	Reg. No.:	
	Name :	

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TERM END EXAMINATIONS (TEE) – December 2021- January 2022

Programme	:	**B.Tech. – All Branches**	**Semester**	:	**Fall 2021-22**
Course Name	:	**Calculus & Laplace Transform**	**Course Code**	:	**MAT 1001**
Faculty Name	:	**Dr. Akshara Makrariya**	**Slot / Class No**	:	**E11+E12+E13 / 0142**
Time	:	**1½ hours**	**Max. Marks**	:	**50**

Answer ALL the Questions

Q. No.		Question Description	Marks
		PART - A (30 Marks)	
1.	(a)	If $z = f(x,y), x = r\ \cos\theta\ , y = r\ \sin\theta$, then show that $$\left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2 = \left(\frac{\partial f}{\partial r}\right)^2 + \frac{1}{r^2}\left(\frac{\partial f}{\partial \theta}\right)^2$$	10
		OR	
	(b)	Find the volume of the solid that lies under the hyperbolic paraboloid $z = 4 + x^2 - y^2$ and above the square$R = [-1,1] \times [0,2]$.	10
2	(a)	Evaluate $\iint \vec{F}.\hat{n}\, ds$ where $\vec{F} = 4x\vec{\imath} - 2y^2\vec{\jmath} + z^2\vec{k}$ and S is the surface bounding the region $x^2 + y^2 = 4,\ z = 0$ and $z = 3$.	10
		OR	
	(b)	Find the solution of differential equation $(D^2 - 2D + 1)y = e^x(3x^2 - 2)$.	5
	(c)	. Solve the Initial value problem $4y'' + 4y' + 37y = 12\cos t$ with $y(0) = 1\ , y'(0) = -2$.	5
3	(a)	Solve the equation $y'' + 9y = \cos 2t\ , y(0) = 1$ and $y\left(\frac{\pi}{2}\right) = -1$ using Laplace transform.	10
		OR	
	(b)	This problem gauges the relative effects of initial position and velocity on the motion in the unforced, overdamped case. Solve the initial value problems$y'' + 4y' + 2y = 0, y(0) = 5, y'(0) = 0$.	10
		PART - B (20 Marks)	
4(a)		Evaluated the double integral $\iint_D (x^2 + y^2)\, dx\, dy$, where D is the region bounded by $y = x, y = 2x$ & $x = 1$ in the first quadrant	5
4(b)		Calculate the minimum value of $x^2 + y^2 + z^2$ subject to the condition $xyz = a^3$	5
5		Consider overdamped forced motion governed by $y'' + 6y' + 2y = 4\,cos(3t)$. (a) Find the solution satisfying $y(0) = 6, y'(0) = 0$. (b) Find the solution satisfying $y(0) = 0, y'(0) = 6$.	10