

**ZC-114**

April-2014

M.Sc., Sem.-IV

**PHY-508 : Physics (Numerical Techniques and C-programming)**

Time : 3 Hours]

[Max. Marks : 70

- Instructions :** (1) Numbers to the right margin indicate full marks of the respective question.  
 (2) Symbols and terminology have their traditional meaning.  
 (3) Use scientific calculator, if required.

1. (a) Explain Matrix Inversion method for finding the solution of simultaneous equations. What are the limitations of this method ? 7

**OR**

What are ill-conditioned equations ? Explain how to improve accuracy of an ill-conditioned system.

- (b) Solve the following set of equations by relaxation method : 7

$$10x - 2y - 3z = 205$$

$$-2x + 10y - 2z = 154$$

$$-2x - y + 10z = 120$$

**OR**

Solve the following set of equations by factorization method :

$$3x + 2y + 7z = 4$$

$$2x + 3y + z = 5$$

$$3x + 4y + z = 7$$

2. (a) Discuss the method of least squares to obtain the unknown involved in the empirical equation. 7

**OR**

Describe how to find three known (a, b, c) of following relations :

(i)  $y = a + bx + cx^2$

(ii)  $y = a + bx^c$

- (b) For the following set of observations, fit the relation  $y = ax^n$  to obtain a and n using method of group averages. 7

<b>x</b>	1.2	1.4	1.6	1.8	2.0	2.4
<b>y</b>	4.2	6.1	8.5	11.5	14.9	23.5

**OR**

- (b) For the following set of observations, fit the relation  $y = a + bx + cx^2$  to obtain a, b and c using method of moments.

<b>x</b>	0	1	2	3	4
<b>y</b>	1	5	10	22	38

3. (a) What is pointer ? Explain how one has to declare and initialize pointers. What are the advantaged of pointers ? 7

**OR**

Write a C-program using structures to find the smallest of three numbers.

- (b) What do you understand by a union ? Explain how members of a union are accessed using a program code. In which applications union can be useful ? 7

**OR**

Write a C-program using pointers to search a value from an array.

4. (a) Using Simpson's method, write a C-program to solve following integration : 7

$$y = \int_0^1 \frac{\sin x}{x} dx$$

**OR**

Write C-program to solve  $Y = a_0 + a_1X + a_2X^2$  using Bisection method.

- (b) Describe Monte Carlo method for numerical integration and write a C-program of solving  $y = \int_a^b f(x)dx$  using this method. 7

**OR**

Write a C-program to solve following three simultaneous equations using Gauss-Seidal method.

$$a_{11}x_1 + a_{12}x_2 + a_{13}x_3 = b_1$$

$$a_{21}x_1 + a_{22}x_2 + a_{23}x_3 = b_2$$

$$a_{31}x_1 + a_{32}x_2 + a_{33}x_3 = b_3$$

5. Answer the following : (each of **one** mark)

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- (i) Factorization of method is applicable only to
- (a)  $m \times n$  matrix ( $m \neq n$ ).
  - (b) every square matrix.
  - (c) every square matrix, provided all the principal minors of the matrix are non-singular.
  - (d) every square matrix, provided all the principal minors of the matrix are singular.

(ii)  $A = \begin{bmatrix} 3 & 2 & 7 \\ 2 & 3 & 1 \\ 3 & 4 & 1 \end{bmatrix}$

The lower triangular matrix coefficient  $l_{21}$  for the above matrix A is \_\_\_\_\_.

- (a) 1
  - (b) 2
  - (c)  $2/7$
  - (d)  $2/3$
- (iii) For solving the simultaneous linear equations, simple iterative methods can be devised for systems in which \_\_\_\_\_.
- (a) the coefficients of the leading diagonal are large as compared to others.
  - (b) the coefficients of the leading diagonal are small as compared to others.
  - (c) the coefficients of the leading diagonal are unity.
  - (d) the coefficients of the leading diagonal are zero.
- (iv) (A) An iterative method may not always converge.  
(B) Direct methods yield the solution after a certain amount of fixed computation.  
(C) For large systems, iterative methods may be faster than the direct methods.  
(D) Iterative methods always give accurate solution.

Which of the above statements are true ? (Choose most appropriate option).

- (a) (A) and (C)
  - (b) (A) and (D)
  - (c) (B) and (D)
  - (d) except (D)
- (v) Let  $(x_1, y_1), (x_2, y_2), (x_3, y_3), \dots, (x_n, y_n)$  be the set of n observations such that  $x_2 - x_1 = x_3 - x_2 = \dots = h$ , then the third moment is defined as
- (a)  $h\sum x$
  - (b)  $h\sum y$
  - (c)  $h\sum xy$
  - (d)  $h\sum x^2y$
- (vi) For principle of least square method
- (a) the sum of root mean squares of errors is minimum
  - (b) the sum of errors is minimum
  - (c) the sum of absolute values of errors is minimum
  - (d) the sum of squares of errors is minimum

(vii) Let  $y = a + b \exp(cx)$

If  $(x_1, y_1), (x_2, y_2), (x_3, y_3)$  be the three particular points such that  $x_1, x_2, x_3$  are in geometrical progression then the value of constant  $a$  is obtained using

(a)  $a = \frac{y_1 y_3 - y_2^2}{y_1 + y_3 - 2y_2}$

(b)  $a = \frac{y_1 + y_3 - 2y_2}{y_1 y_3 - y_2^2}$

(c)  $a = \frac{y_1 y_2 - y_3^2}{y_1 + y_2 - 2y_3}$

(d)  $a = \frac{y_1 + y_3 + 2y_2}{y_1 y_3 + y_2^2}$

(viii) What will be the value of  $x$  after evaluation of the following ?

float value[10] = {1.0, 2.0, 3.0, 4.0, 5.0, 6.0}, \*p, x = 0;

for (p=value, p<value+5; p++)

(a) 0.0

(b) 6.0

(c) 15.0

(d) 21.0

(ix) Scale factors of char and float type data are \_\_\_\_\_ and \_\_\_\_\_, respectively.

(a) 0, 1

(b) 1, 2

(c) 1, 3

(d) 1, 4

(x) What will be the value of  $x$  after evaluation of the following ?

int a[10] = {2, 4, 6}, \*pa=a, x;

x = (\*pa)++

(a) 2

(b) 3

(c) 4

(d) 6

(xi) A string can be read using which function?

(a) getchar( )

(b) scanf( )

(c) gets( )

(d) all of these

(xii) Which operator retrieves the l value of a variable ?

(a) &

(b) ->

(c) \*

(d) ^

(xiii) Typedef can be used with which of these data types ?

(a) struct

(b) union

(c) enum

(d) all of the above

(xiv) Which function returns the next character from stream, EOF if the end of file is reached, or if there is an error ?

(a) fgetc()

(b) fgets()

(c) fputc()

(d) fwrite()