Total No. of Questions : 8]

SEAT No. :

**PA-1211**

[Total No. of Pages : 3

**[5925]-233**

**S.E. (Electrical)**

**NUMERICAL METHODS AND COMPUTER PROGRAMMING**

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

*Time : 2½ Hours]* *[Max. Marks : 70*

***Instructions to the candidates:***

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Assume suitable data, jf necessary.*
4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is permitted.*
5) *Assume suitable data, if necessary.*

***Q1)*** a) Prove **[6]**

i) $\Delta - \nabla = \Delta\nabla$

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

b) Following table gives the distance in nautical miles of the visible horizon for the given heights in feet above earth. **[6]**

| X height | 200 | 250 | 300 | 350 | 400 |
|---|---|---|---|---|---|
| Y distance | 15.04 | 16.81 | 18.42 | 19.90 | 21.27 |

Find the distance when height is 218 feet.

c) Derive the formula for Newton's forward interpolation formula for the equally spaced data points. **[5]**

OR

***Q2)*** a) Find f(10) of the cubic function passing through the points (4,–43) (7,83) (9,327) and (12,1053) using Newtons divided difference formula. **[6]**

b) Derive Lagrange's Interpolation formula for unequally spaced data points. **[6]**

c) Apply Bessel's central difference formula to obtain f(32) given that **[5]**

f(25)=0.2707 f(30)=0.3027 f(35)=0.3386 f(40)=0.3794

*P.T.O.*

**Q3)** a) Derive Trapezoidal rule for numerical integration as a special case of Newton's Cote formula. **[6]**

b) A river is 80m wide. The depth d in meters at a distance x meters from one bank is given in the following table **[6]**

| X(m) | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
|---|---|---|---|---|---|---|---|---|---|
| D(m) | 0 | 4 | 7 | 8 | 12 | 15 | 14 | 8 | 3 |

Find approximately the area of cross section by

i) Trapezoidal rule

ii) Simpson's 1/3rd rule.

c) Derive formula for numerical differentiation of first order using Newton's forward interpolation technique. **[5]**

OR

**Q4)** a) Evaluate $\int_0^1\int_0^1 (x+y)\,dxdy$ using Simpsons 1/3rd rule with h=k=1/2 **[6]**

b) Evaluate the first and second derivative of $\sqrt{x}$ at $x$=15 from the following data **[6]**

| $x$ | 15 | 17 | 19 | 21 | 23 |
|---|---|---|---|---|---|
| $\sqrt{x}$ | 3.873 | 4.123 | 4.354 | 4.583 | 4.796 |

c) Derive Simpson's 1/3rd rule for numerical integration as a special case of Newton's Cote formula. **[5]**

**Q5)** a) Solve the system of equations by Gauss Jordan method **[6]**

$x + y + z = 9$

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

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

b) Use Gauss Seidel method to solve the following system of equations **[6]**

$6x_1++x_2+x_3=105$

$4x_1+8x_2+3x_3=155$

$5x_1+4x_2-10x_3=65$

c) Explain Gauss Jacobi method for the solution of linear simultaneous equations. **[6]**

OR

***Q6)*** a) Explain Gauss-Seidal method for solution of linear simultaneous equation. (Numerical is not expected) **[6]**

b) Apply Gauss Jordan method to find inverse of **[6]**

$$A = \begin{bmatrix} 3 & 0 & 2 \\ 2 & 0 & -2 \\ 0 & 1 & 1 \end{bmatrix}$$

c) Using Jacobi iterative method solve the following system of linear simultaneous equations. Take $x(0) = y(0) = z(0) = 0$ perform 5 iterations. **[6]**

$3x + y + z = 2$

$x + 4y + 2z = -5$

$x + 2y + 5z = 2$

***Q7)*** a) Use $4^{th}$ order RK method to estimate approximate value of $y$ for $x = 0.1$ with step size is 0.1, if $dy/dx = x + y^2$ given that $y = 1$ when $x = 0$. **[6]**

b) Apply Euler's method to find $y(0.1)$. Given $\frac{dy}{dx} = xy$, $y(1) = 5$. Show 5 iterations. **[6]**

c) Explain Euler's method for the solution of ordinary differential equation. **[6]**

OR

***Q8)*** a) Explain Taylor's series method for solution of ordinary differential equations. **[6]**

b) Use Runge Kutta second order method of find an approximate value of y correct to three places of decimal when $x = 0.1$, given that $y = 1.2$ when $x = 1$ and $\frac{dy}{dx} = 3x + y^2$. **[6]**

c) Find the value of $x = 0.1$ for the equation $\frac{dy}{dx} = 1 + xy$ and $y(0)=1$. Take step size h = 0.1 by Taylor series method. **[6]**

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