

Reg. No.:

Name :



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

<b>Programme</b>	<b>B.Tech</b>	<b>Semester</b>	<b>Fall 2021-2022</b>
<b>Course Name</b>	<b>Calculus and Laplace Transform</b>	<b>Course Code</b>	<b>MAT1001</b>
<b>Faculty Name</b>	<b>Dr. Anant Kant Shukla</b>	<b>Slot / Class No</b>	<b>C11+C12+C13/BL2021 221000132</b>
<b>Time</b>	<b>1½ hours</b>	<b>Max. Marks</b>	<b>50</b>

**Answer ALL the Questions**

Q. No. Question Description Marks

**PART - A – (3 x 10 = 30 Marks)**

1 (a) Find the directional derivative of the scalar function  $f(x, y) = x^2y^3 + xy - 5$ , in the direction of a unit vector which makes an angle of  $30^\circ$  with the positive  $x$ -axis in the  $XY$ -plane. 10

OR

(b) Find the value of the double integral  $\int_0^1 \int_{x^2}^{2-x} xy \, dy \, dx$ , by changing the order of integration. 10

2 (a) By using Gauss-Divergence theorem find the value of the surface integral  $\iint_S \vec{F} \cdot \vec{n} \, dS$ , where  $\vec{F} = [8x, -2y^2, z^2]$  and  $S$  is  $x^2 + y^2 = 8, z = 0, z = 3$ . 10

OR

(b) Solve the differential equation  $y''(t) + y'(t) - 2y(t) = 1 - 2t, y(0) = 0, y'(0) = 4$  by using the Laplace transform. 10

3 (a) Check whether the function  $e^{3x}$  is an integrating factor for the differential equation  $(3x^2y + 2xy + y^3)dx + (x^2 + y^2)dy = 0$ . If yes, then find the respective exact differential equation and its solution when  $y(0) = 0$ . 10

OR

(b) Let  $f(t) = \begin{cases} 1, & 0 \leq t < 1 \\ 2 - t, & 1 \leq t \leq 2 \end{cases}$  be a periodic function with period  $T = 2$ . Find the Laplace transform of  $f(t)$ . 10

**Part - B – (2 x 10 = 20 Marks)**

4 Evaluate the line integral  $\int_C \vec{F} \cdot d\vec{r}$ , where  $\vec{F} = [xy, x^2 + y^2]$  and  $C$  is the  $x$ -axis from  $x = 2$  to  $x = 4$  and the line from  $y = 0$  to  $y = 12$ . 10

5 Find the solution of the differential equation  $y''(x) + 8y'(x) + 16y(x) = 5e^{-4x}$  by the method of undetermined coefficients. 10

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