Model Question Paper-I with effect from 2025

USN | | | | | | | | | | | **1BMATM201**

Second Semester B.E./ B.Tech. Degree Examination

Multivariable Calculus and Numerical Methods

TIME:03 Hours **Max.Marks:100**

Note:1.Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**
2. VTU Formula Hand Book is Permitted
3. M:Marks,L:Bloom'slevel,C:Courseoutcomes

		Module-1	**M**	**L**	**C**
Q 1.	**a**	Evaluate$\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)dzdydx$.	**6**	**L2**	1
	b	Evaluate $\int_{o}^{a}\int_{y}^{a}\frac{x}{x^2+y^2}dzdxdy$ by changing the order of integration.	**7**	**L2**	1
	c	**Prove that** $\beta(m\,,n)=\frac{\Gamma(m).\Gamma(n)}{\Gamma(m+n)}$ **and show that** $\Gamma\left(\frac{1}{2}\right)=\sqrt{\pi}$	**7**	**L2**	1
		OR			
Q 2.	**a**	Evaluate$\int_{-1}^{+1}\int_{o}^{z}\int_{x-z}^{x+z}(x+y+z)\,dydxdz$	**6**	**L2**	1
	b	Evaluate $\int_{o}^{\infty}\int_{o}^{\infty}e^{-(x^2+y^2)}$dx dy by changing to polar coordinates.	**7**	**L2**	1
	c	Show that $\int_{o}^{\frac{\pi}{2}}\frac{d\theta}{\sqrt{\sin\theta}}\times\int_{o}^{\frac{\pi}{2}}\sqrt{\sin\theta}\,d\Theta=\pi$	**7**	**L2**	1
		Module-2			
Q 3.	**a**	Solve $\frac{d^2y}{dx^2}-4y=\cos h(2x-1)+3^x$.	**6**	**L2**	2
	b	Solve $\frac{d^2y}{dx^2}+y=\sec x\tan x$ by the method of variation of parameters	**7**	**L2**	2
	c	Solve $x^2\frac{d^2y}{dx^2}-3x\frac{dy}{dx}+4y=(1+x)^2$	**7**	**L2**	**2**
		OR			
Q 4.	**a**	Solve $\frac{d^2y}{dx^2}+3\frac{dy}{dx}+2y=4cos^2x$.	**6**	**L2**	2
	b	Using the method of variation of parameters Solve $\frac{d^2y}{dx^2}+y=\frac{1}{1+sinx}$	**7**	**L2**	2
	c	Solve $(1+x)^2y''+(1+x)y'+y=2\sin\;log(1+x)$	**7**	**L2**	2
		Module-3			
Q 5.	**a**	Find div$\vec{F}$ & Curl $\vec{F}$ *where* $\vec{F}=\nabla(x^3+y^3+z^3-3xyz)$.	**6**	**L2**	3

	b	Find the value of the constant 'a' such that the vectorfield ,$\vec{F} = (axy - z^3)i + (a-2)x^2j + (1-a)xz^2k$ is irrotational & *hence find a* scalar function $\boldsymbol{\Phi}$ such that $\vec{\mathbf{F}} = \nabla\boldsymbol{\Phi}$	7	L2	3
	c	Verify Green's theorem for $\int (xy + y^2)dx + x^2 dy$ .where C is Closed curve of the region bounded by $y = x$ & $y = x^2$.	7	L2	3
		OR			
Q 6.	a	If $\vec{\mathbf{F}} = \nabla(xy^3z^2)$ find div$\vec{\mathbf{F}}$& $curl\ \vec{\mathbf{F}}$ at the point (1, -1 , 1) .	6	L2	3
	b	If $\vec{F}$ =(x+y+az)$i + (bx + 2y - z)j + (x + cy + 2z)k$ Find a, b, c such that curl $\vec{F} = 0$ & then find $\boldsymbol{\Phi}$ such that $\vec{F} = \nabla\boldsymbol{\Phi}$.	7	L3	3
	c	Verify stoke's theorem for vector $\vec{F} = (x^2 + y^2)i - 2xyj$ taken round the rectangle by $x = 0, x = a, y = 0, y = b$.	7	L2	3
		Module-4			
Q 7.	a	Find a real root of the *equation* $x^3 - 2x - 5 = 0$ correct to three decimal places, by using Regula-falsi method	6	L2	4
	b	Given $f(40) = 184, f(50) = 204, f(60) = 226, f(70) = 250, f(80) = 276, f(90) = 304$, *find* $f(38)$& $f(85)$ using suitable interpolation formulae.	7	L2	4
	c	Evaluate $\int_o^1 \frac{xdx}{1+x^2}$by Trapezoidal rule taking seven ordinates & hence find $\log_e 2$.	7	L2	4
		OR			
Q 8.	a	Find the real root of the *Equation*$xe^x - 2 = 0$ correct to three decimal places by applying Newton Raphson method.	6	L2	4
	b	Use Lagrange's interpolation formula to find y at x=10 give x: 5, 6, 9, 11 y: 12, 13, 14, 16	7	L2	4
	c	Use simpson's $\frac{3}{8}^{th}$ rule to Obtain the approximate value of $\int_0^{0.3}(1 - 8x^3)^{\frac{1}{2}}dx$ by considering 3 equal intervals.	7	L2	4
		Module-5			
Q 9.	a	Use Taylor's series method to find y at $x = 0.1, 0.2, 0.3$ considering terms upto the third degree given that $\frac{dy}{dx} - 2y = x^2 + y^2$&$y(o) = 1$.	6	L2	5
	b	Given $\frac{dy}{dx} = 1 + \frac{y}{x}, y = 2$, at x = 1,find the approximate value y at$x = 1.4$ by taking step size $h = 0.2$ applying modified Euler's method.	7	L2	5
	c	Given that $\frac{dy}{dx} = x - y^2$ and the data $y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762$.Compute $y(0.8)$by applying Milne's method.	7	L2	5
		OR			
Q 10.	a	Employ Talyor's series method to find y at $x = 0.1$ *given* $\frac{dy}{dx} - 2y = 3e^x$ Whose solution passes through the origin.	6	L2	5
	b	Using Runge-Kutta method of fourth order, find y(0.2) for the equation $$\frac{dy}{dx} = \frac{y - x}{y + x}, y(0) = 1\ taking h = 0.2$$	7	L2	5
	c	If $\frac{dy}{dx} = 2e^x - y, y(0) = 2, y(0.1) = 2.010, y(0.2) = 2.040$ &$y(0.3) = 2.090$, find $y(0.4)$ Using Milne's method.	7	L3	5