Reg. No | | | | | | | | | |

AY 24

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

M.Tech. (First Semester) Regular Examinations, February – 2025

24MPCHPC11001– Mathematical and Statistical Methods in Chemical Engineering

(Chemical)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions

	Question	CO #	Blooms Level
a.	Prove that if a subsequence of a Cauchy sequence converges to L, then the full sequence also converges to L.	CO1	K2
b.	You apply the Gauss-Seidel method to solve a linear system having an iteration matrix T = -(D+L)-1U with spectral radius ρ(T) = 0.998. Using the fact that log10(0.998) = - 0:0009, roughly how many iterations are needed to reduce the error in the initial guess by a factor of 10-6?	CO2	K2
c.	Write Adam's -Bashforth predictor and corrector formulae.	CO2	K1
d.	Write on Levenberg–Marquardt Algorithm.	CO4	K1
e.	Name the function represented by the Taylor series $1-x^2/2+x^4/24-x^6-720+\ldots$ at a = 0.	CO3	K1

PART – B **(10 x 5 = 50 Marks)**

<u>Answer ***ALL*** the questions</u>

	Question	Marks	CO #	Blooms Level
2. a.	Find for each m, the solution space of the linear system 3x + 2y + mz = 0 mx - y + 4z = 0 2x + y + 3z = 0	10	CO1	K1
	(OR)			
b.	Suppose $p(t) = 3t - t^2$ and $q(t) = 3 + 2t^2$. For p and q in P_2, define (p, q) = p(−1)q(−1) + p(0)q(0) + p(1)q(1). Compute (p, q). Also Compute the orthogonal projection of q onto the subspace spanned by p.	10	CO1	K3
3.a.	Solve the following set of three linear algebraic equations in three variables using Gauss-Seidel method. $10x_1+x_2+2x_3 = 44$ $2x_1+10x_2+x_3 = 51$ $x_1+2x_2+10x_3 = 61$	10	CO1	K2
	(OR)			
b.	Solve by Gauss-Jacobi method, the following system: 28x+4y-z=32 X+3y+10z=24 2x+17y+4z=35	10	CO2	K2
4.a.	Use Newton's backward difference formula to construct an interpolating polynomial of degree 3 for the data: f(- 0.75) = - 0.0718125, f(- 0.5) = - 0.02475, f(- 0.25) = - 0.3349375 and f(0) =1.101. Hence find f (- 1/3).	10	CO4	K2

	(OR)			
b.	Apply Newton's method to determine a real root of equation: $f(x) = x^3-5x+1 = 0$. Take the initial approximation as x0=0.5.	10	CO4	K3
5.a.	Find a real root of cos x = 3x – 1 by Wegstein's method correct to three decimal places.	10	CO3	K2
	(OR)			
b.	Obtain the values of x and y that satisfy the following 2 non-linear algebraic equations: $f(x, y) = e^x+xy-1=0$ G(x,y) = sin xy+x+y-1=0	10	CO3	K2
6.a.	Integrate the ordinary differential equation dy/dx=x+y Using Runge-Kutta 4th order method. The initial condition is at x=0, y=0. determine the value of y at x=0.2. The analytical solution is given by y=ex-x-1.	10	CO5	K3
	(OR)			
b.	Using Milne's method, compute y (0.8) given that $dy/dx=1+y^2$, y(0)= 1, y(0.2)= 0.2027, y(0.4) =0.4228, y(0.6) = 0.6841.	10	CO5	K3

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