(6 pages)

S.No. 185

12PPH07

(For the candidates admitted from 2012–2013 onwards)

M.Sc. DEGREE EXAMINATION,
NOVEMBER 2017.

Third Semester

Physics

COMPUTATIONAL METHODS AND PROGRAMMING

Time : Three hours Maximum : 75 marks

PART A — (5 × 5 = 25 marks)

Answer ALL questions.

1. (a) What are the ways of creating symbolic constants in C++? Explain with an example.

Or

(b) Explain main and void functions with suitable examples.

2. (a) By the method of least squares, find the straight line that best fits the following data

x	1	2	3	4	5
y	14	27	40	55	68

Or

(b) If $f(x) = \frac{1}{x^2}$ find the first divided differences

(i) $[a, b]$ and

(ii) $[a, b, c]$

3. (a) Solve the following equations by Gauss-Jordan method

$$x + y = 2$$
$$2x + 3y = 5$$

Or

(b) Prove that the order of convergence of the Newton-Raphson method is at least 2.

4. (a) The population of a certain town is shown in the following table

Year (x) :	1931	1941	1951	1961	1971
Population (y) :	40.62	60.80	79.95	103.56	132.65

Find the rate of growth of the population in 1961.

Or

(b) Obtain the truncation error in Simpson's one third rule.

5. (a) Using Modified Euler's method solve $\frac{dy}{dx}1+xy$ with $y(0)=2$. Find $y(0.1)$ and $y(0.2)$.

Or

(b) Using Runge-Kutta of fourth order, solve for y at $x=1.2$ from $\frac{dy}{dx}=\frac{2xy+e^x}{x^2+xe^x}$ with $x_0=1, y_0=0$.

PART B — (5 × 10 = 50 marks)

Answer ALL questions.

6. (a) Discuss the following statements with suitable examples.

(i) if

(ii) if else and

(iii) switch.

Or

(b) Explain input, output and comparison operators used in C++ with suitable examples.

7. (a) Obtain a relation of the form $y=ab^x$ for the following data by the method of least squares

x:	2	3	4	5	6
y:	8.3	15.4	33.1	65.2	127.4

Or

(b) The values of $U(x)$ are known at a, b, c. Show that maximum or minimum of Lagrange's interpolation polynomial is attained at

$$x=\frac{\sum U_a(b^2-a^2)}{2\sum U_a(b-c)}$$

8. (a) Find the inverse of the matrix $A=\begin{pmatrix}2&1&1\\3&2&3\\1&4&9\end{pmatrix}$ using Gauss-Jordan method.

Or

(b) Find by Newton-Raphson method to correct to 4 places of decimals the root between 0 and 1 of the equation $3x-\cos x-1=0$.

9. (a) Find the maximum and minimum value of y from the following table :

x :	0	1	2	3	4	5
y :	0	$\frac{1}{4}$	0	$\frac{9}{4}$	16	$\frac{225}{4}$

Or

(b) Evaluate $\int_0^1 \frac{dx}{1+x}$ using :

(i) Trapezoidal rule and

(ii) Simpson's three eight rule.

Take $h = \frac{1}{6}$ for all cases.

10. (a) Solve $\frac{dy}{dx} = 1 - y$, $y(0) = 0$ using Euler's method. Find y at $x = 0.1$ and $x = 0.2$. Also find the values by Euler's improved method. Compare the results with result of the exact solution.

Or

(b) Using second order and fourth-order Runge-Kutta methods, evaluate the value of y when $x = 1.1$ given that

$$\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}; \; y(1) = 1.$$
