Reg. No.:

Name :

VIT BHOPAL
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Mid-Term Examinations – November 2021

Programme	:	**B.Tech.-BCE, BAC, BAI, MIM**	Semester	:	**Fall 2021-2022**
Course	:	**Calculus and Laplace Transforms**	Code	:	**MAT1001**
Faculty	:	**Dr. Bhumika Choksi**	Slot/Class No.	:	**B11+B12+B13/0148**
Time	:	**1½ hours**	Max. Marks	:	**50**

Answer all the Questions

Q. No.	Question Description	Marks
1	If $v = \exp(b\theta)\cos(b \ln r)$, then find the value of $v_{rr} + \frac{1}{r}v_r + \frac{1}{r^2}v_{\theta\theta}$.	**10**
2	The voltage V in a circuit is slowly dropping out as the battery wears out satisfying $V = IR$. At the same time, the resistance R is increasing at the resistor heats up. Find how the current I is changing at the instant when $R = 600\ \Omega$ and $I = 0.04\ \Omega$. Also, R increases at 0.5 Ω/sec and V decreases at 0.01 Ω/sec.	**10**
3	Evaluate the following integral **by changing the order of integration**: $\int_0^a \int_{\frac{y^2}{a}}^{2a-y} xy\ dA.$	**10**
4	A cylindrical hole of radius 'b' is bored through a sphere of radius 'a'. Find the volume of the remaining solid.	**10**
5	If $\bar{F} = (y^2 cosx + z^3)\hat{\imath} + (2ysinx - 4)\hat{\jmath} + (3xz^2 + 2)\hat{k}$, then show that $\int_C \bar{F} \circ \overline{dr}$ is independent of path of integration. Hence evaluate the integral when C is any path joining $P(0, 1, -1)$ to $Q\left(\frac{\pi}{2}, -1, 2\right)$.	**10**

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