



VIT

Vellore Institute of Technology
(Deemed to be University under section 3 of UEA, Act 1956)

SCHOOL OF ADVANCED SCIENCES
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2025-2026

REG.NO.:

SLOT: B1+TB1

Programme Name & Branch : All B. Tech First Years
Course Code and Course Name : BAMAT 101 and Multivariable Calculus and Differential equations
Faculty Name(s) : Common to B1 Slot
Class Number(s) : Common to B1 Slot
Date of Examination : 06-10-2025
Exam Duration : 90 minutes
Maximum Marks: 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Bloom's Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- CO2: change of variables between Cartesian and polar coordinates - Evaluation of triple integrals - change of variables between Cartesian and cylindrical, and spherical coordinates.
- CO3: Scalar and vector-valued functions – gradient, directional derivative, divergence, and curl – scalar and vector potentials. Line, surface and volume integrals -Statement of Green's, Stokes and Gauss divergence theorems -Verification and evaluation of vector integrals using them.
- CO4: Linear second-order ordinary differential equations with constant coefficients (Homogeneous Equations)

Q. No	Question	M	CO	BL
1.	Evaluate by changing to polar coordinates, the integral $\int_0^a \int_0^a \frac{x^2 dx dy}{\sqrt{(x^2 + y^2)}}$.	10	2	2
2.	Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dz dy dx}{\sqrt{(1-x^2-y^2)}}$ by changing to spherical coordinates.	10	2	2
3.	In computer graphics and robotics, potential fields are often used for path planning of autonomous robots. A robot moves in a 3D workspace where the artificial potential field is defined by $\vec{F} = x\vec{i} + 3y\vec{j} + z\vec{k}$. Show that this vector field is conservative, i.e., the path taken by the robot does not affect the total potential energy change. Also, find the scalar potential function ϕ corresponding to this field, which can be used as the robot's navigation potential. Briefly explain how such a potential function helps in avoiding obstacles and guiding the robot to its goal.	10	3	3
4.	Verify Green's theorem for $\oint_C (2xy dx - y^2 dy)$ where C is the boundary of the region bounded by the ellipse $3x^2 + 4y^2 = 12$.	10	3	2
5.	An electric circuit consists of an inductance of 0.1 henry, a resistance of 20 ohms and a condenser of capacitance 25 micro-farads. Find the charge q and the current $i = 0$ at any time t , given that at $t=0$, $q = 0.05$ coulomb.	10	4	3

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