Model Question Paper –I with effect from 2022

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First Semester B. E Degree examination
Mathematics-I for Computer Science Stream (2MATS11)

Time: 03 Hours **Max. Marks: 100**

Note: Answer any **FIVE** full questions, choosing at least **ONE** question from each module.

		Module-1	**Marks**
Q. 01	a	With usual notation prove that $tan\phi = r\dfrac{d\theta}{dr}$	6
	b	Find the angle between the curves $r = alog\theta$ and $r = \dfrac{a}{log\theta}$	7
	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 $4\,acos\left(\dfrac{\theta}{2}\right)$	7
		OR	
Q. 02	a	Show that the curves $r = a(1 + sin\theta)$ and $r = a(1 - sin\theta)$ cuts each other orthogonally	6
	b	Find the pedal equation of the curve $\dfrac{2a}{r} = (1 + cos\theta)$	7
	c	Find the radius of curvature for the curve $y^2 = \dfrac{4a^2(2a-x)}{x}$, where the curve meets the x-axis	7
		Module-2	
Q. 03	a	Expand $log(secx)$ up to the term containing x^4 using Maclaurin's series	6
	b	If $u = e^{ax+by}f(ax - by)$ prove that $b\dfrac{\partial u}{\partial x} + a\dfrac{\partial u}{\partial y} = 2abu$ by using the concept of composite functions.	7
	c	Find the extreme values of the function $f(x, y) = x^3 + 3xy^2 - 3y^2 - 3x^2 + 4$	7
		OR	
Q. 04	a	Evaluate i) $\lim\limits_{x\to0}\left(\dfrac{a^x+b^x}{2}\right)^{1/x}$ ii) $\lim\limits_{x\to0}\left(\dfrac{tanx}{x}\right)^{1/x}$	6
	b	If $u = f(x - y, y - z, z - x)$ show that $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z} = 0$	7
	c	If $x + y + z = u$, $y + z = v$ and $z = uvw$, find the values of $\dfrac{\partial(x,y,z)}{\partial(u,v,w)}$	7
		Module-3	
Q. 05	a	Solve $\dfrac{dy}{dx} + \dfrac{y}{x} = x^2y^6$	6
	b	Find the orthogonal trajectories of $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2+\lambda} = 1$, where λ is a parameter.	7

	c	Solve $xyp^2 - (x^2 + y^2)p + xy = 0$	7
		OR	
Q. 06	a	Solve $(x^2 + y^2 + x)dx + xydy = 0$	6
	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
	c	Find the general solution of the equation $(px - y)(py + x) = a^2p$ by reducing into Clairaut's form by taking the substitution $X = x^2, Y = y^2$	7
		Module-4	

Q. 07	a	Find the least positive values of x such that
		    i) $71 \equiv x(mod8)$
		    ii) $78 + x \equiv 3(mod5)$
		    iii) $89 \equiv (x + 3)(mod4)$
			6

	b	Find the remainder when $(349 \times 74 \times 36)$ is divided by 3	7
	c	Solve $2x + 6y \equiv 1(mod7)$ $4x + 3y \equiv 2(mod7)$	7
		OR	
Q. 08	a	i) Find the last digit of 7^{2013} ii) Find the last digit of 13^{37}	6
	b	Find the remainder when the number 2^{1000} is divided by 13	7
	c	Find the remainder when 14! is divided by 17	7
		Module-5	
Q. 09	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
	b	Solve the system of equations by using the Gauss-Jordan method $x + y + z = 10,\ 2x - y + 3z = 19,\ x + 2y + 3z = 22$	7
	c	Using power method find the largest eigenvalue and the corresponding eigenvector of the matrix $A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$	7
		OR	
Q. 10	a	Solve the following system of equations by Gauss-Seidel method $10x + y + z = 12,\ x + 10y + z = 12,\ x + y + 10z = 12$	6

	b	For what values of a and b the system of equation
		    $x + y + z = 6: x + 2y + 3z = 10: x + 2y + az = b$
		has i) no solution
		    ii) a unique solution and
		    iii) infinite number of solution
			7

	c	Solve the system of equations by Gauss elimination method $x + y + z = 9, x - 2y + 3z = 8, 2x + y - z = 3$	7

Table showing the Blooms Taxonomy Level, Course outcome and Program outcome				
Question		Blooms taxonomy level attached	Course outcome	Program outcome
Q.1	a)	L1	CO 01	PO 01
	b)	L2	CO 01	PO 01
	c)	L3	CO 01	PO 02
Q. 2	a)	L1	CO 01	PO 01
	b)	L2	CO 01	PO 01
	c)	L3	CO 01	PO 02
Q. 3	a)	L2	CO 02	PO 01
	b)	L2	CO 02	PO 01
	c)	L3	CO 02	PO 03
Q. 4	a)	L2	CO 02	PO 01
	b)	L2	CO 02	PO 01
	c)	L3	CO 02	PO 02
Q. 5	a)	L2	CO 03	PO 02
	b)	L3	CO 03	PO 03
	c)	L2	CO 03	PO 01
Q. 6	a)	L2	CO 03	PO 02
	b)	L3	CO 03	PO 03
	c)	L2	CO 03	PO 01
Q. 7	a)	L2	CO 04	PO 01
	b)	L2	CO 04	PO 01
	c)	L2	CO 04	PO 02
Q. 8	a)	L2	CO 04	PO 01
	b)	L2	CO 04	PO 01
	c)	L2	CO 04	PO 02
Q. 9	a)	L2	CO 05	PO 01
	b)	L3	CO 05	PO 01
	c)	L3	CO 05	PO 02
Q. 10	a)	L2	CO 05	PO 01
	b)	L3	CO 05	PO 02
	c)	L3	CO 05	PO 01

		Lower-order thinking skills		
Bloom's Taxonomy Levels		Remembering (Knowledge): L_1	Understanding (Comprehension): L_2	Applying (Application): L_3
		Higher-order thinking skills		
		Analyzing (Analysis): L_4	Valuating (Evaluation): L_5	Creating (Synthesis): L_6