Ref No.: Ex/PE/CSE/T/212/2017(S)

**B. Power Engineering 2nd Year 1stSemester Supplementary Examination, 2017**

# Numerical Methods & Computer Programming

**Time – 3 hours** **Full Marks - 100**

**Answer any five questions**

1. a. Write a function to simulate the functionality of the strcmp function. *4*
   b. Compare local variables and global variables. *2*
   c. Write a program to remove the duplicate elements from an array of integers. The output of the program should be the unique elements of the array. *10*
   d. What is a pointer? How pointers and arrays are related. *2+2*

2. a. Write a program to print all the prime numbers in a given range. *5*
   b. Write 2 functions, one iterative and the other recursive, to find the factorial of a number. *5*
   c. Write a program which takes as input the names, rolls and marks obtained in 6 subjects for a set of students from the user and prints the rolls of the students sorted in decreasing order of total marks obtained. *10*

3. a. What is a structure (*struct*) in C and what is its usefulness? *2*
   b. Write a program to check whether an integer number is a palindrome or not. *6*
   c. Write a program to replace a square matrix with its transpose without using another matrix. *6*
   d. Write a function to reverse a string without using a second string. *6*

4. a. Discuss the functionalities of the "break" and "continue" statements in C with suitable examples. *4*
   b. Is there any difference between a string and a character array? Explain your answer. *2*
   c. What are the utilities of functions? Write the properties of a recursive function. *3+2*
   d. Given the following set of tabular values, find the derivative at x = 0.075. *5*

| $x$ | 0.0 | 0.2 | 0.4 | 0.6 | 0.8 |
|---|---|---|---|---|---|
| $y$ | 0.0 | 0.1823 | 0.3365 | 0.47 | 0.5879 |

   e. Explain the Newton Raphson method together with its graphical interpretation. *4*

5. a. Discuss the trapezoidal method for numerical integration. *4*
   b. Find the root of the equation $x^3 - 16 = 0$ correct upto 3 decimal places using
      i. Bisection method.
      ii. Regula Falsi method.

iii. Newton Raphson method, and
iv. Secant method. *4*4*

6. a. Define Eigenvalue and Eigenvector of a square matrix. *2*
   b. Solve the following set of linear simultaneous equations by the Gauss-Jordan elimination method.

$$\begin{aligned} 3x + y - 2z &= 9 \\ -x + 2y + 3z &= 4 \\ 2x - 3y + z &= 1 \end{aligned}$$

*10*

   c. Find the Eigenvalues and the corresponding Eigenvectors for the following square matrix. *8*

$$A = \begin{matrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{matrix}$$

7. a. What is interpolation and how do you choose an interpolation technique? *2*
   b. Find the relationship between the following pairs of operators:
      i. forward difference operator ($\Delta$) and backward difference operator ($\nabla$)
      ii. central-difference operator ($\delta$) and shift operator (E).
      iii. averaging operator ($\mu$) and shift operator (E). *3*2*
   c. Given the following table of values, find the values of y at $x$=0.15and 0.75. *2*3*

| $x$ | 0.0 | 0.2 | 0.4 | 0.6 | 0.8 |
|---|---|---|---|---|---|
| $y$ | 0.0 | 0.1823 | 0.3365 | 0.47 | 0.5878 |

   d. Evaluate the following integral by the Trapezoidal method considering the error tolerance of 0.001. *6*

$$I = \int_0^2 \frac{1}{x+1} dx$$