

# Model Question Paper- I with effect from 2022

## CBCS SCHEME

### First Semester B.E Degree Examination\_\_\_\_\_

#### Mathematics-I for Computer Science Engineering Stream (BMATS101)

TIME: 03Hours

Max.Marks:100

1. Note: Answer any **FIVE** full questions, choosing at least **ONE** 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 notation prove that $\tan \phi = r \frac{d\theta}{dr}$ .	6	L2	CO1
	b	Find the angle between the curves $r = a \log \theta$ , $r = \frac{\theta}{\log \theta}$	7	L2	CO1
	c	Show that the radius of curvature at any point of the cycloid $x = a(\theta + \sin \theta)$ , $y = a(1 - \cos \theta)$ is $4a \cos\left(\frac{\theta}{2}\right)$ .	7	L3	CO1
OR					
Q.2	a	Show that the curves $r = a(1 + \sin \theta)$ and $r = a(1 + \cos \theta)$ cut each other orthogonally.	7	L2	CO1
	b	Find the pedal equation of the curve $\frac{2a}{r} = (1 + \cos \theta)$ .	8	L2	CO1
	c	Using modern mathematical tool write a program/code to plot the curve $r = 2 \cos 2\theta $ .	5	L3	CO5
Module - 2					
Q.3	a	Expand $\log(\sec x)$ by Maclaurin's series up to the term containing $x^4$ .	6	L2	CO1
	b	If $u = e^{(ax+by)} f(ax - by)$ , prove that $b \frac{\partial u}{\partial x} + a \frac{\partial u}{\partial y} = 2abu$ by using concepts composite functions.	7	L2	CO1
	c	Find the extreme values of the function $f(x, y) = x^3 + 3xy^2 - 3y^2 - 3x^2 + 4$ .	7	L3	CO1
OR					
Q.4	a	Evaluate (i) $\lim_{x \rightarrow 0} \left(\frac{a^x + b^x}{2}\right)^{\frac{1}{x}}$ . (ii) $\lim_{x \rightarrow 0} \left(\frac{\tan x}{x}\right)^{1/x}$ .	7	L2	CO1

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	<b>b</b>	If $x + y + z = u, y + z = uv, z = uvw$ find $\frac{\partial(x, y, z)}{\partial(u, v, w)}$ .	8	L2	CO1
	<b>c</b>	Using modern mathematical tool write a program/code to show that $u_{xx} + u_{yy} = 0$ given $u = e^x(x \cos(y) - y \sin(y))$ .	5	L3	CO5
<b>Module – 3</b>					
<b>Q.5</b>	<b>a</b>	Solve: $\frac{dy}{dx} + \frac{y}{x} = x^2 y^6$ .	6	L2	CO2
	<b>b</b>	Find the orthogonal trajectories of $\frac{x^2}{a^2} + \frac{y^2}{b^2 + \lambda} = 1$ , where $\lambda$ is a parameter.	7	L3	CO2
	<b>c</b>	Solve $xyp^2 - (x^2 + y^2)y + xy = 0$ .	7	L2	CO2
<b>OR</b>					
<b>Q.6</b>	<b>a</b>	Solve $(x^2 + y^2 + x)dx + xy dy = 0$	6	L2	CO2
	<b>b</b>	When a switch is closed in a circuit containing a battery E, a resistance R and an inductance L, the current i build up at a rate given by $L \frac{di}{dt} + Ri = E$ . Find i as a function of t. How long will it be, before the current has reached one-half its final value, if E=6 volts, R=100 Ohms and L=0.1 Henry?	7	L3	CO2
	<b>c</b>	Find the general solution of the equation $(px - y)(py + x) = a^2 p$ by reducing into Clairaut's form by taking the substitution $X = x^2, Y = y^2$ .	7	L2	CO2
<b>Module – 4</b>					
<b>Q.7</b>	<b>a</b>	Find the least positive values of x such that (i) $71 \equiv x \pmod{8}$ (ii) $78 + x \equiv 3 \pmod{5}$ (iii) $89 \equiv (x + 3) \pmod{4}$	6	L2	CO3
	<b>b</b>	Find the remainder when $(349 \times 74 \times 36)$ is divided by 3.	7	L2	CO3
	<b>c</b>	Solve: $2x + 6y \equiv 1 \pmod{7}$ and $4x + 2y \equiv 2 \pmod{7}$ .	7	L3	CO3
<b>OR</b>					
<b>Q.8</b>	<b>a</b>	(i) Find the last digit of $7^{2013}$ (ii) Find the last digit of $13^{37}$ .	6	L2	CO3
	<b>b</b>	Find the remainder when the number $2^{1000}$ is divided by 13.	7	L3	CO3
	<b>c</b>	Find the remainder when $14!$ is divided by 17.	7	L2	CO3

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Module – 5					
<b>Q.9</b>	<b>a</b>	Find the rank of the matrix $\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$	<b>6</b>	<b>L2</b>	<b>CO4</b>
	<b>b</b>	Solve the system of equations by Gauss-Jordan method $x + y + z = 10, 2x - y + 3z = 19, x + 2y + 3z = 22$ .	<b>7</b>	<b>L3</b>	<b>CO4</b>
	<b>c</b>	For what values $\lambda$ and $\mu$ the system of equations $2x + 3y + 5z = 9, 7x + 3y - 2z = 8, 2x + 3y + \lambda z = \mu$ , has (i) no solution (ii) a unique solution and (iii) infinite number of solutions.	<b>7</b>	<b>L2</b>	<b>CO4</b>
OR					
<b>Q.10</b>	<b>a</b>	Solve the following system of equations by Gauss – Seidel method $10x + y + z = 12, x + 10y + z = 12, x + y + 10z = 12$ .	<b>8</b>	<b>L3</b>	<b>CO4</b>
	<b>b</b>	Solve the following system of equations by Gauss-Elimination method $x + y + z = 9, x - 2y + 3z = 8, 2x + y - z = 3$ .	<b>7</b>	<b>L3</b>	<b>CO4</b>
	<b>c</b>	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.	<b>5</b>	<b>L3</b>	<b>CO5</b>