

Total Pages : 4

End Semester Examination of Semester-I, 2016

Subject : PHYSICS (PG)

Paper : PHSPG-103 (Theory)

Group : A & B

Full Marks : 40

Time : 2 Hrs

The figures in the margin indicate the marks corresponding to the question

Candidates are requested to give their answers in their own word as far as practicable.

Illustrate the answers whenever necessary

Use separate Answer scripts for Group A and Group B

Group A (Mark 20)

Answer Question No. 1 and
any one out of Question No. 2 and Question No. 3.

1. Answer any five questions : 2x5=10
- i) What is the difference between Compiler and Interpreter?
 - ii) What is an algorithm? What are the essential properties of an algorithm?
 - iii) Write the following mathematical expression in FORTRAN
 $\sin(\log_{10}(ax^2 + bx)) - c^{|xy|}$.
 - iv) What do you mean by COMMON statement in FORTRAN?

- v) Write the differences between a Function subprogram and subroutine subprogram in FORTRAN.
 - vi) Explain Arithmetic IF statement in FORTRAN.
 - vii) What are the differences between while and do ... while loop in C Language.
 - viii) Write a program in C to compute division between two positive integers without using division operator(/).
2. a) Write a program in FORTRAN / C / C++ to check whether a number is palindrome or not.
- b) Write a FORTRAN program to find the value of $\cos x$ from the following series.

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \dots \dots \infty . \quad 5+5$$

3. a) Write a FORTRAN program to find the value of $\sin 30^\circ$.
- b) Write a program in FORTRAN / C/ C++ to find the number of nuclides disintegrate in each year for the first ten years. The nuclides disintegrate in each year given by the following formula:

$$dN(n) = N(n - 1) - N(n) = N_0 e^{-\lambda n} (e^\lambda - 1)$$

$$\text{Where } \lambda = \frac{\log 2}{T_{1/2}}, T_{1/2} = 2.5 \text{ years, } N_0 = 100000$$

5+5

Group-B (Mark 20)

Answer Q1, and any one out of Q2 and Q3:

1. Answer any five questions: 2x5=10

- i) If π is approximated as 3.14 instead of 3.14156, find the absolute relative and percentage errors.
- ii) Define forward difference (Δ), backward difference (∇) and shift operator (E). Hence show that $\Delta \equiv E - 1$ and $\nabla \equiv 1 - E^{-1}$.
- iii) Using Newton's backward formula, find $f(x)$ as a polynomial in x from the following data:

x	1	3	5	7
$f(x)$	-2	8	42	100

- iv) Show that the second order divided difference of a quadratic polynomial is constant.
- v) If $L_k(x)$ be the Lagrangian function, prove that

$$\sum_{k=0}^n L_k(x) = 1.$$

- vi) Compute $\int_0^2 (1+x) dx$ by Simpson's one third rule taking $h = 0.5$.
- vii) Give one example in each case of an upper triangular matrix and a lower triangular matrix. What indicates the product of the diagonal elements?

viii) Using Lagrange's interpolation formula find the polynomial $f(x)$ from the following data:

x	-1	2	3
f(x)	5	17	33

2. a) Compute $y(0.1)$ from the equation $\frac{dy}{dx} = x + y$, $y(0) = 1$ taking step length $h = 0.1$ by fourth order Runge-Kutta method. Convert to five places of decimals. 4

b) Use least square method to fit a straight line $y = a + bx$ based on the following data:

(1, 10), (-2, -1), (3, 18), (-3, -5) 3

c) Solve the following set of equations using Gaussian elimination method 3

$$x + 4y + z = 4, 2x + 3y + z = 1, 5x + 4y - 2z = 9.$$

3. a) Find a positive root of the equation $x^2 + 2x - 2 = 0$ by Newton-Raphson method correct to two significant figures. 4

b) Find the missing term in the followings table: 3

x	1	2	3	4	5
f(x)	-2	3	8	—	21

c) Use Newton's divided difference interpolation to find the interpolation polynomial for the function $y=f(x)$ given by the table:

x	-1	1	4	6
f(x)	1	-3	21	127

3