

**Examination 2022**

**Subject: Physics**

**Paper: MPH-C104**

**Paper Name: Computational Methods & Programming**

Time : 3 Hrs

Max. Marks: 70

**Question paper is divided into two sections A & B. Attempt all sections. Answer the questions as per instructions given.**

**SECTION – A**

**(Short Answer Type)**

**Note: Attempt any five questions. Each question carries six marks**

Q1. What are Regula falsi method? Compute the second iteration of the Regula falsi method for the equation:

$$x^3 + x - 1 = 0, \text{ starting from the points } x_0 = 0, x_1 = 1$$

Q2. Obtain the interpolating polynomial in simplest form which fits the following data:

<b>x</b>	-1	0	1	2
<b>f(x)</b>	3	-4	5	-6

Q3. Determine least squares polynomial of second degree to fit the following data.

<b>x</b>	0	1	2	3
<b>y</b>	1	6	17	34

Q4. An approximate value of  $\pi$  is given by 3.14278152 and its true value is 3.14159265. Find the absolute and relative error.

Q5. Find the polynomial of the lowest degree which assumes the values 3, 12, 15, -21 when x has the values 3, 2, 1, -1 respectively. (Use Newton interpolation divided difference formula.)

Q6. Find y (1.2) as a solution of

$$y' = x^2 + y^2, y(1) = 2, h = 0.1 \text{ using Runge-Kutta method of order 2.}$$

Q7. The following table of values is given:

$x'$	0.2	0.3	0.4	0.5	0.6
$y(x)$	1.8054	1.5769	1.2834	0.9483	0.5981

Using the differentiation formula:  $y''(x) = \frac{1}{h^2} [y(x-h) - 2y(x) + y(x+h)]$ . Find an approximation to  $y''(0.4)$

Q8. Find  $\int_0^4 \frac{dx}{1+x^2}$  by using Simpson's  $\frac{3}{8}$  rule and hence obtain the approximate value of  $\pi$ .

Q9. What is arithmetic operator? Explain with examples.

Q10. How to write and execute a simple programme.

### SECTION-B

(Long Answer Type)

**Note: Attempt any four questions. Each question carries ten marks.**

Q1. (a) Explain the Newton-Raphson's method and discuss its failure cases.

(b) Apply the Newton-Raphson's method to find the root of  $x^4 - x - 10 = 0$  which is nearer to  $x = 2$  correct to three decimal places.

Q2. (a) Find the first order derivative of the function formed on the table given below, at the point  $x = 1.2$

<b>x</b>	1.0	1.2	1.4	1.6	1.8	2.0	2.2
<b>y</b>	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

(b) Using divided differences, find the value of  $f(8)$ , given that  $f(6) = 1.556$ ,  $f(7) = 1.690$ ,  $f(9) = 1.908$ ,  $f(12) = 2.158$ .

Q3. (a) Derive Newton's forward interpolation formula.

(b) Estimate the population of the year 1905 by using Newton's formula for interpolation.

<b>Year</b>	1891	1901	1911	1921	1931
<b>Population</b>	98,752	1,32,285	1,68,076	1,95,690	2,46,050

Q4. State and prove Cotes integration method. Prove that (i)  $C_k^n = C_{n-k}^n$  (ii)  $\sum_{k=0}^n C_k^n = 1$

Q5. (a) The velocity of a vehicle beginning from rest is given in the following table for part of the first hour. Using Simpson's 1/3 rule, find the distance travelled by the vehicle in this hour.

<b>t = times in minutes</b>	<b>v = velocity km/hr</b>
10	80
20	60
30	70
40	75
50	70
60	80

(b) Prove that  $\mu^2 = 1 + \frac{\delta^2}{4}$

Q6. (a) Use Lagrange's interpolation to find f(3) from the following table :

x	0	1	2	4	5	6
f(x)	1	14	15	5	6	19

(b) Use Stirling's formula to find  $y_{35}$ , given

$$y_{20} = 512, y_{30} = 439, y_{40} = 346, y_{50} = 243.$$

Q7. Explain If, Switch, Break, and Continue statement.

Q8. Define the terms:

- (i) Identifiers
- (ii) Pointers
- (iii) Data types
- (iv) Storage classes
- (v) Formal and actual parameters