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CBCS SCHEME

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BMATC201

Second Semester B.E./B.Tech. Degree Examination, June/July 2026
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. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Evaluate $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)\,dy\,dx\,dz$	7	L3	CO1
	b.	Evaluate $\int_{0}^{1}\int_{x}^{\sqrt{x}} xy\,dy\,dx$ by changing the order of integration.	7	L3	CO1
	c.	Show that $\beta(m,n)=\frac{\Gamma(m)\cdot\Gamma(n)}{\Gamma(m+n)}$	6	L2	CO1
		OR			
Q.2	a.	Evaluate $\int_{0}^{a}\int_{0}^{\sqrt{a^2-x^2}}(x^2+y^2)\,dy\,dx$ by changing into polar coordinates.	7	L3	CO1
	b.	Using double integration find the area bounded between the parabolae $y^2 = 4x$ and $x^2 = 4y$.	7	L3	CO1
	c.	Write a modern mathematical program to evaluate the double integral $\int_{0}^{1}\int_{0}^{x}(x^2+y^2)\,dy\,dx$	6	L3	CO5
		Module – 2			
Q.3	a.	Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point (2, -1, 2).	7	L2	CO2
	b.	If $\vec{F}=\nabla(xy^3z^2)$, find div $\vec{F}$ and curl $\vec{F}$ at the point (1, -1, 1).	7	L2	CO2
	c.	Show that the vector field $\vec{F}=\frac{x\hat{i}+y\hat{j}}{x^2+y^2}$ is both solenoidal and irrotational.	6	L2	CO2
		OR			
Q.4	a.	Find the work done in moving a particle in the force field $\vec{F}=3x^2\hat{i}+(2xz-y)\hat{j}+z\hat{k}$ along the straight line from (0, 0, 0) to (2, 1, 3).	7	L2	CO2

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	b.	Use Stoke's Theorem to evaluate $\int_C \vec{F}\cdot d\vec{r}$ where $\vec{F} = (x^2+y^2)\hat{i} - 2xy\hat{j}$ and C is bounded by the lines $x = \pm a$, $y = 0$, $y = b$.	7	L3	CO2
	c.	Write a modern mathematical program to evaluate $\int_C [(xy+y^2)dx + x^2dy]$, where C is the closed curve made up of the line $y = x$ and the parabola $y = x^2$ by using Green's Theorem.	6	L3	CO5
		Module – 3			
Q.5	a.	Form the partial differential equation by eliminating the arbitrary function from the relation $z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$.	7	L2	CO3
	b.	Solve $\frac{\partial^2 z}{\partial x^2} = xy$ subject to the conditions $\frac{\partial z}{\partial x} = \log_e(1+y)$ when $x = 1$ and $z = 0$ when $x = 0$.	7	L3	CO3
	c.	With usual notations, derive the one-dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2\frac{\partial^2 u}{\partial x^2}$	6	L2	CO3
		OR			
Q.6	a.	Form the partial differential equation by eliminating the arbitrary constants from the relation $(x-a)^2 + (y-b)^2 + z^2 = 4$.	7	L2	CO3
	b.	Solve $\frac{\partial^2 z}{\partial x^2} = z$ given that $z = 0$ and $\frac{\partial z}{\partial x} = \sin y$ when $x = 0$.	7	L3	CO3
	c.	Solve $x^2(y^2-z^2)p + y^2(z^2-x^2)q = z^2(x^2-y^2)$.	6	L3	CO3
		Module – 4			
Q.7	a.	Find the real root of the equation $x\log_{10} x = 1.2$ that lies between 2 and 3 by Regula-Falsi method. Carry out FOUR iterations.	7	L3	CO4
	b.	The area A of a circle corresponding to the diameter D is given below: D : 80 85 90 95 100 A : 5026 5674 6362 7088 7854 Find the area when the diameter is 105 by using Newton's backward interpolation.	7	L3	CO4
	c.	Evaluate $\int_4^{5.2} \log_e x\, dx$ using Simpson's $\left(\frac{3}{8}\right)^{th}$ rule by taking 7 ordinates.	6	L3	CO4

		OR			
Q.8	**a.**	Find the real root of the equation tan x = x near x = 4.5 by Newton-Raphson method. Correct to FOUR decimal places.	**7**	**L3**	**CO4**
	b.	Fit a Lagrange's interpolation polynomial which passes through the points (-1, 0), (1, 2), (2, 9) and (3, 8) and hence estimate the value of y when x = 2.2	**7**	**L3**	**CO4**
	c.	Evaluate $\int_0^{\pi/2} \sqrt{\cos x}\, dx$ using Trapezoidal rule by taking 7 ordinates.	**6**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Using Taylor's series method, find y(0.1) given that $\frac{dy}{dx} = x - y^2$ with y(0) = 1.	**7**	**L3**	**CO4**
	b.	Using Runge-Kutta method of fourth order, find y(0.1) given that $\frac{dy}{dx} = 3e^x + 2y$, y(0) = 1	**7**	**L3**	**CO4**
	c.	Applying Milne's Predictor-Corrector Method, find y(0.8) from $\frac{dy}{dx} = x^3 + y$ with y(0) = 2, y(0.2) = 2.073, y(0.4) = 2.452, y(0.6) = 3.023.	**6**	**L3**	**CO4**
		OR			
Q.10	**a.**	Using Modified Euler's method, find y(0.2) given that $\frac{dy}{dx} = 3x + \frac{y}{2}$, y(0) = 1, taking h = 0.1. Perform two iterations at each step.	**7**	**L3**	**CO4**
	b.	Using Runge-Kutta method of order 4, find y(0.1) given $\frac{dy}{dx} = x^2 + y$, $y(0) = -1$	**7**	**L3**	**CO4**
	c.	Write a modern mathematical program to find y(0.1) given $\frac{dy}{dx} = x - y$, $y(0) = 1$ by Taylor's series method.	**6**	**L3**	**CO5**

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