B.E Food Technology & Biochemical Engineering 2nd Year 2nd Semester Examination 2019
Numerical Methods and Computer Programming
Answer all questions

Time: 3 hours   Full Marks: 100

1) Derive the formula for Newton-Raphson method. Discuss about its convergence. Apply the Method to find the solution of the following equation.

$$Cosx - x^2 - x = 0$$

The root needs to be correct up to 3 decimal places. Take $x_0 = -1.5$

Or

Graphically illustrate Fixed Point Iteration and its convergence. Rewrite the equation x-Cosx=0 in the form x=g(x) such that choice of g(x) follows the condition for convergence of the said method in $(0, \frac{\Pi}{4})$. Apply the method to find the root of the equation continuing for three iterations.

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2) Solve the following linear simultaneous equations using Gaussian Elimination or Gauss-Jordan elimination.

$$x_0 + x_1 + x_2 + x_3 = 2$$

$$2x_0 + 3x_1 - x_2 + 2x_3 = 7$$

$$x_0 + x_1 + 3x_2 - 2x_3 = -6$$

$$x_0 + 2x_1 + x_2 - x_3 = -2$$

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3(a) Graphically illustrate Euler's method for finding numerical solution to first order differential equations. Apply the said method to find the value of y at x= 0.10 from the following:

$\frac{dy}{dx} = (x+y)$, y(0)=1. Take h=0.05

(b) The speed of a moving body in m./sec. is given below

t (sec.)	0	2	4	6	8	10	12
v (m./sec)	4	6	16	34	60	94	136

Find the distance traversed by the moving body in 12 sec., using Trapezoidal rule.

7+7

[Turn over

4) Obtain the Lagrange's interpolating polynomial from the following data.

x=	0	1	3	4
y=	5	6	50	105

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5(a) Write a C program to read the coordinates (x1,y1), (x2,y2) of a pair of points on X-Y plane as input and display the length of the straight and the slope of the straight line joining the two points.

(b) Write a C program to find the sum of *1+(1+2)+(1+2+3)+(1+2+3+4)+ ... n terms*

6+9

6(a) Write a C program to read n numbers, denoted by $x_1, x_2, ... , x_n$, in an array and display

i) the mean (x_m) of the numbers given as $x_m = \frac{\sum_{i=1}^{n} x_i}{n}$

ii) the variance (v) given as $v = \frac{\sum_{i=1}^{n}(x_i - x_m)^2}{n}$

iii) the standard deviation (sd) given as $sd = \sqrt{v}$

The value of n which can be at most 100 is to be read as input at the beginning of the program.

Or

Write a C program to read a list of n numbers in an array and display the second largest number in the list. The value of n which can be at most 100 is to be read as input at the beginning of the program.

Hints: First find the largest number in the list. Then compute the difference between the largest and each number in the list. If the difference between the largest and a number becomes less than the difference between the largest and a number compared previously then store the number as a possible choice for the second largest and continue the process until all the numbers in the list are so compared. The tentatively chosen second largest left finally is the second largest number in the list.

(b) Write a C program to read a 10x10 table of numbers in a two dimensional array and find the sum of all numbers stored there excepting those in the diagonal positions.

10+10

3 Write a user defined function in C to find the value of the following function for a given value of x.

$$f(x) = \begin{cases} 2x^2+3x+4 & \text{for } x<2 \\ 0 & \text{for } x=2 \\ -2x^2+3x-4 & \text{for } x>2 \end{cases}$$

Using the function, write a complete C program to read the value of x as input and display the corresponding value of f(x).

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