Code No.: R22MA201BS	R22	H.T.No.			8	R						

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
I–B.TECH–II–Semester End Examinations (Regular) - June- 2025
VECTOR CALCULUS AND TRANSFORMS
(Common for all)

[Time: 3 Hours] **[Max. Marks: 60]**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 10 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART-A **(10 Marks)**

1.	a)	Write the sufficient conditions for the existence of the Laplace transform of a function.	[1M]
	b)	Define Unit Step function.	[1M]
	c)	Find $L^{-1}\{\frac{1}{s^{n+1}}\}$	[1M]
	d)	State Convolution Theorem.	[1M]
	e)	Define Beta function.	[1M]
	f)	Define Gamma function.	[1M]
	g)	Define Gradient of Scalar Point function.	[1M]
	h)	Define Curl of a vector.	[1M]
	i)	Write any two applications of Line integrals.	[1M]
	j)	State Green's Theorem.	[1M]

PART-B **(50 Marks)**

2.	a)	Evaluate L $\{t^2 \cos 3t\}$.	[5M]
	b)	Evaluate L $\{e^{-4t}\int_0^t \frac{\sin 3t}{t}\,dt\}$.	[5M]
		OR	
3.		Find L {f(t)} where f(t)=1; 0<t<1, and f(t)= -1; 1<t<2. (f(t) is a periodic function with period 2).	[10M]
4.	a)	Find inverse Laplace transformation of $\frac{s}{s^4+4a^4}$.	[5M]
	b)	Solve the integral equation $y(t) = 1 + \int_0^t y(u)\sin(t-u)\,du$, Using Laplace Transform.	[5M]
		OR	
5.		Solve the differential equation (D^2+9) x=sint, Using Laplace transform give that X(0)=1, $X'(0)=0$.	[10M]
6.	a)	Show that $\int_0^\infty x^4 e^{-x^2}\,dx = \frac{3\sqrt{\pi}}{8}$.	[5M]
	b)	Evaluate $\int_0^2 (8-x^3)^{\frac{-1}{3}}\,dx$ by using β –Γ function.	[5M]
		OR	
7.		Change the order of integration $\int_0^1 \int_{x^2}^{2-x} xy\,dy\,dx$ and hence evaluate of double integrals.	[10M]

8.a) Find the directional derivative of $xyz^2 + xz$ at (1, 1, 1) in the direction of normal to the surface $3xy^2 + y = z$ at (0, 1, 1). [5M]

b) Find the angle between the normal's to the surface $xy = z^2$ at the points (4, 1, 2) and (3, 3, -3). [5M]

OR

9. Show that the vector $(x^2 - yz)\,\vec{i} + (y^2 - zx)\,\vec{j} + (z^2 - xy)\,\vec{k}$ is irrotational and find its scalar potential. [10M]

10.a) Evaluate $\int_C y^2dx - 2x^2dy$ along the parabola $y = x^2$ from (0,0) to (2,4). [5M]

b) Apply Gauss Divergence theorem, prove that $\int \bar{r}.\bar{n}\,ds = 3V$. [5M]

OR

11. Verify Green's theorem for $\int(3x^2 - 8y^2)dx + (4y - 6xy)dy$, where C is the closed curve enclosed by the region bounded by $y = \sqrt{x}$ and $y = x^2$. [10M]

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