DATE: 23/5/2022

University of Mumbai

QP CODE: 93401

Program: Chemical Engineering
Curriculum Scheme: 2019
Examination: SE Semester IV
Course Code: CHC403 and Course Name: **Numerical Method in Chemical Engineering**

Time: 2 hour 30 minutes

Max. Marks: 80

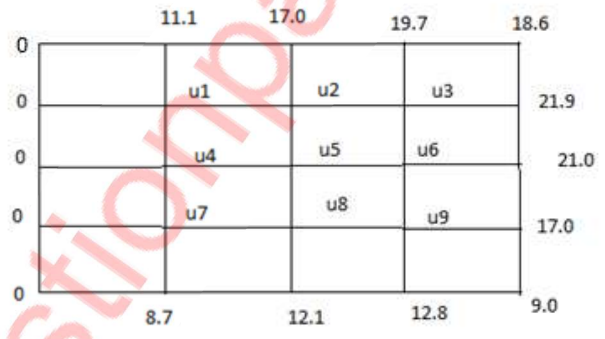===

Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Trapezoidal formula is also known as _____
Option A:	Simpson's rule
Option B:	Co-ordinate method
Option C:	Prismoidal method
Option D:	Average end area method
2.	Root of the equation x^3-x-1 lies between:
Option A:	2 and 3
Option B:	0 and 1
Option C:	3 and 4
Option D:	1 and 2
3.	General form of second order partial differential equations is $Au_{xx}+Bu_{xy}+Cu_{yy}+Du_x+Eu_y+Fu = 0$. The equation is said to be elliptic at a point (x,y) in the plane if
Option A:	$B^2 - 4AC =0$
Option B:	$B^2 - 4AC <0$
Option C:	$B^2 - 4AC >0$
Option D:	$B^2 - 4AC =constant$
4.	The Gauss-Seidel method is applicable to strictly diagonally dominant or symmetric positive definite matrices because in this case
Option A:	convergence is possible
Option B:	error is less
Option C:	solution is stable
Option D:	solution is unstable
5.	Equation for Straight line curve fitting is
Option A:	y=a+bx
Option B:	y=a+bx^2+c
Option C:	y=a+bx^2+cx^3
Option D:	y=ax+bx^2+cx^3+d
6.	The differential equation with more than one independent variable is called _____
Option A:	An Ordinary Differential Equation
Option B:	Partial Differential Equation
Option C:	Simultaneous Equation
Option D:	Simple Equation

7.	In general the ratio of truncation error to that of round off error is
Option A:	2:1
Option B:	1:1
Option C:	1:2
Option D:	1:3
8.	$y(x+h) = y(x) + h\ f(x,y)$ is referred as _____ method.
Option A:	Euler
Option B:	Modified Euler
Option C:	Taylors series
Option D:	Runge kutta method
9.	Which of the following is one dimensional wave equation?
Option A:	$\partial^2 u\ /\ \partial t^2 = C$
Option B:	$\partial^2 u\ /\ \partial t^2 = C\ \partial u\ /\ \partial x$
Option C:	$\partial^2 u\ /\ \partial t^2 = C^2\ \partial u\ /\ \partial x$
Option D:	$\partial^2 u\ /\ \partial t^2 = C^2\ \partial^2 u\ /\ \partial x^2$
10.	The augmented matrix in Gauss Jordan method is reduced to _____
Option A:	Row Echelon form
Option B:	Column Echelon form
Option C:	Matrix Echelon form
Option D:	Augmented form

2	Solve any Two Questions out of Three 10 marks each
A	Explain types of Error and differentiate between Accuracy and precision.
B	Solve the system of equation by Gauss Seidel method, correct to three decimal places. $x + y + 54\ z = 110$ $27\ x - 6\ y - z = 85$ $6\ x + 15\ y + 2\ z = 72$
C	A mass balance for a chemical in a completely mixed reactor can be written as $$V\ (dc\ /dt) = F - Qc - kVc^2$$ where V = volume (14 m^3), c = concentration (g/m^3), F = feed rate (200 g/min), Q = flow rate (1 m^3 /min), and k = a second-order reaction rate (0.12 m^3 /g/min). If c(0) = 0, solve the ODE until t= 3 . Use the Runge Kutta 4th order method (h = 0.5)

3.	Solve any Two Questions out of Three 10 marks each

| A | Calculate straight line (y=a+bx) using Least square method |

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

B	The spherical storage tank containing oil has a diameter of 6 ft. Calculate the height h to which a dipstick 8 ft long would be wet with oil when immersed in the tank when it contains 4 ft3 of oil. The equation that gives the height, h, of the liquid in the spherical tank for the given volume and radius is given by $V = \frac{3\pi h^2(3r-h)}{9}$, Use the Bisection Method to find the height (h), to which the dipstick is wet with oil.
C	Solve by LU Decomposition Method $\begin{bmatrix} 25 & 5 & 1 \\ 64 & 8 & 1 \\ 144 & 12 & 1 \end{bmatrix}$

Q4.	Solve any Two Questions out of Three 10 marks each
A	Solve following PDE by using bender schmidt method $\dfrac{\partial^2 u}{\partial x^2} - \dfrac{\partial u}{\partial t} = 0$ subject to u(0,t)=0 and u(5,t)=0,u(x,0)=x²(25-x) take h=1 upto 3 seconds.
B	Find by Liebmann's method the values at the interior lattice point of a square region of the harmonic function u whose boundary values are as shown in fig. Boundary values (top row): 11.1, 17.0, 19.7, 18.6 Left side: 0, 0, 0, 0, 0 Right side: 21.9, 21.0, 17.0, 9.0 Bottom row: 8.7, 12.1, 12.8 Interior lattice points: u1, u2, u3, u4, u5, u6, u7, u8, u9
C	Find solution using Trapezoidal and Simpsons 1/3 rule | X	1.4	1.6	1.8	2.0	2.2
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F(x)	4.0552	4.9530	6.0436	7.3891	9.0250	