Total No. of Questions : 8]

SEAT No. :

P1505

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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) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Assume Suitable data, if necessary.*

Q1) a) Derive the formula for Newton's divided difference for the interpolation when the data is unequally spaced. **[6]**

b) Construct the forward difference table and hence find the missing value corresponding to $x = 20$. **[6]**

x	0	10	20	30	40	50
$y = f(x)$	22	28	?	45	57	85

c) Use Sterling's interpolation formula and hence find the value of y when $x = 28$ **[6]**

x	20	25	30	35	40
$y = f(x)$	49225	48316	47236	45926	44306

OR

Q2) a) The breakdown voltage of the gaseous insulating material experiment was carried out at the material science laboratory. The distance between two electrodes was increased from 0 to 3 cm and its corresponding breakdown voltage (kV) reading was recorded which is shown in the table below. **[6]**

Distance between two electrodes (cm)	0.5	1	1.5	2	2.5	3
Breakdown Voltage (kV)	4.5	9	15	25	32.5	48.7

Find the breakdown voltage in kV when the distance between the electrodes is 2.8 cm. Use Newton's backward interpolation formula.

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b) Use Lagrange's interpolation formula and hence find the value of y when $x = 0$. **[6]**

x	–2	1	3	7
$y = f(x)$	5	7	11	34

c) Construct the forward difference table for the following data. **[6]**

x	8	12	16	20	24
$f(x)$	48	54	60	74	98

Hence find the value of $f(x)$ when x=10 by using Newton's forward interpolation method.

Q3) a) Evaluate the integral using the trapezoidal rule. Take $h = 0.5$, $k = 0.5$. **[6]**

$$z = \int_0^1 \int_0^1 (x + 2y)\, dxdy$$

b) Find the y(0) and y′(0) from the given table. Use Newton's forward interpolation formula. **[6]**

x	0	1	2	3	4
$f(x)$	3	7	15	6	2

c) Evaluate by using Simpson's (3/8). Take $h = 0.2$. **[5]**

$$I = \int_4^{5.2} \log_e(x)\, dx$$

OR

Q4) a) Evaluate the integral using the Simpson's 1/3rd rule. Take $h = k = \dfrac{\pi}{4}$ **[6]**

$$z = \int_0^{\pi/2} \int_{\pi/2}^{\pi} \cos(x + y)\, dxdy$$

b) From the following table with the values of x and y, find the first and second derivatives when x =10. Use Newton's backward interpolation formula. **[6]**

x	2	4	6	8	10
$f(x)$	4.7183	5.0552	7.3891	9.4789	12.4132

c) Apply Simpon's 1/3rd rule taking $h = 0.25$ **[5]**

$$I = \int_0^1 \frac{dx}{2+x^2}$$

Q5) a) Apply Gauss Elimination Method to solve the following set of equations. **[6]**

$x + 4y - z = -5$

$x + y - 6z = -12$

$3x - y - z = 4$

b) Use the Jacobi's method to solve the following set of equations. Consider the initial approximation as $x^{(0)} = y^{(0)} = z^{(0)} = 0$. Solve only 5 iterations. **[6]**

$15x + 4y - z = 17$

$3x + 15y - 6z = -18$

$2x - 3y + 15z = 25$

c) Use the Gauss Jordan method to find the inverse of the following matirx. **[6]**

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$$

OR

Q6) a) Apply the Gauss Jordan method to solve the following equations. **[6]**

$x + y + z = 9$

$2x - 3y + 4z = 13$

$3x + 4y + 5z = 40$

b) Use the Seidel method to solve the following set of equations. Consider the initial approximation as $x^{(0)} = y^{(0)} = z^{(0)} = 0$. Solve only 4 iterations. **[6]**

$10x + 2y + z = 9$

$2x + 20y - 2z = -44$

$-2x + 3y + 10z = 22$

c) Explain the Gauss Elimination method used for the solution of the linear simultaneous equation. (Problem is not expected. Just write in detail steps). **[6]**

Q7) a) Use the Euler's method to solve the following ordinary differential equation and hence find the value of y (1.2) taking the step size as h = 0.4. **[6]**

$$\frac{dy}{dx} = x + y$$

$$y(0) = 1$$

b) Use the Runge-Kutta method of fourth order, Solve the following ODE and find the value of y (0.2) and y'(0.2). Correct to four decimal places. **[6]**

$$y'' = y + xy'$$

The initial conditions given are $x = 0$, $y = 1.5$, $y' = 0$

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

OR

Q8) a) Solve the following ordinary differential equation by using Runge-Kutta fourth order method. Find the value of y when x=0.2, x = 0.4. The initial approximation is $y(0)=1$. **[6]**

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

b) Find the y(0.1) and y(0.2) by using Taylor's series method. Consider the terms up to fourth derivative. Consider the initial value as y(0)=1. **[6]**

$$\frac{dy}{dx} = x^2 y - 1$$

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

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