

CBCS SCHEME

USN

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

BMATC201

Second Semester B.E/B.Tech. Degree Examination, June/July 2025

Mathematics – II for Civil Engineering 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 Formula Hand Book is permitted.

Module – 1				M	L	C
1	a.	Evaluate $\int_0^4 \int_0^{\sqrt{z}} \int_0^{\sqrt{4z-x^2}} dy dx dz$.		7	L3	CO1
	b.	By changing order of integration evaluate $\int_0^a \int_0^{\sqrt{ax}} x^2 dy dx$.		7	L3	CO1
	c.	Define beta and gamma functions. Show that $\sqrt{\frac{1}{2}} = \sqrt{\pi}$.		6	L2	CO1
OR						
2	a.	Evaluate : $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx dy$ by changing into polar coordinator.		7	L3	CO1
	b.	Find the area bounded between parabolas $y^2 = 4ax$ and $x^2 = 4ay$ using double integration.		7	L3	CO1
	c.	Write a modern mathematical program to evaluate the integral $\int_0^3 \int_0^{3-x} \int_0^{3-x-y} xyz dz dy dx$.		6	L3	CO5
Module – 2						
3	a.	Find the directional derivative at $\phi = 4xz^3 - 2x^2y^2z$ at $(2, -1, 2)$ along the vector $2i - 3j + 6k$.		7	L2	CO2
	b.	If $\phi = x^2 + y^2 + z^2$ and $\vec{F} = \nabla\phi$ then find $\text{grad } \phi$, $\text{div } \vec{F}$ and $\text{curl } \vec{F}$.		7	L2	CO2
	c.	Show that $\vec{F} = \frac{x_i + y_j}{x^2 + y^2}$ is both Solenoidal and irrotational.		6	L2	CO2

OR

4	a.	Compute the line integral $\int_c [(x^2 + xy)dx + (x^2 + y^2)dy]$ where c is the square formed by the lines $y = \pm 1$ and $x = \pm 1$.	7	L2	CO2
	b.	Apply Stokes theorem to evaluate $\int_c (ydx + zdy + xdz)$ where c is the curve of intersection $x^2 + y^2 + z^2 = a^2$ and $x + z = a$.	7	L3	CO2
	c.	Write a modern mathematical tool program to find the gradient of $\phi = x^2y + 2xz - 4$.	6	L3	CO5

Module – 3

5	a.	Form the partial differential equation by eliminating the arbitrary constant from the relation. $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$.	7	L2	CO3
	b.	Solve the equation $\frac{\partial^2 z}{\partial u^2} = x + y$ given that $z = y^2$ when $x = 0$ and $\frac{\partial z}{\partial x} = 0$ when $x = 2$.	7	L3	CO3
	c.	Solve $y^2p - xyq = x(z - 2y)$.	6	L3	CO3

OR

6	a.	Form the partial differential equation by eliminating arbitrary function from the equation $z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$.	7	L2	CO3
	b.	Solve $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + 2z = 0$ subject to $z = e^y$ and $\frac{\partial z}{\partial x} = 0$ when $x = 0$.	7	L3	CO3
	c.	With usual notation derive a one-dimensional heat equation.	6	L2	CO3

Module – 4

7	a.	Using the Regula – Falsi method find the fifth root of 10 assuming that the root lies between 1 and 2. Carry out three approximations.	7	L3	CO4										
	b.	Given that : <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>y = f(x)</td><td>1</td><td>3</td><td>7</td><td>13</td></tr></table> <p>Find the value of y at x = 0.1, by using appropriate formula.</p>	x	0	1	2	3	y = f(x)	1	3	7	13	7	L3	CO4
x	0	1	2	3											
y = f(x)	1	3	7	13											
	c.	Evaluate $\int_0^{\pi/2} \sqrt{\cos\theta} d\theta$ by Simpson's $\frac{1}{3}$ rule taking 7 ordinates.	6	L3	CO4										

OR

8	a.	Use Newton – Raphson method to find the approximate root of the equation $e^x - 3x = 0$ that lies between 0 and 1. Perform and approximate.	7	L3	CO4										
	b.	Using Lagranges interpolation formula find $f(18)$ for the data : <table border="1"><tr><td>x</td><td>10</td><td>12</td><td>19</td><td>22</td></tr><tr><td>y</td><td>24</td><td>48</td><td>162</td><td>200</td></tr></table>	x	10	12	19	22	y	24	48	162	200	7	L3	CO4
x	10	12	19	22											
y	24	48	162	200											
	c.	Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ by using Simpson's $\frac{3}{8}$ rule taking four equal strips.	6	L3	CO4										

Module – 5

9	a.	Use Taylor's series method solve the initial value problem $\frac{dy}{dx} = xy - 1$, $y(1) = 2$ at the point $x = 1.02$, consider three non-zero terms.	7	L3	CO4
	b.	Using fourth order Runge–Kutta method find y at $x = 0.1$, given that $\frac{dy}{dx} = x(1+xy)$, $y(0) = 1$.	7	L3	CO4
	c.	Solve the differential equation $\frac{dy}{dx} = -xy^2$ under the initial condition $y(0) = 2$, by using modified Euler's method at $x = 0.1$. Take step size $h = 0.1$. Perform three modification.	6	L3	CO4

OR

10	a.	Employ Taylor's series method to find y at $x = 0.1$ given that $\frac{dy}{dx} - 2y = 3e^x$, $y(0) = 0$, consider three non-zero terms.	7	L3	CO4
	b.	Applying Milne's predictor – corrector method compute y at $x = 0.8$, for the data $y(0) = 2$, $y(0.2) = 1.9231$, $y(0.4) = 1.7241$ and $y(0.6) = 1.4706$ to the equation $\frac{dy}{dx} = -xy^2$	7	L3	CO4
	c.	Write a modern mathematical tool program to solve $\frac{dy}{dx} = 2x + y$, $y(1) = z$ by R – K 4 th order method.	6	L3	CO4
