

# CBCS SCHEME

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BMATS101

## First Semester B.E./B.Tech. Degree Examination, Jan./Feb. 2023 Mathematics – I for Computer Science 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. With usual notations, prove that $\tan \phi = r \frac{d\theta}{dy}$ .	6	L2	CO1
	b. Find the angle of intersection between the curves $\gamma = \frac{a\theta}{1+\theta}$ , $\gamma = \frac{a}{1+\theta^2}$ .	7	L2	CO1
	c. Find radius of curvature of the curve $y = a \log \sec \left( \frac{x}{a} \right)$ at any point (x, y).	7	L2	CO1
<b>OR</b>				
Q.2	a. With usual notations prove that $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4} \left( \frac{dr}{d\theta} \right)^2$ .	8	L2	CO1
	b. Find the radius of the curvature of the curve $r = a(1 + \cos\theta)$ .	7	L2	CO1
	c. Using modern mathematical tool write a program/code to plot the Sine and Cosine curve.	5	L3	CO5
<b>Module – 2</b>				
Q.3	a. Using Maclaurin's series prove that $\sqrt{1 + \sin 2x} = 1 + x - \frac{x^2}{2!} - \frac{x^3}{3!} + \frac{x^4}{4!} + \dots$	6	L2	CO1
	b. If $Z = e^{ax+by} f(ax-by)$ , prove that $b \frac{\partial Z}{\partial x} + a \frac{\partial Z}{\partial y} = 2abz$ .	7	L2	CO1
	c. Find the extreme values of the function $f(x, y) = x^3 + y^3 - 3x - 12y + 20$ .	7	L3	CO1
<b>OR</b>				
Q.4	a. Evaluate $\lim_{x \rightarrow 0} \left( \frac{a^x + b^x + c^x + d^x}{4} \right)^{\frac{1}{x}}$ .	8	L2	CO1
	b. If $u = \frac{2yz}{x}$ , $v = \frac{3xz}{y}$ , $w = \frac{4xy}{z}$ find $J \left( \frac{u, v, w}{x, y, z} \right)$ .	7	L2	CO1

	c.	Using modern mathematical tool write a program code to evaluate $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x$ .	5	L3	CO5
<b>Module – 3</b>					
Q.5	a.	Solve $\frac{dy}{dx} + y \tan x = y^3 \sec x$ .	6	L2	CO2
	b.	Find orthogonal trajectories of family of curves $r^n = a^n \cos n\theta$ .	7	L3	CO2
	c.	Solve $x^2 p^2 + 3xyp + 2y^2 = 0$ .	7	L2	CO2
<b>OR</b>					
Q.6	a.	Solve $(x^2 + y^2 + x)dx + xydy = 0$ .	6	L2	CO2
	b.	Find the general solution of the equation $(px - y)(py + x) = 2p$ by reducing into Clairaut's form by taking the substitution $X = x^2, Y = y^2$ .	7	L2	CO2
	c.	A 12 volts battery is connected to a series circuit in which the inductance is $\frac{1}{2}$ Henry and resistance is 10 ohms. Determine current I, if the initial current is zero.	7	L3	CO2
<b>Module – 4</b>					
Q.7	a.	i) Find the last digit in $13^{37}$ . ii) Find the remainder when $7^{118}$ is divided by 10.	6	L2	CO3
	b.	Find the solutions of the linear congruence $12x \equiv 6 \pmod{21}$ .	7	L2	CO3
	c.	Find the general solution of linear Dio-phantine equation $70x + 112y = 168$ .	7	L2	CO3
<b>OR</b>					
Q.8	a.	Find the remainder when $14!$ is divided by 17.	6	L2	CO3
	b.	Find the solution of system of linear congruences $7x + 3y \equiv 10 \pmod{16}$ $2x + 5y \equiv 9 \pmod{16}$	7	L2	CO3
	c.	Solve $x \equiv 3 \pmod{5}, x \equiv 2 \pmod{6}, x \equiv 4 \pmod{7}$ using Chinese remainder theorem.	7	L3	CO3
<b>Module – 5</b>					
Q.9	a.	Find the rank of matrix $A = \begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$ .	6	L2	CO4



	b.	Solve the system of equations by Gauss-Jordan method. $x + y + z = 9$ ; $2x + y - z = 0$ ; $2x + 5y + 7z = 52$ .	7	L3	CO4
	c.	Find the largest eigen value and the corresponding eigen vector of the matrix $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ taking $[1 \ 1 \ 1]^T$ as initial eigen vector, using power method.	7	L3	CO4
<b>OR</b>					
Q.10	a.	Find the values of $\lambda$ and $\mu$ for which the system $x + y + z = 6$ ; $x + 2y + 3z = 10$ ; $x + 2y + \lambda z = \mu$ has i) Unique solution ii) Infinitely many solutions iii) no solution.	8	L2	CO4
	b.	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
	c.	Using modern mathematical tool, write a program/code to test the consistency of the equations $x + 2y - z = 1$ , $2x + y + 4z = 2$ , $3x + 3y + 4z = 1$ .	5	L3	CO5

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