Z/K/TY

Reg. No: 25BME0129

Final Assessment Test – November 2025

VIT®
Vellore Institute of Technology

Course: **BAMAT101 - Multivariable Calculus and Differential Equations**

Class NBR(s): **5455 / 5501 / 5503 / 5505 / 5509 / 5511 / 5513 / 5515 / 5517 / 5527**

Slot: **D2+TD2**

Time: **Three Hours**

Max. Marks: **100**

- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

COs	CO Statements
CO1	Evaluate partial derivatives and solve optimization problems involving several variables with or without constraints.
CO2	Solve multiple integrals in cartesian, polar, cylindrical and spherical coordinates.
CO3	Understand gradient, directional derivatives, divergence, curl, Green's, Stokes and Gauss Divergence theorems.
CO4	Utilize different solution methods to obtain the solution for second-order ordinary differential equations.
CO5	Demonstrate proficiency in solving linear and nonlinear first-order partial differential equations.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions
(10 X 10 = 100 Marks)

1.	Expand $e^x \cos y$ about $\left(0, \frac{\pi}{2}\right)$ upto the third term using Taylor's series.	CO1	BL2
2.	Find the dimensions of the rectangular box without a top of maximum capacity, whose surface is 108 sq cm.	CO1	BL3
3.	By changing the order of integration, evaluate: $\int_0^a \int_0^{x^2} x(x^2 + y^2) dy\, dx$.	CO2	BL3
4.a)	By transforming into cylindrical coordinates, evaluate the integral $\iiint (x^2 + y^2 + z^2) dx\, dy\, dz$ taken over the region of space defined by $x^2 + y^2 \leq 1$ and $0 \leq z \leq 1$.	CO2	BL2

OR

4.b)	Think of a circular wall of unit radius, capped by a parabolic dome defined by $z = -x^2 - y^2 + 9$. Practically, this models the volume of material under a curved roof mound confined within a circular wall boundary of radius 1. Calculate the volume of material under the paraboloid over that circular plan area.	CO2	BL2
5.	Prove that $\vec{f} = (2x + yz)\vec{i} + (4y + zx)\vec{j} - (6z - xy)\vec{k}$ is solenoidal as well as irrotational. Also, find the scalar potential.	CO3	BL3
6.a)	Verify Green's theorem in the xy plane for $\int_C [(xy + y^2)dx + x^2 dy]$, where C is the closed curve of the region bounded by $y = x$ and $y = x^2$.	CO3	BL3

OR

6.b) Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)\vec{i} - 2xy\vec{j}$, taken around the rectangle bounded by the lines $x = \pm a,\ y = 0,\ y = b$. CO3 BL3

A circuit has in series an electro motive force given by $\cos t$, resistor of 3 Ohm, inductor of 1 Henry and capacitor of 0.5 Farad. In initial current and charge on capacitor is zero. Find the charge on capacitor at any time $(t > 0)$. CO4 BL2

Solve, $xy'' - 2y' + \frac{2}{x}y = x$. CO4 BL2

9. a) Derive a partial differential equation from the relation $z = (x + y)f(x^2 - y^2)$. CO5 BL3

b) Solve, $z^2(p^2 + q^2) = x^2 + y^2$.

10. Solve the partial differential equation $(x^2 - yz)p + (y^2 - zx)q = z^2 - xy$. CO5 BL3

⇔⇔⇔ Z/K/TY ⇔⇔⇔

① $f(p,q) = 0$

② $f(z,p,q) = 0$

③ $f(p,q) = 0$

④ ~~$f(x,y,z,p,q)$~~

$z = ax + by + f(p,q)$

(5)