CBCS SCHEME

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BMATS101

First Semester B.E./B.Tech. Degree Examination, June/July 2023
Mathematics-I for CSE 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 $\tan\phi = r\frac{d\theta}{dr}$	06	L2	CO1
	b.	Find the angle between the curves $r^n = a^n \cos n\theta$ and $r^n = b^n \sin n\theta$	07	L2	CO1
	c.	Find the radius of curvature for $\sqrt{x} + \sqrt{y} = \sqrt{a}$ at $[a/4, a/4]$	07	L3	CO1
		OR			
Q.2	a.	With usual notations prove that $\rho = \frac{(1+y_1^2)^{3/2}}{y_2}$	07	L2	CO1
	b.	Obtain pedal equation for the curve $r^n = a^n \cos n\theta$	08	L2	CO1
	c.	Using modern mathematical tool write a program/code to plot the curve $r = 2\lvert\cos 2\theta\rvert$	05	L3	CO5
		Module – 2			
Q.3	a.	Expand Leg(cos x) by Maclaurin's series upto term containing x^6	06	L2	CO2
	b.	If $u = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$, show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = 0$	07	L2	CO2
	c.	Find the extreme values of the function $x^3 + y^3 - 3x - 12y + 20$	07	L3	CO2
		OR			
Q.4	a.	Evaluate $\lim_{x \to 0}\left(\frac{a^x + b^x + c^x + d^x}{4}\right)^{1/x}$	07	L2	CO3
	b.	If $u = \frac{yz}{x}$, $v = \frac{zx}{y}$, $w = \frac{xy}{z}$, show that $\frac{\partial(u,v,w)}{\partial(x,y,z)} = 4$	08	L2	CO3
	c.	Using modern mathematical tool write a program/code to show that $u_{xx} + u_{yy} = 0$ give $u = e^x(x\cos y - y\sin y)$	05	L2	CO5
		Module – 3			
Q.5	a.	Solve : $x\frac{dy}{dx} + y = x^3y^6$	06	L2	CO3
	b.	Find the orthogonal trajectories of the family of the curves $r^n \sin n\theta = a^n$ where 'a' is parameter.	07	L3	CO3
	c.	Solve : $xyp^2 - (x^2 + y^2)p + xy = 0$	07	L2	CO3
		OR			

Q.6	a.	Solve $(x^2 + y^3 + 6x)dx + y^2x\,dy = 0$	06	L2	CO3
	b.	Find the general and singular solutions of $xp^2 + xp - yp + 1 - y = 0$	07	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 $X = x^2$, $Y = y^2$.	07	L2	CO3
		Module – 4			
Q.7	a.	Find the least positive values of 'x' such that i) $78 + x \equiv 3 \pmod 5$ ii) $89 \equiv (x + 3) \pmod 4$	06	L2	CO4
	b.	Find the solution of the linear congruence $14x \equiv 12 \pmod{18}$	07	L2	CO4
	c.	Encrypt the message STOP using RSA with key (2537, 13) using the prime numbers 43 and 59.	07	L2	CO4
		OR			
Q.8	a.	i) Find the remainder when 2^{23} is divided by 47. ii) Find the last digit in 7^{118}.	06	L2	CO4
	b.	Solve the system of linear congruence $x \equiv 2 \pmod 3$; $x \equiv 3 \pmod 5$; $x \equiv 2 \pmod 7$ using Remainder Theorem.	07	L2	CO4
	c.	i) Find the remainder when $175 \times 113 \times 53$ is divided by 11. ii) Solve $x^3 + 2x - 3 \equiv 0 \pmod 9$	07	L2	CO4
		Module – 5			
Q.9	a.	Find the rank of the matrix $A = \begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 1 & 3 \\ 6 & 3 & 0 & -7 \end{bmatrix}$	06	L2	CO4
	b.	Test for consistency and solve $2x + 5y + 7z = 52$; $2x + y - z = 0$; $x + y + z = 9$.	07	L2	CO4
	c.	Using Rayleigh's power method find the dominant eigen value and the corresponding eigen vector of $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ by taking $X_0 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$.	07	L2	CO4
		OR			
Q.10	a.	Solve the system of equations $x + 2y - z = 3$; $3x - y + 2z = 1$; $2x - 2y + 3z = 2$ by using Gauss-Jordan method.	07	L2	CO4
	b.	Solve the system of equations $20x + y - 2z = 17$, $3x + 20y - z = -18$; $2x - 3y + 20z = 25$ by using Gauss – Seidel method.	08	L2	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.	05	L3	CO5

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