Total No. of Questions : 8]

SEAT No. :

PB3609

[Total No. of Pages :4

[6261]-14

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) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume Suitable data if necessary.***

Q1) a) Evaluate $f(9)$ using Newton's divided difference interpolation. **[6]**

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

b) Use Sterling's formula to find y(35) from the following table. **[6]**

x	10	20	30	40	50
$y = f(x)$	600	512	439	346	243

c) What is the difference between equally spaced data and unequally spaced data in the case of interpolation? Write examples of each. Hence, mention the methods used for interpolation when the data is equally spaced and unequally spaced. **[6]**

OR

Q2) a) For the following data, calculate the forward difference table and obtain the forward difference polynomical. **[6]**

x	0.1	0.2	0.3	0.4	0.5
$y = f(x)$	1.40	1.56	1.76	2.00	2.28

b) From the given data, find the value of y at $x = 4.5$. **[6]**

x	1	2	3	4	5
$y = f(x)$	2.38	3.65	5.85	9.95	14.85

c) Derive Lagrange's interpolation formula for unequally spaced data. **[6]**

P.T.O.

Q3) a) Use the trapezodial rule with four steps to estimate the following integral.

$$I = \int_0^2 \frac{x}{\sqrt{x^2+1}} dx$$ **[6]**

b) Evaluate the integral using Simpson's 1/3rd rule. Take $h = 0.5$, $k = 0.5$

$$z = \int_0^1 \int_0^1 (x^2 y^2) dx dy$$ **[6]**

c) Derive formula for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = x_n$ using Newton's backward difference interpolation formula. **[5]**

OR

Q4) a) Use the Simpson's 1/3rd with step size as $h = 0.5$ to estimate the following integral. $I = \int_1^2 \frac{1}{x^2} dx$ **[6]**

b) Evaluate the integral using the trapezoidal rule. Take $h = 0.5$, $k = 0.5$

$$z = \int_0^1 \int_0^1 (x^2 y^2) dx dy$$ **[6]**

c) Derive formula for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = x_0$ using Newton's forward difference interpolation formula. **[5]**

Q5) a) Find the inverse of the matrix using the Gauss-Jordan method.

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$$ **[6]**

b) Solve the following set of equations using the Gauss-Jacobi method. Solve only 4 interations. Consider $x^{(0)} = y^{(0)} = z^{(0)} = 0$. **[6]**

$$7x + 52y + 13z = 104$$

$$83x + 11y - 4z = 95$$

$$3x + 8y + 29z = 71$$

c) Derive the Gauss elimination method used to solve the linear simultaneous equation. (Derivation is expected. Problem is not expected as the derivation.) **[6]**

OR

Q6) a) Use the Gauss-Jordan method to find the values of x, y, z. **[6]**

$$\begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 6 \\ 4 \end{bmatrix}$$

b) Solve the following set of equation using the Gauss-Seidel Method. Solve only 4 iterations. Consider $x^{(0)} = y^{(0)} = z^{(0)} = 0$. **[6]**

$$7x + 52y + 13z = 104$$

$$83x + 11y - 4z = 95$$

$$3x + 8y + 29z = 71$$

c) Enlist the iterative methods used for the solution of the linear simultaneous equation. Explain to anyone in detail. (Derivation is expected. Problem is not expected as the derivation.) **[6]**

Q7) a) Obtain the solution of $y' = 3x + y^2$ using Taylors' series method. Take the initial condition as $y(0) = 1$. Find the value of y for $x = 0.1$. Solve up to the fourth term of derivative. **[6]**

b) Using Euler's method, obtain the solution of $y' = x - y$. Given that $y(0) = 2$ at $x = 0.6$ with the step size as $h = 0.2$. **[6]**

c) Derive the expression of Modified Euler's method used for the solution of the ordinary differential equation. **[5]**

OR

Q8) a) Solve $10y' = x^2 + y^2$ at $x = 0.4$ using the fourth-order Runge Kutta method. The initial conditions are $y(0) = 2$. Take step size as $h = 0.4$. **[6]**

b) Employ the Runge-Kutta method to calculate y for $x = 0.1$ from the equation: $y'' = xy'^2 - y^2$. Given that $y(0) = 1, y' = 0, h = 0.1$. **[6]**

c) Derive the expression of Taylor's series method used for the solution of the ordinary differential equation. **[5]**