CBCS SCHEME

BMATS101

USN | | | | | | | | | | |

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 $\tan\phi = r\dfrac{d\theta}{d\gamma}$.	6	L2	CO1
	b.	Find the angle of intersection between the curves $\gamma = \dfrac{a\theta}{1+\theta}$, $\gamma = \dfrac{a}{1+\theta^2}$.	7	L2	CO1
	c.	Find radius of curvature of the curve $y = a \log \sec\left(\dfrac{x}{a}\right)$ at any point (x, y).	7	L2	CO1
		OR			
Q.2	a.	With usual notations prove that $\dfrac{1}{p^2} = \dfrac{1}{r^2} + \dfrac{1}{r^4}\left(\dfrac{dr}{d\theta}\right)^2$.	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
		Module – 2			
Q.3	a.	Using Maclaurin's series prove that $\sqrt{1+\sin 2x} = 1 + x - \dfrac{x^2}{2!} - \dfrac{x^3}{3!} + \dfrac{x^4}{4!} + \ldots\ldots$	6	L2	CO1
	b.	If $Z = e^{ax+by} f(ax-by)$, prove that $b\dfrac{\partial z}{\partial x} + a\dfrac{\partial z}{\partial y} = 2abz$.	7	L2	CO1
	c.	Find the extreme values of the function $f(x, y) = x^3 + y^3 - 3x - 12y + 20$.	7	L3	CO1
		OR			
Q.4	a.	Evaluate $\lim\limits_{x \to 0}\left(\dfrac{a^x + b^x + c^x + d^x}{4}\right)^{1/x}$.	8	L2	CO1
	b.	If $u = \dfrac{2yz}{x}$, $v = \dfrac{3xz}{y}$, $w = \dfrac{4xy}{z}$ find $J\left(\dfrac{u, v, w}{x, y, z}\right)$.	7	L2	CO1

	c.	Using modern mathematical tool write a program code to evaluate $\underset{x \to \infty}{\mathrm{Lt}} \left(1+\frac{1}{x}\right)^{x}$.	5	L3	CO5
Module – 3					
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 $x^2p^2 + 3xyp + 2y^2 = 0$.	7	L2	CO2
OR					
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
Module – 4					
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
OR					
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
Module – 5					
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 $\begin{bmatrix}1 & 1 & 1\end{bmatrix}^T$ as initial eigen vector, using power method.	7	L3	CO4
		OR			
Q.10	a.	Find the values of λ and μ 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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