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**B.Tech. (Chemical Engg.) (Sem.-4)**  
**NUMERICAL METHODS IN CHEMICAL ENGG.**

Subject Code : BTCH-405B

M.Code : 78135

Date of Examination : 14-07-22

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

**SECTION-A**

**1. Write briefly :**

- a) The area of cross-section of a rod is desired upto 0.2% error. How accurately should the diameter be measured?
- b) Using finite difference method, find  $y(1)$  satisfying the differential equation  $\frac{d^2y}{dx^2} + y = x^2$ , subject to the boundary condition  $y(0) = 0, y(2) = 2$ .
- c) Compute the value of  $\int_0^6 e^x dx$  using Simpson's  $\frac{1}{3}rd$  rule.
- d) Find the condition that the cubic  $x^3 - lx^2 + mx - n = 0$  should have its root in Arithmetical progression.
- e) Find the Laplace transform of  $\sin^2(at)$ .
- f) Derive Simpson's  $\frac{3}{8}$ th rule from Newton Cotes formula of numerical integration.
- g) What do you mean by complete pivoting in Gauss-Elimination method?
- h) Which interpolation polynomial can be used for the given data in unequal intervals?
- i) Find Laplace transform  $\frac{1}{2s^2 - 1}$ .
- j) Like parallel forces 4 and 7 dynes act at points A and B which are 22 cm apart. Find the magnitude and distance of resultant from point A.

## SECTION-B

2. Solve the following system of equations by Gauss-Seidel method, correct upto two decimal places :

$$9x - 2y + z = 50,$$

$$x + 5y - 3z = 18,$$

$$-2x + 2y + 7z = 19.$$

3. Using Newton-Raphson iterative method, find the real root of  $x \log_{10} x = 1.2$  correct to three decimal places.
4. A curve passes through the points (0,18), (1,10), (3, -18) and (6,90). Find the slope of the curve at  $x = 2$  using Lagrangian interpolation.
5. Find the inverse Laplace transform of the function :  $F(s) = \frac{(s-1)^2}{(s-2)^4}$ .
6. Evaluate  $\int_0^1 \frac{dx}{1+x}$  using Trapezoidal rule.

## SECTION-C

7. Solve the system of equations using LU decomposition :

$$3x + 2y + 7z = 4$$

$$2x + 3y + z = 5$$

$$3x + 4y + z = 7$$

8. Use Runge-Kutta method of 4th order to approximate the value of  $y$  at  $x = 0.2$  with step size 0.1 of the differential equation  $\frac{dy}{dx} = x + y^2$ , given that,  $y = 1$  when  $x = 0$ .
9. Use Faddeev's method to find the characteristic polynomial and eigen values of the matrix  $\begin{bmatrix} 2 & -12 \\ 1 & -5 \end{bmatrix}$ .

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**