

(b) Write FORTRAN 77 code for the above question. 6

8. (a) Construct the difference tables for the following data : 8

| | | | | | | | |
|--------|-------|-------|-------|-------|-------|-------|-------|
| x | 0.1 | 0.3 | 0.5 | 0.7 | 0.9 | 1.1 | 1.3 |
| $f(x)$ | 0.003 | 0.067 | 0.148 | 0.248 | 0.370 | 0.518 | 0.697 |

Find the value of $f(0.6)$

- (b) Using Lagrange interpolation formula, estimate the value of $\cos 1.15$. 6

| | | | |
|----------|--------|--------|--------|
| x | 1.0 | 1.1 | 1.2 |
| $\cos x$ | 0.5403 | 0.4536 | 0.3624 |

UNIT - V

9. (a) Evaluate the following integral 8

$$\int_0^2 (e^{x^2} - 1) dx, \quad n = 8$$

using composite Simpson's 1/3 rule.

- (b) Write FORTRAN 77 code for the above question. 6

10. (a) Use Runge-Kutta method, find the solution of the following differential equation i.e. $y(1)$ value.

$$\frac{dy}{dx} = \frac{x}{y} \quad y(0) = 1$$

with step size $h = 0.25$ 8

- (b) Write FORTRAN 77 code for the above question. 6

PG (CBCS) EVEN SEMESTER EXAMINATION, 2023

PHYSICS

2nd Semester

Course No. : PHYCC - 204 C

(Numerical Analysis and Computer Programming)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

(Answer five questions, taking one from each unit)

UNIT - I

- (a) Describe with the help of block diagram, the process of numerical computing. 4

(b) Discuss the four characteristics of numerical computing. 4

(c) How is assembly language better than machine language. 2

(d) Why do we often use flow charts for developing computer programs. 4
- (a) Discuss in details about types of errors encountered in numerical computing. 10

(2)

- (b) Discuss about accuracy and precision and how they are related with significant digits. 4

UNIT - II

3. (a) Write a FORTRAN 77 program to calculate and print the mean, variance and standard deviation of a set of N numbers. 8

$$\text{Mean} = \frac{1}{N} \sum_{i=1}^N x_i$$

$$\text{Variance} = \frac{1}{N} \sum_{i=1}^N x_i^2 - \frac{1}{N^2} \left(\sum_{i=1}^N x_i \right)^2$$

$$\text{Standard deviation} = \sqrt{\text{Variance}}$$

- (b) Write a FORTRAN 77 program to evaluate the following function to 0.00001 % accuracy. 6

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$$

4. (a) Using both the function and subroutine subprograms, write a main program to calculate the binomial coefficient. 4+4=8

$$n_c_r = \frac{n!}{r!(n-r)!}$$

- (b) Discuss with an example the conditional execution statement structure implemented in an FORTRAN 77 program. 6

(3)

UNIT - III

5. (a) Derive the Newton - Raphson iterative formula.

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \quad 6$$

for solving $f(x) = 0$

- (b) Apply Newton - Raphson method to find the root of the following equation. (five place decimal) 4

$$\log x - \cos x = 0$$

- (c) Write the FORTRAN 77 code for the above question. 4

6. (a) Find a root of the following equation 5+5=10
 $x \tan x - 1 = 0$

using

- (i) Bisection method
(ii) False position method

- (b) Write the FORTRAN 77 code for the bisection method mentioned in the above question. 4

UNIT - IV

7. (a) Using partial pivoting technique solve the following equations. 8

$$\begin{aligned} 2x_1 + 2x_2 + x_3 &= 6 \\ 4x_1 + 2x_2 + 3x_3 &= 4 \\ x_1 - x_2 + x_3 &= 0 \end{aligned}$$

(Turn Over)