CBCS SCHEME

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1BMATC101

First Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

Differential Calculus and Linear Algebra : CV Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. VTU Handbook is permitted.

		Module – 1	M	L	C
Q.1	a.	With usual notations, prove that $Tan\varphi = r\frac{d\theta}{dr}$.	6	L2	CO1
	b.	Find the angle of intersection of the curves $r^2\sin 2\theta = 4$ and $r^2 = 16\sin 2\theta$	7	L2	CO1
	c.	Show that for the curve $r(1-\cos\theta) = 2a$, ρ^2 varies as r^3.	7	L2	CO1
		OR			
Q.2	a.	With usual notations, prove that $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4}\left(\frac{dr}{d\theta}\right)^2$.	6	L2	CO1
	b.	Find the pedal equation of the polar curve $r^m = a^m(\cos m\theta + \sin m\theta)$	7	L2	CO1
	c.	Show that the radius of curvature at (a,0) on the curve $y^2 = \frac{4a^2(2a-x)}{x}$ is 'a'.	7	L2	CO1
		Module – 2			
Q.3	a.	Expand $\log(\sec x + \tan x)$ in powers of x as far as the term in x^5.	6	L2	CO1
	b.	If $u = f\{\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\}$ then show that $\sum x\frac{\partial u}{\partial x} = 0$	7	L2	CO1
	c.	If $u = \frac{yz}{x}, v = \frac{xz}{y}, w = \frac{xy}{z}$, show that $J\frac{(u,v,w)}{(x,y,z)} = 4$.	7	L2	CO1
		OR			
Q.4	a.	Evaluate i) $\lim_{x\to 0}[\frac{a^x+b^x+c^x}{3}]^{\frac{1}{x}}$ ii) $\lim_{x\to 0}[\frac{\sin x}{x}]^{\frac{1}{x^2}}$	6	L2	CO1
	b.	If u = f(y-z , z-x , x-y) then show that $\sum\frac{\partial u}{\partial x} = 0$	7	L2	CO1
	c.	Find the extreme valueof the function $f = x^4 + y^4 - 2(x-y)^2$	7	L2	CO1
		Module – 3			
Q.5	a.	Solve $\frac{dy}{dx} + \frac{y\cos x+\sin y+y}{\sin x+x\cos y+x} = 0$	6	L2	CO1
	b.	$[4xy + 3y^2 - x)]dx + x(x+2y)dy = 0$	7	L2	CO1
	c.	Abacterial culture growing exponentially increases from 100 to 400 grams in 10 hours. How much was present after 1hour	7	L3	CO1

		OR			
Q.6	a.	Solve $xy(1+xy^2)\frac{dy}{dx}=1$	6	L2	CO1
	b.	Find the Orthogonal trajectories of the family of curve $r=a(1+sin\theta)$	7	L2	CO1
	c.	In a certain chemical reaction the rate of conversion of a substance at time 't' is proportional to the quantity of the substance still untransformed at that instant. At end of 1hour 60grams remains and at the end of 4hours 21grams.how many grams of the first substance was there initially	7	L3	CO1
		Module – 4			
Q.7	a.	Solve $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+25y=e^{2x}+sinx+x$	6	L2	CO1
	b.	Solve by variation of parameter method $\frac{d^2y}{dx^2}+4y=tan2x$	7	L2	CO1
	c.	Solve $(x+1)^2\frac{d^2y}{dx^2}+(x+1)\frac{dy}{dx}+y=2sin\{\log(1+x)\}$	7	L2	CO1
		OR			
Q.8	a.	Solve $\frac{d^3y}{dx^3}-2\frac{d^2y}{dx^2}+4\frac{dy}{dx}-8y=0$	6	L2	CO1
	b.	Solve $x^2\frac{d^2y}{dx^2}-4x\frac{dy}{dx}+6y=x$	7	L2	CO1
	c.	Solve by variation of parameter method $\frac{d^2y}{dx^2}+y=secx$	7	L2	CO1
		Module – 5			
Q.9	a.	Find the rank of the matrix $\begin{bmatrix}4 & 0 & 2 & 1\\ 2 & 1 & 3 & 4\\ 2 & 3 & 4 & 7\\ 2 & 3 & 1 & 4\end{bmatrix}$.	6	L2	CO2
	b.	Solve the following system of equation by Gauss elimination method $x-2y+3z=2,\ 3x-y+4z=4,\ 2x+y-2z=10.$	7	L3	CO2
	c.	Find the Eigen values and Eigen vectors of the following matrix by using Rayleigh's power method. $A=\begin{bmatrix}4 & 1 & -1\\ 2 & 3 & -1\\ -2 & 1 & 5\end{bmatrix}$	7	L2	CO2
		OR			
Q.10	a.	Investigate the values of λ and μ such that $2x+y+4z=12,\ x+2y+3z=10,\ x+2y+\lambda z=\mu.$ (i) Unique Solution (ii) Infinite Solution (iii) No Solution	6	L3	CO2
	b.	Solve by Gauss-seidel iteration method: $83x+11y-4z=9, 3x+8y+29z=71, 7x+52y+13z=104$	7	L3	CO2
	c.	Find the eigen values and eigen vectors of the matrix $A=\begin{bmatrix}-19 & 7\\ -42 & 16\end{bmatrix}$	7	L2	CO2

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