MAKE-UP EXAM

USN ☐☐☐☐☐☐☐☐☐☐

BMATC101

First Semester B.E./B.Tech. Degree Examination, Nov./Dec. 2023

Mathematics – I 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.**	Prove that $\tan\phi = r \cdot \frac{d\theta}{dr}$ with usual notations.	**6**	**L1**	**CO1**
	b.	Show that the curves $r = a[1 + \cos\theta]$, $r = b[1 - \cos\theta]$ intersects each other orthogonally.	**7**	**L2**	**CO1**
	c.	Find the radius of curvature for the curve $\sqrt{x} + \sqrt{y} = 4$ at (4, 4).	**7**	**L3**	**CO1**
		OR			
Q.2	**a.**	Derive an expression for radius of curvature in Cartesian form $\rho = \frac{[1+y_1^2]^{3/2}}{y_2}$.	**7**	**L1**	**CO1**
	b.	Find the pedal equation for the curve $\frac{2a}{r} = 1 - \cos\theta$.	**8**	**L2**	**CO1**
	c.	Using modern mathematical tool, write proper mode , plot the curve $r = 2\lvert\cos 2\theta\rvert$.	**5**	**L3**	**CO5**
		Module – 2			
Q.3	**a.**	Expand Sin x in powers of x upto 5th degree terms.	**6**	**L2**	**CO2**
	b.	Evaluate $\lim_{x\to 0}\left[\frac{a^x + b^x}{2}\right]^{\frac{1}{x}}$.	**7**	**L2**	**CO2**
	c.	If $u = \frac{yz}{x}$, $v = \frac{zx}{y}$, $w = \frac{xy}{z}$ then show that $\frac{\partial(u,v,w)}{\partial(x,y,z)} = 4$.	**7**	**L3**	**CO2**
		OR			
Q.4	**a.**	Expand Cos x in power of x upto 4th degree terms.	**6**	**L2**	**CO2**
	b.	If $u = f(x - y , y - z , z - x)$ then show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$.	**7**	**L2**	**CO2**
	c.	Using Modern mathematical tool, write a program / code to evaluate $\lim_{x\to\infty}\left[1 + \frac{\Gamma}{x}\right]^x$.	**7**	**L3**	**CO5**

		Module – 3			
Q.5	**a.**	Solve $(2x + y + 1)dx + (x + 2y + 1)dy = 0$.	**6**	**L2**	**CO3**
	b.	Solve $\frac{dy}{dx} + \frac{y}{x} = x\,y^2$.	**7**	**L3**	**CO3**
	c.	Find the Orthogonal Trajectory for the curve $y^2 = 4ax$.	**7**	**L2**	**CO3**
		OR			
Q.6	**a.**	Solve $y(2xy + 1)dx - x\,dy = 0$.	**6**	**L2**	**CO3**
	b.	A body in air at 25°C cools from 100 °C to 72°C in 1 minute. Find the temperature of the body at the end of 3 minutes.	**7**	**L3**	**CO3**
	c.	Solve for P : $y\,y'' + (x - y)\,y' - x = 0$.	**7**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Solve : $y'' - 3y' + 2y = e^{3x} + 2x$.	**6**	**L2**	**CO3**
	b.	Solve : $y'' + a^2\,y = \text{Sec}\,ax$ by the method of variation of parameters.	**7**	**L2**	**CO3**
	c.	Solve $x^2\,y'' - xy' + y = 2\log x$.	**7**	**L2**	**CO3**
		OR			
Q.8	**a.**	Solve : $(D^2 + 3D + 2)y = \text{Cos}^2\,x$.	**6**	**L2**	**CO3**
	b.	Solve : $y'' - 9y = x^2 + 1$.	**7**	**L2**	**CO3**
	c.	Solve $(3x + 2)^2\,y'' + 3(3x + 2)y' - 36y = 3x^2 + 4x + 1$.	**7**	**L2**	**CO3**
		Module – 5			
Q.9	**a.**	Find the rank of the matrix $A = \begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$.	**6**	**L2**	**CO4**
	b.	Test for consistency and solve the system of equations : $x + y + z = 6$, $x - y + 2z = 5$, $3x + y + z = 8$.	**7**	**L3**	**CO4**
	c.	Solve the system of equations by Gauss Seidel Method. $10x + y + z = 12$ $x + 10y + z = 12$ $x + y + 10z = 12$.	**7**	**L3**	**CO4**
		OR			
Q.10	**a.**	Solve the following system of equations by Gauss Elimination method. $2x + y + 4z = 12$ $4x + 11y - z = 33$ $8x - 3y + 2z = 20$.	**7**	**L3**	**CO4**

	b.	Find the dominant Eigen value and the corresponding Eigen Vector of the matrix. $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ by Power method by taking the initial vector $[1, 1, 1]^T$.	**7**	**L3**	**CO4**
	c.	Using modern mathematical tool, write a program / code to find the largest Eigen value of $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ by Power method.	**6**	**L3**	**CO5**

* * * * *