Total No. of Questions : 8]

SEAT No. :

PD4060

[Total No. of Pages : 3

[6402]-19

S.E. (Electrical Engineering)

NUMERICAL METHODS AND COMPUTER PROGRAMMING

(2019 Pattern) (Semester - IV) (203148)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagram must be drawn wherever necessary.*
4) *Assume suitable data if necessary.*
5) *Use of non-programmable calculator in allowed.*

Q1) a) With the usual notation, prove the following. **[4]**

$(1+\Delta)(1-\nabla)=1$

$\Delta+\nabla=\frac{\Delta}{\nabla}-\frac{\nabla}{\Delta}$

b) For the data given below, construct the forward difference table and hence find the value of $f(-1.5)$ **[6]**

x	–2	–1	0	1	2	3
$f(x)$	15	5	1	3	11	25

c) Find the missing term in the table using Newton's divided difference interpolation method. **[8]**

x	0	1	2	3	4
y	1	3	9	--	81

OR

Q2) a) Derive the Newton's backward interpolation formula for equally spaced points. **[4]**

b) Given that $f(0) = 1$, $f(1) = 3$ and $f(3) = 55$, find a unique polynomial of degree 2 that fits the given data using Lagrange interpolation technique. **[6]**

c) Estimate the value of $f(42)$ from the following available data using newton backward interpolation formula. **[8]**

x	25	30	35	40	45
y	332	291	260	231	204

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Q3) a) Derive trapezodial rule for numerical integration from the Newton Cotes formula. **[3]**

b) Evaluate the given integral using Simpson's 1/3rd rule. Take 6 sub-intervals. **[6]**

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

c) The following data gives the velocity of a particle for 20 seconds at an interval of 5 seconds. Find the initial acceleration using the entire data. **[8]**

Time (sec)	0	5	10	15	20
Velocity (m/sec)	0	3	14	69	228

OR

Q4) a) Derive Simpson's 1/3rd rule for numerical integration from the Newton Cotes formula. **[3]**

b) Find from the following table, the area bounded by the curve $f(x)$ and the x-axis from $x = 7.47$ to $x = 7.53$ using **[6]**

i) Trapezoidal rule and

ii) Simpson's 3/8th rule.

x	7.47	7.48	7.49	7.50	7.51	7.52	7.53
$y = f(x)$	1.93	1.95	1.98	2.01	2.03	2.06	2.09

c) The following data represents the function $f(x) = e^{2x}$.

x	0	0.3	0.6	0.9	1.2
$f(x)$	1	1.8221	3.3201	6.0496	11.0232

Find $f'(1.2)$ and $f''(1.2)$ using Newton backward difference formula. **[8]**

Q5) a) Explain the Gauss elimination method used for solving linear simultaneouse equations. **[4]**

b) Apply the Gauss-Jacobi method to solve the equations up to 5 iterations. **[6]**

$$5x - y + z = 10$$
$$2x + 4y = 12$$
$$x + y + 5z = -1$$

Choose initial values : $x_0 = 2, y_0 = 3$ and $z_0 = 0$.

c) Apply the Gauss-Jordan method to solve the equations. **[8]**

$$x + y + z = 3$$
$$2x - y - z = 3$$
$$x - y + z = 9$$

OR

Q6) a) Explain the Jacobi iterative method for solving linear simultaneous equations. **[4]**

b) Find the inverse of the given matrix using Gauss Jordan method. **[6]**

$$\begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$$

c) Solve the given system of equations using Gauss Elimination method with partial pivoting. **[8]**

$2x + y + z = 5$

$4x - 6y = -2$

$-2x + 7y + 2z = 9$

Q7) a) Explain the Taylor series method of solving ordinary differential equations. **[5]**

b) Given $\frac{dy}{dx} = \frac{y-x}{y+x}$ with the initial condition $y = 1$ at $x = 0$. Find y at $x = 0.1$ using Euler's method. Take step size $h = 0.02$. **[6]**

c) Solve the given differential equation using Runge-Kutta fourth order method and hence find $y\,(0.1)$ $\frac{dy}{dx} = y - x; y(0) = 2$ **[6]**

OR

Q8) a) Explain the Euler's method of solving ordinary differential equations. **[5]**

b) Solve the differential equation given below using Taylor Series method and find the value of y at $x = 0.1$ taking h = 0.1 and considering terms up to the 4th derivative. $\frac{dy}{dx} = x^2 y - 1; \quad y(0) = 1$

[6]

c) Using the Runge-Kutta method, solve the second order differential equation $\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$ and find the value of y for $x = 0.2$. The initial conditions are $x = 0$, $y = 1$, $\frac{dy}{dx} = 0$. **[6]**

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