Enrolment No/Seat No.: ___________________

R.N.G.PATEL INSTITUTE OF TECHNOLOGY-RNGPIT

(An Autonomous College U/s UGC Act 1956)

B.TECH SEMESTER-I, SEMESTER END EXAMINATION – SUMMER 2025

Subject Code: 1SH101 **Date: 02-06-2025**

Subject Name: ENGINEERING MATHEMATICS

Time: 11:00 AM to 02:00 PM **Total Marks: 70**

Instructions

1. It is **compulsory** for students to write **Enrolment No. /Seat No.** on the question paper.
2. Write answers of **Section A** and **Section B** in **separate answer books**.
3. Attempt all questions from both **Section A** and **Section B**.
4. Each section carries **35 marks**, with a total of **70 marks** for the examination.
5. The figures to the right of each question indicate full marks, make suitable assumptions with justification.
6. BL - Bloom's Taxonomy Levels (R-Remember, U-Understanding, A –Application, N –Analyze, E –Evaluate, C -Create), CO - Course Outcomes.

SECTION A

		Marks	BL	CO
Q.1	**Multiple-Choice Questions**	**[05]**		
	(a) The gradient of $\phi(x,y,z)=xyz$ at (1, 2, -1) is ______. **(i)** (-2,-1,2) **(ii)**(6,2,1) **(iii)**(2,-2,-1 **(iv)** (-2,2,-1)	**1**	**A**	**2**
	(b) If $f(x,y)=c$ be an implicit function, then $\frac{dy}{dx}=$ ____ . **(i)** $\frac{p}{q}$ **(ii)** $\frac{-q}{p}$ **(iii)** $-\frac{f_x}{f_y}$ **(iv)** $-\frac{f_y}{f_x}$	**1**	**R**	**2**
	(c) If $L\{f(t)\}=\frac{s}{(s-3)^2}$, then $L\{e^{-3t}f(t)\}$ is______. **(i)** $\frac{s-3}{s^2}$ **(ii)** $\frac{s+3}{s}$ **(iii)** $\frac{s+3}{s^2}$ **(iv)** $\frac{s-3}{s}$	**1**	**A**	**4**
	(d) $L^{-1}\left\{\frac{1}{(s+a)^2}\right\}=$ ____ **(i)** e^{-at} **(ii)** te^{-at}	**1**	**A**	**4**

	(iii) $t^2 e^{-at}$ **(iv)** te^{at}			
	(e) Which of the following is an even function?	**1**	**R**	**5**
	(i) $\cos x$ **(ii)** e^x			
	(iii) $\sin x$ **(iv)** $\pi^2 - x^3$			
Q.2	**Attempt Any Two**	**[10]**		
	(a) Find the equations of the tangent plane and normal line to the surface $2x^2 + y^2 + 2z = 3$ at $(2,1,-3)$.	**5**	**A**	**2**
	(b) If $u = f(x-y, y-z, z-x)$, then show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$.	**5**	**A**	**2**
	(c) Find the extreme value of $x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$.	**5**	**A**	**2**
Q.3	**Attempt Any Two**	**[10]**		
	(a) Find the inverse Laplace transform of $\frac{s}{(s+1)(s-1)^2}$.	**5**	**A**	**4**
	(b) Find Laplace transform of $t(\sin t - t\cos t)$.	**5**	**A**	**4**
	(c) Solve the initial value problem Solve $y'' + y = t,\ y(0) = 1,\ y'(0) = 0$ using Laplace transform.	**5**	**A**	**4**
Q.4	**Attempt Any Two**	**[10]**		
	(a) Find the half-range cosine series of $f(x) = x(\pi - x)$ in the interval $(0, \pi)$.	**5**	**A**	**5**
	(b) Find the Fourier series of $f(x) = x^2$ in the interval $(-\pi, \pi)$.	**5**	**A**	**5**
	(c) Find the Fourier cosine integral of $f(x) = e^{-kx}$, where $x > 0, k > 0$.	**5**	**A**	**5**

SECTION B

	Marks	BL	CO
Q.1 Multiple-Choice Questions	**[05]**		
(a) The Eigen value of $A\begin{bmatrix}1&1&1\\0&2&1\\0&0&3\end{bmatrix}$ are ______ **(i)** $0,0,0$ **(ii)** $1,1,1$ **(iii)** $1,2,3$ **(iv)** $-1,-2,-3$	**1**	**U**	**1**
(b) The rank of the matrix is $\begin{bmatrix}1&2&3\\2&4&6\\3&4&5\end{bmatrix}$ is_____ **(i)** 1 **(ii)** 2 **(iii)** 3 **(iv)** 0	**1**	**U**	**1**
(c) The order and degree of $\frac{d^2y}{dx^2}=\left[\left(\frac{dy}{dx}\right)^2+1\right]^{\frac{3}{2}}$ is ______ **(i)** 2,2 **(ii)** 2,1 **(iii)** 1,2 **(iv)** 2, 3	**1**	**A**	**3**
(d) The equation $M(x,y)dx+N(x,y)dy=0$ is exact if ______ **(i)** $\frac{\partial M}{\partial x}=\frac{\partial N}{\partial y}$ **(ii)** $\frac{\partial M}{\partial x}=-\frac{\partial N}{\partial y}$ **(iii)** $\frac{\partial M}{\partial y}=-\frac{\partial N}{\partial x}$ **(iv)** $\frac{\partial M}{\partial y}=\frac{\partial N}{\partial x}$	**1**	**A**	**3**
(e) The Wronskian of $y_1=\cos 2x, y_2=\sin 2x$ is ______ **(i)** -2 **(ii)** 1 **(iii)** 2 **(iv)** 0	**1**	**A**	**3**
Q.2 Attempt Any Two	**[10]**		
(a) Find inverse by using Gauss Jordan method for the matrix $\begin{bmatrix}0&1&2\\1&2&3\\3&1&1\end{bmatrix}$	**5**	**A**	**1**

(b) Investigate for what values of λ and μ the equations **5** **A** **1**

$$x+2y+z=8$$
$$2x+2y+2z=13$$
$$3x+4y+\lambda z=\mu$$

have (i) no solution (ii) a unique solution, and (iii) many solutions.

(c) Find Eigen value and Eigen vector for the matrix **5** **A** **1**

$$\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}.$$

Q.3 Attempt Any Two **[10]**

(a) Form the differential equation by eliminating arbitrary constants from $y=Ae^{-3x}+Be^{2x}$. **5** **A** **3**

(b) Solve $\frac{dy}{dx}+y\sin x=e^{\cos x}$. **5** **A** **3**

(c) Solve $\frac{dy}{dx}+\frac{y}{x}=\frac{y^2}{x^2}$. **5** **A** **3**

Q.4 Attempt Any Two **[10]**

(a) Solve $y'''-3y''+3y'-y=4e^{x}$. **5** **A** **3**

(b) Using method of variation of parameter solve $\frac{d^2y}{dx^2}+y=\operatorname{cosec} x$. **5** **A** **3**

(c) Using method of undetermined coefficients, solve the equations $y''+2y'+4y=2x^2+3e^{-x}$. **5** **A** **3**

****