

**VIT**Vellore Institute of Technology  
Approved by the Government of India under section 3 of IT Act, 2007**Continuous Assessment Test (CAT) – 2 – December 2022**

Programme	B.Tech.	Semester	Fall 2022-2023
Course Title	Calculus	Code	BMAT101L
Faculty	Dr. Biswajit Mallick, Dr. Surath Ghosh, Dr. Radha S, Dr. P. Vijay Kumar, Dr. Rajesh Kumar Mohapatra, Dr. Soumendu Roy, Dr. Abhishek Kumar Singh, Dr. Ashish Kumar, Dr. Manivannan, Dr. Kalyan Manna, Dr. Ashis Bera	Slot	B2+TB2
		Class Nbr	CH2022231700261, 263, 265, 269, 271, 547, 549, 551, 553, 555, 619
Duration	1 ½ Hours	Max. Marks	50

**Answer all the Questions (5×10=50)**

Q.No.	Sub. Sec.	Question Description	Marks
1.		Expand $f(x, y) = e^x \sin y$ in Taylor Series about $(1, \frac{\pi}{2})$ up to third degree terms and hence find the approximate value of $e^{0.5} \sin\left(\frac{\pi+2}{2}\right)$ .	[10]
2.		Find the absolute extrema of $z = 2x^2 + y - 3xy$ in the plane region $D$ bounded by the lines $y = 1 - x$ , $y = 1 + x$ , $y = -1 - x$ and $y = -1 + x$ .	[10]
3		Sketch the region of integration and evaluate $\int_0^3 \int_{4y/3}^{\sqrt{25-y^2}} x \, dx \, dy$ after changing the order of integration.	[10]
4.	[a]	Using spherical coordinates, evaluate $\iiint_E (x^2 + y^2) \, dv$ where $E$ lies between the spheres $x^2 + y^2 + z^2 = 4$ and $x^2 + y^2 + z^2 = 9$ .	[7]
	[b]	Evaluate $\iiint_R (x - y - z) \, dx \, dy \, dz$ , where $R: 1 \leq x \leq 2; 2 \leq y \leq 3; 1 \leq z \leq 3$ .	[3]
5.	[a]	If $n$ is positive integer and $m > -1$ , then prove that $\int_0^1 x^m (\log x)^n \, dx = \frac{(-1)^n n!}{(m+1)^{n+1}}$	[5]
	[b]	Using Beta and Gamma function, evaluate $\int_0^a y^4 \sqrt{a^2 - y^2} \, dy$ .	[5]

