CBCS SCHEME

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BMATC201

Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.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 by changing the order of integration $\int_{0}^{\infty}\int_{x}^{\infty}\frac{e^{-y}}{y}\,dy\,dx$.	**7**	**L3**	**CO1**
	c.	Derive the relation $\beta(m,n)=\frac{\Gamma m.\Gamma n}{\Gamma(m+n)}$.	**6**	**L2**	**CO1**
		OR			
Q.2	**a.**	Evaluate $\int_{0}^{1}\int_{0}^{\sqrt{1-x^2}} xy\,e^{x^2}\,dy\,dx$.	**7**	**L3**	**CO1**
	b.	Evaluate $\int_{0}^{a}\int_{0}^{\sqrt{a^2-x^2}} y^2\sqrt{x^2+y^2}\,dy\,dx$ by changing to polar coordinates .	**7**	**L3**	**CO1**
	c.	Write a modern mathematical tool 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			
Q.3	**a.**	If $\vec{r}=x\hat{i}+y\hat{j}+z\hat{k}$, show that (i) $\nabla.\vec{r}=3$, (ii) $\nabla\times\vec{r}=0$ (iii) $\nabla r^n = nr^{n-2}.\vec{r}$, where $\lvert\vec{r}\rvert=r$.	**7**	**L2**	**CO2**
	b.	If $\vec{f}=grad(x^3+y^3+z^3-3xyz)$ find $div\,\vec{f}$ and $curl\,\vec{f}$.	**7**	**L2**	**CO2**
	c.	Define solenoidal vector. If $V=W\times\vec{r}$ and W is a constant vector show that $W=\frac{1}{2}curlV$.	**6**	**L2**	**CO2**

		OR			
Q.4	**a.**	Find the total work done by the force $\vec{F} = 3x^2\hat{i} + (2xz - y)\hat{j} + z\hat{k}$ in moving a particle along the curve $x^2 = 4y,\ 3x^2 = 8z$ from x = 0 to x = 2.	**7**	**L3**	**CO2**
	b.	Use Stokes theorem, evaluate $\int_C [(2x - y)dx - yz^2dy - y^2zdz]$ were C is the circle $x^2 + y^2 = 1$ corresponds to the surface of sphere of unit radius.	**7**	**L3**	**CO2**
	c.	Write the modern mathematical tool program to find the gradient of x^2yz.	**6**	**L2**	**CO5**
		Module – 3			
Q.5	**a.**	Form the partial differential equation from the relation, $z = ax + by + cxy$ by eliminating arbitrary constants.	**7**	**L2**	**CO3**
	b.	Solve $(mz - ny)p + (nx - lz)q = ly - mx$.	**7**	**L3**	**CO3**
	c.	Derive one dimensional wave equation.	**6**	**L2**	**CO3**
		OR			
Q.6	**a.**	Form a partial differential equation by eliminating the arbitrary functions ϕ and ψ from the relation $z = x\phi(y) + y\psi(x)$.	**7**	**L2**	**CO3**
	b.	Solve $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + 5z = 0$ given that $z = e^y$ and $\frac{\partial z}{\partial x} = 0$ when x = 0.	**7**	**L3**	**CO3**
	c.	Derive one dimensional heat equation.	**6**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Find the real root of the equation $\cos x = 3x - 1$ that lies between 0.5 and 1, using Regula-falsi method.	**7**	**L3**	**CO4**
	b.	The area y of circle for different diameters x are given below : x: 80, 85, 90, 95, 100 y: 5026, 5674, 6362, 7088, 7854 Calculate the area when x = 98.	**7**	**L3**	**CO4**
	c.	Evaluate $\int_0^1 \frac{x}{1+x^2}dx$ by using Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule.	**6**	**L3**	**CO4**
		OR			
Q.8	**a.**	Find the real root of the equation $x\log_{10}(x) = 1.2$ the approximate root near 2.5, using Newton-Raphson method.	**7**	**L2**	**CO4**

Table for Q.7 b:

x	80	85	90	95	100
y	5026	5674	6362	7088	7854

	b.	Using Lagrange's method to find the value for x = 6 from the following table: x: 3, 7, 9, 10 f(x): 168, 120, 72, 63	**7**	**L3**	**CO4**
	c.	Given x: 4.0, 4.2, 4.4, 4.6, 4.8, 5.0, 5.2 logx: 1.3863, 1.4351, 1.4816, 1.5261, 1.5686, 1.5686, 1.6487 Evaluate $\int_4^{5.2} \log x dx$ by Simpson's $\frac{3}{8}^{th}$ rule.	**6**	**L3**	**CO4**
Module – 5					
Q.9	**a.**	Find an approximate value of y when x = 0.2. If $\frac{dy}{dx} = x^2 + y^2$ and y = 1 when x = 0 using Taylor's method.	**7**	**L3**	**CO4**
	b.	By Runge Kutta method of order 4 solve the equation $\frac{dy}{dx} = 3x + \left(\frac{y}{2}\right)$ with y(0) = 1 for y(0.1).	**7**	**L3**	**CO4**
	c.	Given $\frac{dy}{dx} = x^2 + \left(\frac{y}{2}\right)$ for y(1) = 2, y(1.1) = 2.2156, y(1.2) = 2.4649 and y(1.3) = 2.7514 find y at 1.4 using Milines predictor-corrector method.	**6**	**L3**	**CO4**
OR					
Q.10	**a.**	Use modified Eulers method to solve $\frac{dy}{dx} = x + \sqrt{y}$ in the range $0.2 \le x \le 0.6$ taking h = 0.2 given that $y = 1$ at x = 0.	**7**	**L3**	**CO4**
	b.	Using Runge-Kutta method, find the solution of the equation, $\frac{dy}{dx} = \frac{y-x}{y+x}$, y(0) = 1 at the point x = 0.1.	**7**	**L3**	**CO4**
	c.	Write modern mathematical tool program to solve $\frac{dy}{dx} = x - y^2$, y(0) = 1 by Runge-Kutta 4^{th} order method, find y(0.1).	**6**	**L2**	**CO5**

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