



## Pre-semester Examination-2069

Bachelor Level/Second Year/Third Semester/Science

Full marks: 60

Numerical Method (CSC 204)

Pass marks: 24

Time :3 hrs

### **Set A**

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1. Derive the formula for Newton Raphson method using an illustrative figure. Find a real root of the following equation using NR method correct up to two decimal places.

[3+5=8]

$$f(x) = x \sin x + \cos x \text{ using } x_0 = \pi$$

OR

Derive the formula for Secant method. Find a real root of following equation using Secant method.

$$f(x) = \sin x - 2x + 1 \text{ using } x_1 = 0, x_2 = \pi$$

2. Write down the application of interpolation in practical life. Find the value of  $f(x)$  at  $x=0$  for the following data by using Lagrange interpolating polynomial formula. [2+6=8]

X	-1	-2	2	4
f(x)	-1	-9	11	69

3. (a). Fit a straight line to the following set of data. [4]

X	1	2	3	4	5
Y	3	4	5	6	8

- (b). Compute the integral [4]

$$\int_{-1}^1 e^x dx \text{ by using Simpson's } 3/8 \text{ rule for } n=4$$

4. In which situation system of linear equations are in ill-conditioned? Solve the following system of linear equations by using Gauss-Seidel iterative method. [2+6=8]

$$2x_1 - 2x_2 - x_3 - x_4 = -9$$

$$x_2 + 3x_3 + 2x_4 = 19$$

$$3x_2 + 2x_3 + 2x_4 = 20$$

$$x_1 + 4x_2 + 2x_4 = 17$$

OR

What do you mean by eigen-value eigen-vector problems? Find the largest eigen value correct to two significant digits and corresponding eigen vectors of the following matrix using power method. [2+6=8]

$$A = \begin{bmatrix} 2 & 4 & 1 \\ 0 & 1 & 3 \\ 1 & 0 & 3 \end{bmatrix}$$

5. What is initial value problem? How it is differ from boundary value problem? Solve the following equation by using Picard's method [2+1+5=8]

$$dy/dx = y^1(x) = x^2 + 2x + y \text{ with } y(0)=0 \text{ and estimate } y(0.2).$$

Hint: Solve up to 2<sup>nd</sup> iteration.

6. What is ordinary differential equation? Given the following differential equation,

$$dy/dx = y^1(x) = 3x^2 + 1 \text{ with } y(1)=2 \text{ estimate } y(2) \text{ by using } [1+3+4=8]$$

- Euler's Method
- Heun's method with h=0.5

OR

Derive a difference equation to represent a Poison's equation. Solve the Poison's equation

$$\nabla^2 f = 2x^2 y^2 \text{ over the domain } 0 \leq x \leq 3, 0 \leq y \leq 3 \text{ with } f = 0 \text{ on the boundary and } h=0.$$

[3+5=8]

7. Write an algorithm and complete C-program to solve the given non-linear equation by using Bisection method (Half interval method). [5+7=12]

$$f(x) = x^2 - 4x - 10 \text{ using initial guesses } x_1 = -2 \text{ and } x_2 = -1$$

In this program display final root, functional value of final root and number of steps required to solve such a non-linear equation.

*The End*



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**Set B**

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1. What is non-linear equation? Find the root of  $f(x) = x^2 - 4x - 10$  using Bisection Method. Compute initial guess of roots itself. [2+6=8]

OR

Derive the formula for Secant method. Find a real root of following equation using Secant method.

$$f(x) = \sin x - x + 5 \text{ using } x_1 = 0, x_2 = \pi$$

2. What do you mean by interpolation and extrapolation? Find the value of  $f(x)$  at  $x=3$  for the following data by using Lagrange interpolating polynomial formula. [2+6=8]

X	-1	-2	2	4
f(x)	-1	-9	11	69

3. (a). Fit a straight line to the following set of data. [4]

X	1	2	3	4	5
Y	3	4	5	6	8

- (b). Compute the integral

[4]

$$\int_{-1}^1 e^x dx \text{ by using Simpson's } 1/3 \text{ rule for } n=4$$

4. In which situation system of linear equations are in ill-conditioned? Solve the following system of linear equations by using Gauss-Seidel iterative method. [2+6=8]

$$x_1 - 2x_2 - x_3 = -9$$

$$x_2 + 9x_3 + 2x_4 = 15$$

$$3x_2 + 2x_3 + 2x_4 = 20$$

$$3x_1 + x_2 + 4x_4 = 16$$

OR

What do you mean by eigen-value eigen-vector problems? Find the largest eigen value correct to two significant digits and corresponding eigen vectors of the following matrix using power method. [2+6=8]

$$A = \begin{bmatrix} 120 & \\ & 210 \\ 00 & -1 \end{bmatrix}$$

5. What is initial value problem? How it is differ from boundary value problem? Solve the following equation by using Picard's method [2+1+5=8]

$$dy/dx = y^1(x) = x^2 + 2y \text{ with } y(0)=0 \text{ and estimate } y(0.4).$$

Hint: Solve up to 2<sup>nd</sup> iteration.

6. What is ordinary differential equation? Given the following differential equation, [1+3+4=8]  
 $dy/dx = y^1(x) = x^2 + y^2$  with  $y(1)=2$  estimate  $y(1.6)$  by using  
c. Euler's Method  
d. Heun's method with  $h=0.3$

OR

How can you solve Laplace's equation? Explain. The steady-state two dimensional heat flows in a metal plate is defined by  $\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$ .

A steel plate of size 30 x 30cm is given. Two adjacent sides are placed at 100°C and other side at held at 0°C. Find the temperature at interior points, assuming the grid size of 10x10.

- 7 Write an algorithm and complete C-program to find the root of given equation by using Secant method.

$$f(x) = x^2 - 4x - 10 \text{ (use } x_1=4 \text{ and } x_2=2)$$

[5+7=12]

in a program display final root and number of iterations.

*The End*