

**B.E Production Engineering 1<sup>st</sup> Year 2<sup>nd</sup> Semester Examination 2018**  
**Computer Programming and Numerical Analysis**

*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 root of the following equation corrected up to 3 decimal places  $\cos x - x^2 - x = 0$ . Take  $x_0 = -1.5$

OR

Graphically illustrate Fixed Point Iteration and its convergence. Apply the method to find the root of the equation  $e^x - 4x^2 = 0$  in (4,5). Give the value of the root obtained after three iterations.

14

2(a) Apply Gaussian Elimination to solve the following:

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

$$2x_0 + x_1 + x_2 - 3x_3 = 1$$

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

$$5x_0 + x_1 + 3x_2 - 2x_3 = 7$$

(b) Assuming  $n$  variable simultaneous linear equations, write the formula for  $i^{\text{th}}$  variable  $x_i$  for  $(k+1)^{\text{th}}$  iteration under Gauss Seidel Iterative Method and its condition for convergence. When would you prefer an iterative method?

8+6

3(a) A river is 80 meter wide. The depth  $y$  in meter at a distance  $x$  from one bank is given by the following table.

$x$ (in m.)	0	10	20	30	40	50	60	70	80
$y$ (in m.)	0	4	7	9	12	15	14	8	3

Calculate the area of the vertical cross section of the river using a suitable numerical method you have studied.

(b) Give the formula for modified Euler's method. Find  $y(0.25)$  and  $y(0.5)$ , using modified Euler's method with  $h=0.25$ , given that

$$\frac{dy}{dx} = 3x^2 + y, y(0) = 4.$$

7+7

[ Turn over

4) The following table gives the premium payable at ages in years completed. Interpolate the premium payable at age 35 years completed.

Age Completed	25	30	40	60
Premium in Rs.	50	55	70	95

8

5(a) Write a C program to read the lengths of the three sides of a triangle as input and display a message indicating whether the triangle is a right angled one.

(b) Write a C program to implement Newton-Raphson Method. The result needs to be correct up to 3 decimal places. Test your program with the function  $f(x)=x^4-x-10$ . Take  $x_0=1$ .

6+9

6(a) Write a C program to sort a list of integers in ascending order of their values. Use **Bubble Sort**. The program needs to be so designed that if the list of integers supplied as input is found sorted at the beginning then the program will stop after scanning the numbers in the list just for once.

(b) The **1-norm** of a square matrix  $a$  is nonnegative real number denoted by

$$||A||_1 = \max_{1 \leq j \leq n} \left( \sum_{i=1}^n |a_{ij}| \right)$$

= the maximum column wise sum of absolute values

For example, the 1-norm of the following matrix

$$\begin{bmatrix} 5 & -4 & 2 \\ -1 & 2 & 3 \\ -2 & 1 & 0 \end{bmatrix}$$

Is  $\max(5+1+2, 4+2+1, 2+3+0)=8$ .

Write a C program to find the 1-norm of a square matrix. The matrix shown above may be used as test data for the program.

10+10

7(a) Write a C program for printing the first  $n$  prime numbers. Use a user defined function to check the primality of a number passed as its argument.

(b) Write C program that will ask for the name of its user and printing a message thanking the user by mentioning his/her name.

10+5