INDIAN STATISTICAL INSTITUTE

First Semester Examination: 2025-26

M. S. (QE) – I

COMPUTER PROGRAMMING & APPLICATIONS

Date: 17/11/2025 Total Marks: 50 Duration: 3 hours

Answer any 5 questions with *neat handwriting*. Do not use calculator/log table.

1. Approximate the following definite Integral using Trapezoidal rule with the given sub-intervals (correct up to 2 decimal places). Also calculate the ration of errors in both the cases (a & b).

$$\int_0^2 \frac{2x^4 + 3x^2 + 4}{x + 1}$$

a) with $n = 2$ sub-intervals

b) with $n = 4$ sub-intervals

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2. Consider the following system of equations:

$$2x + 3y - z = 8$$
$$2x + \alpha y + 3z = 4$$
$$4x + 2y + \beta z = 8$$

Use the Gaussian elimination method and determine the consistency of this system, for

a) $\alpha = 1,\ \beta = 6$

b) $\alpha = 4,\ \beta = 5$

If the system consistent, then find its solution (rounded to 2 decimal places).

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3. Approximate the square root of the following numbers using Newton-Raphson's method.

a) 4 (use $x_0 = 3$)

b) 16 (use $x_0 = 5$)

Find x_1, x_2 and x_3 only (you may keep then in fraction).

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4. In ANSI C programming, the first argument to *strtok()* is a pointer to the string you want to tokenize and the second argument is a pointer to a string containing the delimiter characters. *strtok()* finds the first token, replaces the delimiter character immediately following it with a null terminator (\0), and returns a pointer to the beginning of this token. For subsequent calls to get the next token from the same string, the first argument to *strtok()* should be NULL, whereas the second argument (the delimiter string) can be the same or different. The function *strtok()* remembers the state of the string from the previous call and continues searching for the next token. It returns a pointer to the next token or NULL if no more tokens are found. Implement (ANSI C) such function without using *strtok()*.

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5. To store an Triangular matrix ($N \times N$) using 2 dimensional array 0 (zero)s are unnecessarily stored. To store non-zero elements, only $\frac{N \times (N+1)}{2}$ space is needed instead of N^2. Therefore for larger values of N, implementing such Triangular matrix using 2 dimensional array is not an efficient implementation (considering memory requirement). You need to design a better way to store such matrix.

   Write an ANSI C program to read and display Upper / Lower Triangular matrix using your proposed design.

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6. A polynomial of a single indeterminate may be represented using the following structure.

```
struct POLYNOMIAL{
        double dCoefficient;
        unsigned  uiExponent;
        struct POLYNOMIAL * stpNextTerm;
}
```

   Write an ANSI C functions to read, display and free POLYNOMIAL using the above mentioned structure.

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