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End Semester Examination of Semester–I, 2015
Subject : PHYSICS (PG)
Paper : PHS–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) Find the absolute error, relative error and percentage error when $\frac{1}{3}$ is approximated as 0·333.

   ii) Using Newton's forward formula find f(x) as a polynomial in x from the following data:

x	1	3	5	7
f(x)	0	10	36	78

iii) Define degree of precision of a quadrature formula. Write down the values of degree of precision for the methods: a) trapezoidal and b) Simpson's $\frac{1}{3}$rd rule.

iv) Find the eigenvalue of the largest magnitude of the matrix

$$\begin{pmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 5 & 5 \end{pmatrix}.$$

v) Prove that $\Delta x^{(n)} = nhx^{(n-1)}$, where n^{th} factorial of x denoted by $x^{(n)}$.

vi) Evaluate $\int_{-1}^{3} |x| dx$ using trapezoidel rule taking four equal intervals.

vii) Using Lagrange's interpolation formula find the polynomial f(x) which corresponds to the following:

x	−1	0	3
f(x)	12	7	16

viii) Show that the first order divided difference of a linear polynomial is constant.

2. a) Find a root of the equation $\cos x - 5x + 5 = 0$ by iteration method correct upto four decimal places. 4

b) Using Gaussian elimination method solve the following set of equations: 4

$x + 2y - 3z = -4$, $2x + 3y + z = 11$, $x + y + z = 6$.

c) Illustrate with a simple example to show that the inverse of an upper triangular matrix is also an upper triangular matrix. 2

3. a) Use least square method to fit the line $y = a + bx$ based on the sample (1, 7) (3, 13) (–1, 1) (–2, 0). 4

b) Using Runge-Kutta method, find the value of $y(1{\cdot}1)$ from the differential equation

$$\frac{dy}{dx} = 3x + y^2, \text{ given } y(1) = 1{\cdot}2$$ 4

c) Give the geometric interpretation of Newton-Raphson method of solving an equation. 2

Group–B (Mark 20)

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

1. Answer any **five** questions: 2x5=10

i) What is the difference between a program and a software?

ii) Explain the action of RAM and compare it with ROM.

iii) Write down the differences between STOP and END statement in FORTRAN.

iv) Write the following algebraic expression into an equivalent FORTRAN statement

$$\log_{10}^{x} + e^{|x+y|} + \frac{a}{b}\left(1 - x^{\frac{1}{3}} + y^{\frac{1}{2}}\right)$$

v) Explain Computed GO TO statement in FORTRAN.

vi) Explain increment and decrement operator in C language.

vii) Explain DO..CONTINUE statement in FORTRAN.

viii) Write down the differences between SRAM and DRAM.

2. a) Write a FORTRAN program to display prime numbers within the range a to b. 6

b) Write a FORTRAN / C / C++ program to find the three lowest energy levels of a particle in an infinite quantum well of width L. Use the following parameters.

Mass of particle m = $0{\cdot}067*9{\cdot}1*10^{-31}$ Kg

Planks constant h = $6{\cdot}65*10^{-34}$ Js

Electron charge e = $1{\cdot}6*10^{-19}$ C

width L = $0{\cdot}53*10^{-10}$ m

π = 3·1416

Formula $\varepsilon_n = \frac{h^2}{8emL^2} n^2$ in electron volt. 4

3. a) Write a FORTRAN program to multiply all integers divisible by 7 between two numbers N_1 and N_2 (input N_1 and N_2). 5

b) Write a program to form a (5×5) matrix 'A' whose elements are $A_{ij} = i + j$. 5