

**Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)**



M.Tech. (First Semester – Regular/Supplementary) Examinations, January– 2026
**24MCHPC11001 – Mathematical & Statistical Methods in Chemical
Engineering
(Chemical Engg.)**

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 <i>ALL</i> questions	CO #	Blooms Level
a. Explain the terms initial and boundary value problems?	CO1	K1
b. Define dot product.	CO2	K1
c. What are the eigenvalues of the matrix $[1\ 4\ 6\ 0\ 2\ 5\ 0\ 0\ 3]$?	CO4	K1
d. What is the Levenberg–Marquardt Algorithm?	CO5	K1
e. Write Adam’s -Bashforth predictor and corrector formulae.	CO3	K1

PART – B **(10 x 5 = 50 Marks)**

Answer *ALL* the questions

	Marks	CO #	Blooms Level
2. a. $S = \{(2,5,3), (1,0,2)\}$ and $T = \{(2,0,5), (3,5,5)\}$. The intersection of $\text{span}(S)$ and $\text{span}(T)$ is a vector space. What is the dimension of that space? (OR)	10	CO1	K2
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	K2
3.a. Solve the following set of three linear algebraic equations in three variables using Gauss-Seidel method. $10x_1 + x_2 + 2x_3 = 44$ $2x_1 + 10x_2 + x_3 = 51$ $x_1 + 2x_2 + 10x_3 = 61$ (OR)	10	CO3	K3
b. Apply Newton’s method to determine a real root of equation: $f(x) = x^3 - 5x + 1 = 0$. Take the initial approximation as $x_0 = 0.5$.	10	CO4	K2
4.a. Obtain the values of x and y that satisfy the following 2 non-linear algebraic equations: $f(x, y) = e^x + xy - 1 = 0$ $G(x, y) = \sin xy + x + y - 1 = 0$ (OR)	10	CO4	K2
b. 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 $x=0.2$.	10	CO3	K2
5.a. Use Milne’s predictor–corrector method to compute $y(0.6)$ for the differential equation $dy/dx = x + y$ with step size $h=0.2$ and the following starting values:	10	CO4	K2

$y(0)=0, y(0.2)=0.2214, y(0.4)=0.4918.$

(OR)

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|------|---|----|-----|----|
| b. | Use the Taylor series method of order 3 to approximate $y(0.2)$ for the differential equation: $dy/dx=x+y^2, y(0)=0.1$ with step size $h=0.1$. | 10 | CO4 | K2 |
| 6.a. | Find a root of $f(x)=e^x+x-2=0$ upto 4 decimal places using Secant method assuming Initial values of $x_0=0$ and $x_1=1$, tolerance: $\epsilon=0.0001$. | 10 | CO5 | K2 |
| (OR) | | | | |
| b. | Find a real root of $\cos x - x = 0$ by Wegstein's method correct to three decimal places. | 10 | CO5 | K2 |

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