M.Sc. 1st Semester Examination, 2013

PHYSICS

PAPER—PHS - 103(A & B)

Full Marks : 40

Time : 2 hours

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

GROUP — A

[ Marks: 20 ]

Time : 1 hour

Answer Q. No. 1 and 2 and any one from the rest

1. Answer any three bits :

   (a) What is the difference between source program and Object program.

   (Turn Over)
(b) Give at least three rules for naming a Real variable in FORTRAN 77.

(c) Write the following algebraic expression into an equivalent FORTRAN statement

\[ \log_{10} x + e^{ix+y} + \frac{a}{b} \left( 1 - x^{1/3} + y^{1/2} \right) \]

(d) If \( A = 2.5, B = 8.25, I = 5 \) then find the value of \( L = A/5.0 + 8/5 + B/I \)

(e) Explain Random Access Memory and compare it with Read Only Memory.

2. Answer any one bit:

(a) Find the output of the FORTRAN program after the following statement is executed.

\[ \begin{align*}
K &= 5 \\
DO 101 &= 2, 4 \\
K &= K + 1 \\
DO 9 J &= 4, 7, 2 \\
\text{IF} (K.GT.17) &\text{GO TO 11} \\
K &= K + J
\end{align*} \]
9 CONTINUE
10 CONTINUE
11 WRITE (*, 20) I, J, K
20 Format (2x, 3(15, 2x))
     STOP
     END

(b) Consider a particle falling down freely under the gravity with initial velocity \( u \). The displacement \( s \) at any time \( t \) is given by

\[ s = ut + \frac{1}{2}gt^2 \]

where \( g = 9.8 \text{ m/ sec}^2 \). Write a program to calculate \( s \) for \( u = 1 \text{ m/s} \) and for values of \( t \) from 0 sec to 2 sec increment 0.5 sec.

3. (a) Write a FORTRAN program to multiply all integers divisible by 7 between two numbers N1 and N2 (input N1 and N2).

(b) Write a program to form a \((5 \times 5)\) matrix 'A' whose elements \( A_{ij} = i + j \).
4. Write a function subprogram to find the value of \( n! \). Use this function to find the value of \( C_r \) for given values of \( n \) and \( r \).

GROUP—B

[ Marks : 20 ]

Time : 1 hour

Answer any four questions :

1. Establish Lagrange's polynomial interpolation formula (No remainder necessary).

2. Solve the following system of equation by Gauss-elimination method

\[
2x + 3y + z = 9 \\
x + 2y + 3z = 6 \\
3x + y + 3z = 8.
\]

3. Compute the integral.

\[
\int_{0}^{1} \frac{dx}{1 + x^2}.
\]
by Simpson's $\frac{1}{3}$ rule and then use it to compute the value of $\Pi$.

4. Find by the method of least squares a formula of the type $f(x) = a + bx$, which fit the following data

<table>
<thead>
<tr>
<th>$x$</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f(x)$</td>
<td>1.00</td>
<td>3.85</td>
<td>6.50</td>
<td>9.35</td>
<td>12.05</td>
</tr>
</tbody>
</table>

5. Find the largest magnitude eigenvalue of the matrix

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

Find also the corresponding eigenvector.

6. Using Runge-Kutta method, find $y(1.1)$ given

$$
\frac{dy}{dx} = 3x + y^2, \quad y(1) = 1.2
$$