) Solve the following differential equation using Laplace transform method :

$$\frac{d^2y}{dt^2}-2\frac{dy}{dt}+y=e^t \text{ with } y(0)=2,\ y'(0)=-1.$$

(c) Find the Fourier sine transform of $e^{-|x|}$. Hence show that :

$$\int_0^\infty \frac{x\sin mx}{1+x^2}dx=\frac{\pi e^{-m}}{2},\ m>0.$$

5. (a) The probability that a pen manufactured by a company will be defective is 1/10. If 12 such pens are manufactured, find the probability that :

(i) exactly two will be defective

(ii) at least two will be defective

(iii) none will be defective.

(b) Fit a Poisson distribution to the set of the following :

x	y
0	122
1	60
2	15
3	2
4	1

(c) The mean and standard deviation of the marks obtained by 1000 students in an examination are respectively 34.4 and 16.5. Assuming the normality of the distribution, find the approximate number of students expected to obtain marks between 30 and 60.

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