Ref. No. : Ex/PHARM/T/125/2018

B. PHARMACEUTICAL TECHNOLOGY 1ST YEAR 2ND SEMESTER EXAMINATION-2018
Subject: Numerical Methods & Computer Programming

Time: 3 Hours **Full Marks: 100**

Note: Attempt *Q. 1* and any *four* from the rest

Q 1. Answer any ***ten*** questions:

a) What do you mean by static variables in the C programming? Which memory segment is used to store static variables?
b) What do you mean by pointer variables? What is the significance of dereferencing on pointer variable?
c) Distinguish between formal parameters and actual parameters?
d) What is the difference between pre-decrement and post-decrement operations?
e) When should you pass address of a variable as an argument to a function?
f) With a small code fragment, show how we allocate memory dynamically in the C programming language.
g) Write down a small code fragment in C to check whether a given number is even or odd.
h) Define a function '***swap***' to perform swapping between two integer numbers.
i) What is 'stdio.h'? What is the necessity of it?
j) Provide the basic syntax of the 'for' loop in C.
k) What is the difference between 'while' and 'do-while' loop?
l) How can we represent a polynomial using a C program? Specify only its data structure.

[2x10=20]

Q 2.

a) How do we measure the relative error of a numerical computation? Why is the relative error representation more preferable to absolute error representation?
b) Assume, a root finding algorithm determines the root of a polynomial as 0.076495, though its actual root is present at x=0.0775. Measure the absolute and relative errors of the computation. Also represent the computed root using a precision of 3 significant digits.
c) Specify three different types of error and their significance for any numerical computations. Among them which are controllable using efficient numerical techniques?
d) State how we represent floating-point numbers using IEEE 754 Floating-Point Standard.
e) Consider the roots of an equation $f(x) = 0$. Using the first two terms of the Taylor expansion of $f(x)$ about the point x_i, derive the Newton-Raphson iteration formula.
f) Give one advantage and one disadvantage of the Newton-Raphson method. Also make a remark on the convergence rate of this method.

[3+3+3+2+5+4=20]

Q 3.

a) Explain with a suitable diagram the algorithm for the Bisection method.

b) Using the aforesaid algorithm, try to find out a positive real root of the equation $x^3 - x - 4 = 0$, assuming the root lies between 1 and 2. Represent this root corrected up to 3 decimal places.

c) With proper mathematical derivation, find out the rate of convergence of the Bisection method?

d) Knowing that a root of an equation lies between ***a*** and ***b***, how do you narrow down the interval (a, b) with the Regula Falsi method?

[5+5+6+4=20]

Q 4.

a) Prove that for n+1 distinct points in two-dimensional Euclidean space, there must be a unique polynomial of degree P, where $P \leq n$.

b) For the following tabular function, find out a degree 2 polynomial using the Lagrange interpolation formula.

X	2	4	7
f(x)	3	11	38

c) List the main advantages and disadvantages of the Lagrange interpolation technique.

d) Identify the polynomial for the following tabulated function using any interpolation technique.

x	0	1	2	3	4	5
f(x)	3	5	9	15	23	33

e) Prepare a forward divided difference table for the following tabulated function. Also find out the value of the function at x=0.17.

x	0.1	0.2	0.3	0.4	0.5
f(x)	1.40	1.56	1.76	2.0	2.28

[4+4+2+5+5=10]

Q 5.

a) Why do we generally get higher level of accuracy in Simpson's 1/3 rule compared to that in Trapezoidal rule?

b) Provide the geometrical interpretation of the Trapezoidal formula.

c) Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ taking 6 subintervals by i) Trapezoidal Rule and ii) Simpson's 1/3 rule. Compare the relative percentage of error in each of the above two cases. (corrected up to 4 decimal points.)

d) Find the value of f ' (1.0) and f " (1.0) from the following tabulated function:

X	1	2	3	4	5
f(x)	3	11	31	69	131

[2+4+(4+4+2)+4=20]

Q 6.

a) Solve the following system of linear equations by Gauss elimination method.

$$2x + 4y - z = 1$$
$$4x + y + z = -2$$
$$2x - 3y + 6z = 1$$

b) Find out the inverse of the following matrix using Gauss-Jordan method.

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 5 \\ 1 & 0 & 8 \end{bmatrix}$$

c) Solve the following system of linear equations by Gauss-Jacobi iterative method.

$$4x + y + z = 2$$
$$x + 5y + 2z = -6$$
$$x + 2y + 3z = -4$$

d) What is the main drawback of the Gauss-Jacobi method and how do we overcome this problem in Gauss-Seidel method?

[5+6+7+2=20]