CBCS SCHEME

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BMATS101

First Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024

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 $\tan\phi = r\frac{d\theta}{dr}$.	6	L2	CO1
	b.	Show that the curves $r = a(1 + \sin\theta)$ and $r = b(1 - \sin\theta)$ intersect each other orthogonally.	7	L2	CO1
	c.	Find the radius of curvature at the point $\left(\frac{39}{2}, \frac{39}{2}\right)$ for the curve $x^3 + y^3 = 3axy$.	7	L3	CO1
		OR			
Q.2	a.	With usual notations prove that $\rho = \frac{\left[1 + y_1^2\right]^{3/2}}{y_2}$	8	L2	CO1
	b.	Find the pedal equation of the curve : $r^n = a^n \cos n\theta$.	7	L1	CO1
	c.	Using modern mathematical tool, write a program/code to plot the curve $r = 2\lvert\cos 2\theta\rvert$.	5	L1	CO5
		Module – 2			
Q.3	a.	Obtain the Maclaurin's expansion of $\log(1 + e^x)$ upto the term containing x^4.	6	L2	CO1
	b.	If $u = f[2x - 3y, 3y - 4z, 4z - 2x]$ then find the value of $\frac{1}{2}\frac{\partial u}{\partial x} + \frac{1}{3}\frac{\partial u}{\partial y} + \frac{1}{4}\frac{\partial u}{\partial z}$.	7	L1	CO1
	c.	Find the maximum and minimum value of the function, $f(x, y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$.	7	L1	CO1
		OR			
Q.4	a.	Evaluate $\lim_{x \to 0}\left(\frac{a^x + b^x + c^x + d^x}{4}\right)^{\frac{1}{x}}$	7	L2	CO1

	b.	If $u = x^2 - y^2$, when $x = e^t \cos t$, $y = e^t \sin t$, show that $\frac{\partial u}{\partial t} = 2e^{2t}[\cos 2t - \sin 2t]$.	**8**	**L2**	**CO1**
	c.	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**
		Module – 3			
Q.5	**a.**	Solve: $\frac{dy}{dx} + \frac{y}{x} = y^2 x$	**6**	**L3**	**CO2**
	b.	Find the orthogonal trajectories of $\frac{x^2}{a^2 + x} + \frac{y^2}{b^2 + x} = 1$ where λ is a parameter.	**7**	**L1**	**CO2**
	c.	Solve : $x^2p^2 + xyp - 6y^2 = 0$.	**7**	**L3**	**CO2**
		OR			
Q.6	**a.**	Solve : $(y^4 + 2y)dx + (xy^3 + 2y^4 - 4x)dy = 0$.	**6**	**L2**	**CO2**
	b.	Solve the differential equation $L\frac{di}{dt} + Ri = 200\sin 300t$ when L = 0.05 and R = 100 and find the value of the current I at any time t, it initially there is no current in the circuit. What value does i approach after a long time.	**7**	**L3**	**CO2**
	c.	Find the general and singular solution of $(a^2 - x^2)p^2 + 2xyp + b^2 - y^2 = 0$	**7**	**L2**	**CO2**
		Module – 4			
Q.7	**a.**	(i) Find the remainder when 41^{75} is divided by 3, (ii) Find the last digit in 7^{289}.	**6**	**L2**	**CO3**
	b.	Find the solution of the linear congruence $18x \equiv 30 (\text{mod } 42)$	**7**	**L2**	**CO3**
	c.	Using RSA algorithm find public key and private key with respect to p = 3, q = 11 and m = 31	**7**	**L3**	**CO3**
		OR			
Q.8	**a.**	Show that $8^{30} - 1$ is divisible by 31 using Fermet to little theorem.	**6**	**L2**	**CO3**
	b.	Solve the system of linear congruence's using CRT $x \equiv 2(\text{mod } 3)$, $x \equiv 3(\text{mod } 5)$, $x \equiv 2(\text{mod } 7)$.	**7**	**L3**	**CO3**
	c.	(i) Find the remainder when $349 \times 74 \times 36$ is divided by 3. (ii) Find the roots of $x^2 + 2x - 3 \equiv 0(\text{mod } 5)$	**7**	**L2**	**CO3**
		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**	**CO4**

	b.	Test for consistency and solve $5x+3y+7z=4$, $3x+26y+2z=9$, $7x+2y+10z=5$	**7**	**L3**	**CO4**
	c.	Find the largest Eigen value and the corresponding Eigen vector, $A=\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ with initial vector $[1\ 1\ 1\ 1\ 1]^T$ carry out 5 iterations.	**7**	**L1**	**CO4**
		OR			
Q.10	**a.**	Solve the system of equations by Gauss Seidal method $83x+11y-4z=95$, $7x+52y+13z=104$, $3x+8y+29z=71$. Carry out three iterations.	**8**	**L4**	**CO3**
	b.	Solve the system of equations by using Gauss-Jordan method: $x+2y+z=8$ $2x+3y+4z=20$, $4x+3y+2z=16$	**7**	**L3**	**CO4**
	c.	Using modern mathematical tool, write a program/code to find the largest eigen value of, $A=\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$	**5**	**L3**	**CO5**

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