T/K/TY

Reg. No: 25BCE0701

Final Assessment Test – November 2025

VIT
Vellore Institute of Technology

Course: BAMAT101 - Multivariable Calculus and Differential Equations

Class NBR(s): 5324 / 5331 / 5334 / 5338 / 5348 / 5352 / 5364 / 5368 / 5372 / 5374 / 5389 / 5395 / 5398 / 5404 / 5407 / 5412 / 5416 / 5418 / 5420 / 5422 / 5424

Slot: B2+TB2

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.	Using Taylor's series expansion expand the function $f(x,y) = e^x \log(1+y)$ in powers of x and y up to third degree terms.	CO1	BL3
2.	Find the dimensions of rectangular server cabin, (top open) of maximum capacity and surface area 432 square meters.	CO1	BL3
3.	By changing the order of integration, evaluate $\int_0^1 \int_y^{2-y} xy\, dx\, dy$.	CO2	BL5
4.a)	By transforming into cylindrical coordinates, evaluate, $\iiint (x^2+y^2+z^2)\, dxdydz$ taken over the region of space defined by $x^2+y^2 \le 1$, and $0 \le z \le 1$.	CO2	BL5
	OR		
4.b)	A spherical antenna has signal strength distribution in space given by $\varphi(x,y,z) = \sqrt{1-x^2-y^2-z^2}$. The antenna has coverage radius $r = 1$ meters. Compute the total signal strength over the spherical coverage region.	CO2	BL5
5.	Find the values of the constants a, b, c if $\vec{F} = axyz^3\hat{\imath} + bx^2z^3\hat{\jmath} + cx^2yz^2\hat{k}$ is irrotational. For these values of a, b, c find its scalar potential φ.	CO3	BL2

6.a)	Verify Green' s theorem in the plane for $\int_C [(2x-y)dx + (x+y)dy]$ where C is the boundary of the circle $x^2 + y^2 = a^2$.		CO3	BL2
	OR			
6.b)	Verify Stokes theorem for $\vec{F} = (xy + y^2)\hat{\imath} + x^2\hat{\jmath}$ in the region in the xy-plane bounded by $y = x$ and $y = x^2$.		CO3	BL3
7.	Solve the differential equation by the method of variation of parameters. $(x^2D^2 - 4xD + 6)y = \sin(\log x)$, where $D = \frac{d}{dx}$, $x > 0$.		CO4	BL2
8.	The LCR- circuit equation, charge $q(t)$ on a plate of the condenser is given by $\frac{d^2q}{dt^2} + 2\frac{dq}{dt} + q = 2\sin 2t$. Find the charge q at time t, if initially $q = 0$ and $i = 0$.		CO4	BL3
9.	(i) Form the partial differential equation by eliminating the arbitrary function $'f'$ from the relation $z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$.		CO5	BL2
	(ii) Solve $p(1+q) = qz$.			
10.	Solve the partial differential equation $\frac{\partial u}{\partial x} = 4\frac{\partial u}{\partial y}$, $u(0,y) = 8e^{-3y}$, by the method of separation of variables.		CO5	BL2

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