

[This question paper contains 3 printed pages.]

Your Roll No.

3247

J

M.Sc. / IV

APPLIED PHYSICS—Course IV S-10

(Numerical Methods and Fortran Programming)

Time : 3 Hours

Maximum Marks : 100

(Write your Roll No. on the top immediately
on receipt of this question paper.)

Answer any five questions,

each carry equal marks.

1. (a) Write a Fortran program which will evaluate the function $\sin x$ for the set of values of x . 10
(b) Distinguish between input and output statement as used in Fortran. 10
2. Deduce the fourth order Runge-Kutta method and solve the differential equation :

$$y' = -2xy^2 \qquad y(0) = 1$$

with $h = 0.4$ on the interval $[0, 0.8]$. Express the result upto two decimal place. 20

3. Using Newton forward difference formulae, calculate :

$$\frac{dy}{dx} \text{ and } \frac{d^2y}{dx^2} \text{ at } 0.70$$

[P. T. O.]

from the tables of values of x and y :

| | | | | | |
|-----|--------|--------|--------|--------|----|
| x | 0.68 | 0.69 | 0.70 | 0.71 | 20 |
| y | 0.8086 | 0.8253 | 0.8422 | 0.8595 | |

4. Find the eigenvalues and eigenvector of the matrix :

$$\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix} \quad 20$$

5. Use the predictor-corrector formulae for tabulating a solution of

$$10 \frac{dy}{dx} = x^2 + y^2, \quad y(0) = 1$$

for the range $0.5 \leq x \leq 1.0$. 20

6. (a) Deduce the Newton-Raphson method to find the roots of the equation $f(x) = 0$. 10

- (b) Find the roots of equation :

$$x^3 - x - 5 = 0$$

Using any iterative method with atleast two iterations. 10

7. (a) Use Simpson's rule to compute the integral :

$$\int_5^{12} \frac{dx}{x} \quad \text{with } n = 2. \quad 15$$

- (b) Explain the term function as used in Fortran. 5

8. Find the solution of system of linear algebraic equation :

$$-4x_1 + x_2 + x_3 = 4$$

$$x_1 + 4x_2 - 2x_3 = 4$$

$$3x_1 + 2x_2 - 4x_3 = 6$$

Using either Grout's method or Gauss's method.