2012 C

2013

(May)

NUMERICAL METHODS AND COMPUTER PROGRAMMING

Paper : MA 401

Full Marks : 100

Pass Marks : 30

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer ***any five*** *questions.*

1. *(a)* What do you mean by relative error ? Find the absolute error and the relative error if the number $X = 0.004997$ is rounded off to three decimal digits. 5

   (b) The area A of a circle of diameter 'd' is given by the following values : 5

d :	80	85	90	95	100
A :	5026	5674	6362	7088	7854

   Find the approximate value for the area of circle of diameter 82.

(c) A slider in machine moves along a fixed straight rod. Its distance x *cm* along the rod is given below for various values of the time t seconds. Find the velocity of the slider and its acceleration when $t = 0.3$ *seconds* 10

t :	0	0.1	0.2	0.3	0.4	0.5	0.6
x :	30.13	31.62	32.87	33.64	33.95	33.81	33.24

2. (a) Write the algorithm of Lagrange's interpolation formula. 5

(b) Compute the value of $\int_{0.2}^{1.4} (\sin x - \log x + e^x)\, dx$ using Simpson's $\frac{3}{8}$th rule by taking seven ordinates. 5

(c) The pressure and the volume of a gas are related by the equation $PV^{\gamma} = K$; γ and K being constants. Fit the equation to the following set of observations : 10

$P\left(kg/cm^2\right)$:	0.5	1.0	1.5	2.0	2.5	3.0
V (*litres*) :	1.62	1.00	0.75	0.62	0.52	0.46

3. (a) Write the geometrical interpretation of Newton-Raphson's method. 5

(b) Using Lagrange's formula find the form of the function given by 5

x	:	3	2	1	–1
$f(x)$	:	3	12	15	–21

(c) Solve the following equations by Gauss-Seidal iteration method to correct four decimal places, $7x_1 + 52x_2 + 13x_3 = 104$; $83x_1 + 11x_2 - 4x_3 = 95$; $3x_1 + 8x_2 + 29x_3 = 71$ 10

4. (a) Using Regula-Falsi method, find the real root of $e^x = 4 \sin x$ correct to three decimal places. 5

(b) Given,

x	:	1	2	3	4	5	6	7	8
$f(x)$	:	1	8	27	64	125	216	343	512

Find $f(7.5)$. 5

(c) Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = xy + y^2$ with $y(0) = 1$ at $x = 0.1,\ 0.2,\ 0.3$ 10

5. (a) Using Bisection method, find the root of the equation $\cos x = xe^x$ correct to three decimal places. 6

(b) By means of Newton's divided difference formula find the value of $f(8)$ from the following table : 5

x	:	4	5	7	10	11	13
$f(x)$	:	48	100	294	900	1210	2028

(c) Using Milne's method, find $y(2)$ if $y(x)$ is the solution of $\frac{dy}{dx} = \frac{1}{2}(x+y)$ given that $y(0) = 2$, $y(0.5) = 2.636$, $y(1) = 3.595$, $y(1.5) = 4.968$ 9

6. (a) Using Gauss elimination method, solve the equations : 6

$$3x_1 + 2x_2 - 2x_3 = -2$$

$$2x_1 + 4x_2 + x_3 = 3$$

$$x_1 - x_2 + x_3 = 6$$

(b) Using three point Gaussian quadrature formula evaluate $\int_0^1 \frac{dx}{1+x}$. 5

(c) Solve the differential equation $\frac{dy}{dx} - xy = 0$; $y(0) = 1$ from $x = 0$ to $x = 0.25$ using Euler's method. 9

7. (a) Fit a second degree Parabola to the following data : 8

x =	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y =	1.1	1.3	1.6	2.0	2.7	3.4	4.1

(b) Write an algorithm to implement Euler's Improve method. Using Euler's Improve method, find y at $x = 0.1$ and $x = 0.2$ given that $\frac{dy}{dx} = y - \frac{2x}{y}$, $y(0) = 1$. 4+8=12