CBCS SCHEME

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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

		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 $y=\pm1$ and $x=\pm1$.	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 : x: 0, 1, 2, 3 y = f(x): 1, 3, 7, 13 Find the value of y at x = 0.1, by using appropriate formula.	7	L3	CO4
	c.	Evaluate $\int_0^{\pi/2}\sqrt{\cos\theta}\,d\theta$ by Simpson's $\frac{1}{3}^{rd}$ rule taking 7 ordinates.	6	L3	CO4

Table for 7 b:

x	0	1	2	3
y = f(x)	1	3	7	13

			Marks	Level	CO
		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 : x: 10, 12, 19, 22 y: 24, 48, 162, 200	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 4^{th} order method.	6	L3	CO4

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