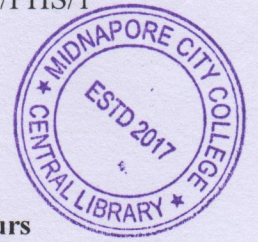


Third Semester Examination-2018**M.Sc. PHYSICS**

Paper Code:MTM306 (CBCS)

Full Marks : 40

Time: 2 Hours



(Numerical Methods and Computer Programming)

Answer Question no 1 and any One from the rest.

1. Answer any four questions out of eight questions :

$$4 \times 2 = 8$$

a) Write the formula for 4th order Runge-Kutta Method to solve

$$\frac{dy}{dx} = f(x, y), y(x_0) = y_0 .$$

b) Write the error term for Trapezoidal's and Simpson's 1/3rd rule.c) Find the iteration formula to find the solution of $x^3 + x - 1 = 0$ using Newton-Raphson method.d) Form the divided difference table to approximate $f(x) = x^3 - 1$ based on the four point $x = -1, 0, 1, 3$.e) Write the iteration formula of Gauss-Seidal method to solve $3x + 4y + 8z = 3$, $5x + y + z = 5$ and $3x + 8y - z = 3$ so that the equation converges to the true solution.

f) How is a numeric array converted into a cell array.

g) What is the relationship between a stream pointer and a buffer area.

h) What is pointer variable.

2. Answer any four questions out of eight questions.

$$4 \times 4 = 16$$

a) State and prove the existence and uniqueness property of interpolation.

b) Derive the Simpson's 1/3rd formula for the integration $\int_a^b f(x)dx$ by taking three points with spacing h .c) Using composite Trapezoidal rule, approximate $\int_{-4}^4 |x + 1|dx$ with $h = 1$.d) Approximate $5^{\frac{1}{4}}$ using Newton-Raphson method of a nonlinear equation with initial approximation as 1. Do five iterations.e) Find the value of $y(2, 1)$ as solution of $(x^3 + y^3)dx = xy^2dy$, $y(2) = 2.55$ using Euler's method with $h = 0.1$

f) Prove the following relation

i)
$$1 + \delta^2 \mu^2 = \left(1 + \frac{\delta^2}{2}\right)^2$$

ii)
$$hD = \sinh^{-1} \mu \delta$$

- g) Prove that the rate of convergence of Newton-Raphson method is quadratic.
- h) Write a C program to solve an ordinary differential equation by fourth order Runge-Kutta method.

3. Answer any two questions out of four questions.

$$2 \times 8 = 16$$

- a) i) $P_2(x) = x^2 + x + 1$ interpolates $f(x)$ at $x = -3, -1$ and 0 . Prepare the divided difference table. Now $f(2) = 15$ is added to the data, find $P_2(x)$ which interpolates $f(x)$ at $x = -3, -1, 0$ and 2 by adding term to $P_2(x)$.
- ii) Write a program to solve $\frac{dy}{dx} = f(x, y), y(x_0) = y_0$ using Runge-Kutta of order two.
- b) i) Find a root of $x^3 + x - 1 = 0$ in $[0, 1]$ using Bisection method. Do four iterations.
- ii) Write a program to calculate $\int_a^b f(x) dx$ using Simpson's $1/3^{\text{rd}}$ rule.
- c) i) Find the value of $y(1.2)$ as solution of $x dy = (1 + y^2) dx, y(1) = 2$ using Runge-Kutta method of 4^{th} order with $h = 0.2$.
- ii) Write recursion relation to find the roots of quadratic equation. Using any loop write a C program for finding the roots of a quadratic equation.
- d) i) Write down an iteration scheme for finding square root of a positive number N . Hence find the square-root of the number 2 .
- ii) Discuss the stability of 2^{nd} order Runge-Kutta method.

