

Paper I — RESEARCH METHODOLOGY

Time : Three hours

Maximum : 100 marks

PART A — (5 × 5 = 25 marks)

Answer ALL questions.

1. Briefly discuss problem selection in research studies.
2. Explain random errors, environmental errors and observational errors.
3. Solve the equation $x^3 + x^2 - 1 = 0$ for the positive root by iteration method.
4. What are symmetry elements and symmetry operations? Explain.
5. Explain structures and unions in C++ with examples.

PART B — (5 × 15 = 75 marks)

Answer ALL the questions.

6. (a) Discuss qualitative and quantitative analysis of research in detail.

Or

- (b) Write an essay on writing the thesis with examples.

7. (a) (i) By the method of least squares find the best fitting straight line to the data given below.

X 5 10 15 20 25

Y 15 19 23 26 30

Or

- (ii) Briefly explain variance and standard deviation.

Or

(b) Explain :

- (i) Rejection of data.
(ii) Polynomial regression.

8. (a) (i) Derive Newton- Raphson formula.
(ii) Find the real positive root of $3x - \cos x - 1 = 0$ by Newton's method correct to 6 decimal places.

Or

- (b) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using

(i) Trapezoidal rules

(ii) Simpson's $\frac{1}{3}$ rule.

(iii) Simpson's $\frac{3}{8}$ rule.

9. (a) Explain

(i) Character table.

(ii) Molecular point group with examples

Or

(b) Explain molecular vibrations and symmetry species of point groups in detail?

10. (a) Explain the various operators of C++ with examples.

Or

(b) Explain the string handling functions in C++ with examples.

Paper II — COURSE WORK I

Time : Three hours

Maximum : 100 marks

PART A — (5 × 5 = 25 marks)

Answer ALL the questions.

1. Explain the concept of spin. Briefly discuss the pauli spin matrices and their properties.
2. Show that $N_k^2 = N_k$ for fermions.
3. Explain structure and properties of crystals.
4. What is meant by quality factor in lasers? Obtain an expression for it.
5. Discuss the basics of photometry. Write the limitations of Beer-Lambert law.

PART B — (5 × 15 = 75 marks)

Answer ALL questions.

6. (a) Discuss in detail the spin functions of three electrons. Write a note on Slater determinant.

Or

- (b) Obtain Thomas-Fermi model of atom. Explain its advantages and drawbacks.

