CBCS SCHEME

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BMATS101

First Semester B.E./B.Tech. Degree Examination, June/July 2024
Mathematics for CSE Stream – I

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. 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 $r = \frac{a}{1+\cos\theta}$ and $r = \frac{b}{1-\cos\theta}$.	7	L2	CO1
	c.	Show that the radius of curvature at any point θ on the cycloid $x = a(\theta + \sin\theta)$, $y = a(1 - \cos\theta)$ is $4\cos\left(\frac{\theta}{2}\right)$.	7	L3	CO1
		OR			
Q.2	a.	Find the pedal equation of the curve $r(1 - \cos\theta) = 2a$.	7	L2	CO1
	b.	Find the radius of curvature for the curve $y^2 = \frac{a^2(a-x)}{x}$ at the point (a, 0).	8	L3	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.	Expand log(secx) upto the term containing x^4 using Maclausin's series.	6	L2	CO2
	b.	If u = log(tanx + tany + tan2), show that $\sin 2x\frac{\partial u}{\partial x} + \sin 2y\frac{\partial u}{\partial y} + \sin 2z\frac{\partial u}{\partial 2} = 2$.	7	L2	CO2
	c.	Find the extreme values of the function $f(x, y) = x^2 + y^2 + 6x - 12$.	7	L3	CO2
		OR			
Q.4	a.	Evaluate i) $\lim_{x \to 0} \frac{(a^x + b^x)}{2}^{1/x}$ ii) $\lim_{x \to 0}\left(\frac{\tan x}{x}\right)^{1/x^2}$.	7	L2	CO2
	b.	If $u = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$, show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + 2\frac{\partial u}{\partial z} = 0$.	8	L2	CO2
	c.	Using modern mathematical tool write a program/code to evaluate $\underset{x \to \infty}{\text{lt}} (1 + 1/x)^x$.	5	L3	CO2

		Module – 3			
Q.5	**a.**	Solve : $\frac{dy}{dx} + \frac{y}{x} = y^2 x$.	6	L2	CO3
	b.	Find the orthogonal trajectories of $r = a(1+\cos\theta)$, where a is a parameter.	7	L3	CO3
	c.	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	CO3
		OR			
Q.6	**a.**	Solve $(y \log y)\,dx + (x - \log y)dy = 0$.	6	L2	CO3
	b.	Prove that the system of parabolas $y^2 = 4a(x + a)$ is self-orthogonal.	7	L3	CO3
	c.	Solve : $xyp^2 - (x^2 + y^2)p + xy = 0$.	7	L2	CO3
		Module – 4			
Q.7	**a.**	i) Find the last digit of 7^{2013} ii) Find the last digit of 13^{37}	6	L2	CO4
	b.	i) Find the remainder when $175 \times 113 \times 53$ is divided by 11. ii) Find the remainder when 2^{23} is divided by 47.	7	L2	CO4
	c.	Encrypt the message STOP using RSA with key (2537, 13) using the prime numbers 43 and 59.	7	L3	CO4
		OR			
Q.8	**a.**	Solve $2x + 6y \equiv 1 \pmod 7$ $4x + 3y \equiv 2 \pmod 7$.	6	L2	CO4
	b.	Using Fermat's little theorem, show that $8^{30} - 1$ is divisible by 31.	7	L2	CO4
	c.	Show that $4(29)! + 5!$ Is divisible by 31.	7	L3	CO4
		Module – 5			
Q.9	**a.**	Find the Rank of the matrix $\begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$	6	L2	CO5
	b.	Solve the system of Equations by Gauss-Jordon method $x + y + z = 9$ $2x + y - z = 0$ $2x + 5y + 7z = 52$.	7	L3	CO5
	c.	Using power method, find the largest eigen value and the corresponding eigen vector of the matrix $A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$. Carry out six iterations.	7	L3	CO5

		OR			
Q.10	**a.**	Solve the following system of equations by Gauss-Siedel method. $27x + 6y - z = 85$, $6x + 15y + 2z = 72$, $x + y + 54z = 110$. Carry out three iterations.	**7**	**L3**	**CO5**
	b.	Investigate for what values of λ, μ the equations $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$ have i) No solution ii) Unique solution iii) Infinite number of solutions.	**8**	**L3**	**CO5**
	c.	Using modern mathematical tool, write a program/code to test the consistency of the equation $x + 2y - z = 1$ $2x + y + 4z = 2$ $3x + 3y + 4z = 1$	**5**	**L3**	**CO5**

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