

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:

x	-1	0	1	2
f(x)	3	-4	5	-6

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

x	0	1	2	3
y	1	6	17	34

Q4. An approximate value of π 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 π .

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 $x = 1.2$

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	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.

Year	1891	1901	1911	1921	1931
Population	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.

t = times in minutes	v = velocity km/hr
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