Model Question Paper-I with effect from 2025-26

USN | | | | | | | | | | | 1BMATC201

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

Differential Calculus and Numerical Methods

TIME: 03Hours **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's level, C: Course outcomes.***

		Module-1	M	L	COS
Q 1.	a	Evaluate $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)dy\,dx\,dz$	6	L2	CO-1
	b	Change the order of the integration and hence evaluate $\int_{0}^{1}\int_{0}^{\sqrt{1-x^2}} y^2 dx\,dy$	7	L2	CO-1
	c	Show that the area between the parabola $y^2 = 4ax$, $x^2 = 4ay$ is $\frac{16}{3}a^2$	7	L2	CO-1
		OR			
Q 2.	a	Find the volume generated by the revolution of the cardioid $r = a(1+cos\theta)$	6	L2	CO-1
	b	Prove that $\beta(m,n) = \frac{\lceil m \ \lceil n}{\lceil m+n}$	7	L2	CO-1
	c	Prove that $\int_{0}^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{sin\theta}} \times \int_{0}^{\frac{\pi}{2}} \sqrt{sin\theta}\, d\theta = \pi$	7	L2	CO-1
		Module-2			
Q 3.	a	Form the partial differential equation by eliminating arbitrary constant from. $\log(az-1) = x + ay + b$	6	L2	CO-1
	b	Form the partial differential equation by eliminating arbitrary function from $z = f(x+ay) + g(x-ay)$	7	L2	CO-1
	c	Solve $\frac{\partial^2 u}{\partial x\,\partial y} + 9x^2y^2 = \cos(2x-y)$ $given\ that\ u =$ $0\ when\ y = 0\ and\ \frac{\partial u}{\partial y} = 0\ when\ x = 0$	7	L2	CO-1
		OR			

Q 4.	a	Solve $\frac{\partial^2 z}{\partial x^2} - 6\frac{\partial z}{\partial x} + 9z = 0$ given that z=0 and $\frac{\partial z}{\partial x} = e^y$ when x=0.	6	L2	CO-1
	b	Solve by the method of separation of variables $4\frac{\partial u}{\partial x} + 3\frac{\partial u}{\partial y} = u$	7	L2	CO-1
	c	Derive the one dimensional heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$	7	L2	CO-1
Module-3					
Q 5.	a	Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at (2, -1, 2) along 2i-3j+6k	6	L2	CO-1
	b	Find Div $(\vec{F})$, Div $(curl\ (\vec{F}))$ for the vector $\overrightarrow{F} = y^2i + 2x^2yzj\ x - 3y^2zk$ at the point (2,1,1).	7	L2	CO-1
	c	If $\vec{A} = xz^3i - 2x^2yzj + 2yz^4k$. Find $\nabla.A,\quad \nabla \times A \quad and \quad \nabla.(\nabla \times A)$	7	L2	CO-1
OR					
Q 6.	a	Find the value of the constant "a" such that the vector field $\vec{F} = (axy - z^3)i + (a-2)x^2j - (1-a)xz^2k$ is irrotationl and hence find scalar function ϕ such that $\vec{F} = \nabla\phi$	6	L2	CO-1
	b	If $\overrightarrow{F} = xy\ i + yz\ j + zx\ k$ evaluate $\int_c \overrightarrow{F}.d\vec{r}$where c is the curve represented by $x = t, y, = t^2, z = t^3, -1 \le t \le 1$	7	L2	CO-1
	c	Find the area between the curves $4y = x^2, and\ y^2 = 4x$ with the help of the Green`s theorem in a plane.	7	L2	CO-1
Module-4					
Q 7.	a	Find the real root of the equation $xe^x - cosx = 0$ by method of false position.	6	L2	CO-2
	b	Using Newton Raphson method to find the real root of the equation $x\ sinx + cosx = 0$ near x= π, correct to 4 decimal places.	7	L2	CO-2
	c	The area of a circle(A) corresponding to diameter(D) is given below: D 80 85 90 95 100 A 5026 5674 6362 7088 7854 find the area corresponding to diameter 105 using an appropriate interpolation formula.	7	L2	CO-2
OR					
Q 8.	a	Evaluate $\int_4^{5..2} logx\ dx$ by 6 equal parts by Simpson's three eight rule	6	L2	CO-2
	b	Evaluate $\int_0^1 \frac{x\ dx}{1+x^2}$ taking into six equal parts. By using Simpson's $\frac{3}{8}$rule.	7	L2	CO-2

	c	Use Legrange`s interpolation formula fit a polynomial for the data. x: 0, 1, 3, 4 y: -12, 0, 6, 12	7	L2	CO-2
Module-5					
Q 9.	a	Find y at x=1.02 correct to five decimal places given $dy = (xy - 1)dx$ and y=2 at x=1 applying Taylor`s series method.	6	L2	CO-2
	b	Use Modified Euler`s method to compute y(1.2) correct to five decimal places given that $\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}\ and\ y = 1\ at\ x = 1, taking\ h = 0.1$.	7	L2	CO-2
	c	Use forth order Runge-kutta method to solve $(x + y)\frac{dy}{dx} = 1, y(0.4) = 1, at$ x=0.5 correct to four decimal places.	7	L2	CO-2
OR					
Q 10.	a	Solve the differential equation $5x\frac{dy}{dx} + y^2 - 2 = 0\ with$ y$(4) = 1$,initially y(4.1)=1.0049, y(4.2)=1.0097, y(4.3)=1.0049 using Milne`s method.	6	L2	CO-2
	b	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) correct to four decimal places by using Adams- Bashforth predictor method	7	L2	CO-2
	c	Use forth order Runge-kutta method to solve $\frac{dy}{dx} = \frac{y-x}{(x+y)}$, $y\ (0) = 1, at$ x=0.1 correct to four decimal places.	7	L2	CO-2