Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 1 – EXAMINATION – SUMMER 2026

Subject Code: BE01000041 / BE01R00041 **Date: 18/06/2026**

Subject Name: Mathematics-I

Time: 10:30 AM TO 01:30 PM **Total Marks: 70**

Instructions:

1. Attempt all questions.

2. Make suitable assumptions wherever necessary.

3. Figures to the right indicate full marks.

4. Simple and non-programmable scientific calculators are allowed.

Q.1	**(a)**	Check the convergence of $\int_0^\infty \frac{1}{x^2+1}dx$	**03**
	(b)	Define gamma function and using it evaluate the integral $\int_0^\infty x^4 e^{-x}dx$	**04**
	(c)	The circle $x^2+y^2=r^2$ is rotated about the x-axis to generate a sphere. Find the volume of the sphere.	**07**
Q.2	**(a)**	Evaluate $\lim_{x\to 0}\frac{x-sinx}{x^3}$ using L'Hospital rule.	**03**
	(b)	Find the Taylor series generated by $f(x)=cosx$ at $x=0$	**04**
	(c)	Find the Maclaurin series of the function $f(x)=(1+x)^\alpha$ where α is any real number.	**07**
		OR	
Q.2	**(c)**	Find the local extreme values of the function $f(x)=2x^3+3x^2-12x$	**07**
Q.3	**(a)**	Test the convergence of the series $\sum_{n=1}^{\infty}\frac{-n}{2n+5}$	**03**
	(b)	Test the convergence of the series $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{1}{n^{\frac{3}{2}}}$	**04**
	(c)	Check whether the series $\sum_{n=1}^{\infty}\frac{cosn}{n^2}$ is (a) absolutely convergent (b) conditionally converegent.	**07**
		OR	
Q.3	**(a)**	Investigate the convergence of the series $\sum_{n=1}^{\infty}\frac{2^n}{n^3}$	**03**
	(b)	Find the sum of the series $\sum_{n=0}^{\infty}\frac{4}{2^n}$	**04**
	(c)	Determine the values of x for which the series $\sum_{n=1}^{\infty}(-1)^{n-1}\frac{x^n}{n}$ is convergent.	**07**
Q.4	**(a)**	If $f(x,y)=\frac{x^2-y^2}{x^2+y^2}$, does $\lim_{(x,y)\to(0,0)} f(x,y)$ exist?	**03**
	(b)	If $z=x^2y+xy^2$, where $x=2+t^4$, $y=1-t^3$, find $\frac{\mathrm{d}z}{\mathrm{d}t}$ when $t=0$	**04**

(c) Find the extreme values of the function $f(x,y) = x^2y$ on the curve $x^2 + 2y^2 = 6$ **07**

OR

Q.4 **(a)** Find the equation of the normal line at the point $(-2,1,-3)$ to the ellipsoid $\frac{x^2}{4} + y^2 + \frac{z^2}{9} = 3$ **03**

(b) If $f(x,y,z) = xsin(yz)$, find the directional derivative of f at $(1,3,0)$ in the direction of the vector $\mathbf{v} = \mathbf{i} + 2\mathbf{j} - \mathbf{k}$ **04**

(c) Find the local extreme values of the function $f(x,y) = 9 - 2x + 4y - x^2 - 4y^2$ **07**

Q.5 **(a)** Evaluate $\int_0^{\pi} \int_1^2 ysin(xy)dxdy$ **03**

(b) Integrate $f(x,y) = xcosy$ over the region bounded by the curves $y = 0, y = x^2, x = 1$ **04**

(c) Sketch the region of integration, reverse the order of integration and evaluate the integral $\int_0^2 \int_{x^2}^{2x} (x^2 + y^2)dydx$ **07**

OR

Q.5 **(a)** Evaluate $\int_0^3 \int_0^1 \int_0^{\sqrt{(1-z^2)}} ze^y dxdzdy$. **03**

(b) Evaluate $\int_0^3 \int_0^{\sqrt{(9-x^2)}} sin(x^2 + y^2)dydx$ by converting to polar coordinates. **04**

(c) Find the volume of the solid that lies under the paraboloid $z = x^2 + y^2$ and above the region R in the $xy - plane$ bounded by $y = x^2$ and $x = y^2$ **07**

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