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 $\int_0^4 \int_0^{2\sqrt{z}} \int_0^{\sqrt{4z-x^2}} dy\,dx\,dz$.	7	L3	CO1
	b.	By changing order of integration evaluate $\int_0^a \int_0^{2\sqrt{ax}} x^2 dy\,dx$.	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 grad ϕ, div $\vec{F}$ and 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

<table>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>4</td><td>a.</td><td>Compute the line integral $\int_c [(x^2+xy)dx+(x^2+y^2)dy]$ where c is the square formed by the lines $y=\pm1$ and $x=\pm1$.</td><td>7</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>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 $x+z=a$.</td><td>7</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>Write a modern mathematical tool program to find the gradient of $\phi = x^2y+2xz-4$.</td><td>6</td><td>L3</td><td>CO5</td></tr>
<tr><td colspan="6" align="center">Module – 3</td></tr>
<tr><td>5</td><td>a.</td><td>Form the partial differential equation by eliminating the arbitrary constant from the relation. $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$.</td><td>7</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>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 $x=2$.</td><td>7</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>Solve $y^2p-xyq=x(z-2y)$.</td><td>6</td><td>L3</td><td>CO3</td></tr>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>6</td><td>a.</td><td>Form the partial differential equation by eliminating arbitrary function from the equation $z=y^2+2f\left(\frac{1}{x}+\log y\right)$.</td><td>7</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>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 $x=0$.</td><td>7</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>With usual notation derive a one-dimensional heat equation.</td><td>6</td><td>L2</td><td>CO3</td></tr>
<tr><td colspan="6" align="center">Module – 4</td></tr>
<tr><td>7</td><td>a.</td><td>Using the Regula – Falsi method find the fifth root of 10 assuming that the root lies between 1 and 2. Carry out three approximations.</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>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>
Find the value of y at x = 0.1, by using appropriate formula.</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>Evaluate $\int_0^{\pi/2}\sqrt{\cos\theta}\,d\theta$ by Simpson's $\frac{1}{3}^{rd}$ rule taking 7 ordinates.</td><td>6</td><td>L3</td><td>CO4</td></tr>
</table>

		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 : $\begin{array}{\|c\|c\|c\|c\|c\|}\hline x & 10 & 12 & 19 & 22 \\ \hline y & 24 & 48 & 162 & 200 \\ \hline\end{array}$	7	L3	CO4
	c.	Evaluate $\int_0^1 \frac{1}{1+x^2}dx$ by using Simpson's $\frac{3}{8}^{th}$ 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 4th order method.	6	L3	CO4

* * * * *