

- N.B. : 1) Question No.1 is compulsory
 2) Answer any three questions from remaining questions
 3) Assume data if necessary and specify assumptions clearly

Q.1 a) Use crank Nicholson scheme to solve $u_{xx}=ut$, $0 \leq x \leq 1$, $h=1/4$, $k=1/8$, Given $u(x,0)=0$, $u(0,t)=0$, $u(1,t)=50t$. Compute u for 1- step in t - direction. [5marks]

b) Explain Truncation error in short. [5 marks]

c) A chemical reaction is carried out in batch reactor and it has been found that concentration of reactant changes as per the equation given below. [05]

$$\frac{dC_A}{dt} = \frac{C_A}{1 + 0.5C_A^{1.8}}$$

d) Solve following system of equation by using gauss elimination method.

$x+y+z=7$; $x+2y+3z=16$; $x+3y+4z=22$ [5 marks]

Q.2 a) Calculate straight line ($y=a+bx$) using Least square method. [10 marks]

X	1996	1997	1998	1999	2000
Y	40	50	62	58	60

b) Solve by using regula falsi method $x^3 - 4x - 9$ upto 4 decimal places. [10 marks]

Q.3 a) if $dy/dx = (y^2 - x^2) / (y^2 + x^2)$, $y(0)=1$, $h=0.2$ find $y(0.4)=?$

By using runge kutta order 4 method. [10 marks]

b) Solve by using LU decomposition method.

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

$$3x+2y+z=10$$

$$x-5y+3z=0$$

Q4 a) A volume and level in gravity flow tank system is given by following equations, [20 marks]

$$\frac{dV}{dt} = 0.0107h - 0.00205V^2$$

$$\frac{dh}{dt} = 0.311 - 0.062V$$

Where, V in cu. ft and h in ft and time in sec.

The parameters and variables are given as given below.

V= tank volume, (at t=0, 3.4 cu.ft.)

h= level in tank, (at t=0, 20.5 ft.)

Find the level and volume after one minute using Runge kutta second order method.

Q.5 a) Solve $\frac{dy}{dx} = x^2(1 + y)$, $y(1) = 1$, $h=0.1$ find the value of $y(1.4)_p$ and $y(1.4)_c$ by Adam-Bashforth method.

[10 marks]

b) Calculate the volume of superheated steam at 100atm and 350 0C using the equation $\left(P + \frac{a}{v^2}\right)(v - b) = RT$, Newton Raphson Method, for initial value of v use ideal gas equation.

Where, $a = \frac{27R^2T_c^2}{64P_c}$, $b = \frac{RT_c}{8P_c}$, $T_c=647.11K$, $P_c=220.76$ atm.

[10 marks]

Q.6 a) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ By using

[10 marks]

1. Trapezoidal rule
2. Simpson's (1/3)rd rule
3. Simpson's (3/8)th rule

b) Using Newton's Backward Difference formula to find solution.

[10 marks]

x	1.4	1.6	1.8	2	2.2
f(x)	4.0552	4.953	6.0496	7.3891	9.025

At x=2 .