2014

(2nd Semester)

BACHELOR OF COMPUTER APPLICATIONS

Course No. : 202

[Mathematics—II (Numerical Analysis)]

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. What is the order of error in Weddle's rule? 1

2. Briefly explain Cramer's rule. 2

3. Determine the order and the degree of the differential equation

$$\frac{\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}{\left(\frac{d^2y}{dx^2}\right)}=1$$

2

4. *(a)* Assuming that a root of $x^3 - 9x + 1 = 0$ lies in the interval (2, 4), find that root by bisection method. 8

Or

(b) Find a positive root for $e^{0.4x} - 0.4x = 9$ by Newton-Raphson method correct to 3 decimal places.

5. *(a)* Solve the following system of equations by Gauss-Jordan elimination method : 8

$$5x_1 + x_2 + x_3 + x_4 = 4$$
$$x_1 + 7x_2 + x_3 + x_4 = 12$$
$$x_1 + x_2 + 6x_3 + x_4 = -5$$
$$x_1 + x_2 + x_3 + 4x_4 = -6$$

Or

(b) By using Gauss-Seidel method, solve the following system of equations :

$$10x - 2y + z = 12$$
$$x + 9y - z = 10$$
$$2x - y + 11z = 20$$

6. *(a)* Using the method of least squares, fit a law of the type $y = ae^{bx}$ to the data given below : 9

x	0	1	2	3
y	1·05	2·10	3·85	8·30

Or

(b) By the method of group averages, fit a curve of the form $y = ax^b + c$ from the data given below :

x	0·5	1	2	4	8	12
y	160	120	94	75	62	56

7. *(a)* The following data are taken from the steam table :

Temperature, t (in °C)	140	150	160	170	180
Pressure, p (in kgf/cm^2)	3·685	4·854	6·302	8·076	10·225

Using Newton's interpolation formula, find the pressure at temperature $t = 142°$ C and 175° C. 8

Or

(b) The population of a town is given below :

Year, x	1911	1921	1931	1941	1951
Population, y (in thousands)	15	20	27	39	52

Apply Gauss's interpolation formula to get the population in 1926 and 1947.

8. *(a)* Using Lagrange's interpolation formula, find the age corresponding to the annuity value 13·6 given in the table : 7

Age, x	30	35	40	45	50
Annuity value, y	15·9	14·9	14·1	13·3	12·5

Or

(b) Using the following table, find $f(x)$ as a polynomial by using Newton's divided difference interpolation formula :

x	–1	0	3	6	7
$f(x)$	3	–6	39	822	1611

9. By dividing the interval into 6 equal parts, evaluate $\int_4^{5\cdot2} \log_e x \, dx$ using—

(a) trapezoidal rule;

(b) Simpson's one-third rule;

(c) Simpson's three-eight rule;

(d) Weddle's rule. 10

10. Solve any *three* of the following differential equations : 4×3=12

(i) $(1+x)(1+y^2)dx+(1+y)(1+x^2)dy=0$

(ii) $(1+e^{2x})dy+e^x(1+y^2)dx=0$

(iii) $x\frac{dy}{dx}=y-x\tan\frac{y}{x}$

(iv) $x\frac{dy}{dx}-y=x^2$

11. *(a)* Using modified Euler's method, find $y(0\cdot2)$, $y(0\cdot1)$ given

$$\frac{dy}{dx}=x^2+y^2,\ y(0)=1$$ 8

Or

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

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

given $y(0)=1$ at $x=0\cdot2$ and $x=0\cdot4$.

* * *