CBCS SCHEME

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BMATM101

First Semester B.E./B.Tech. Degree Examination, June/July 2025
Mathematics - I for ME Stream

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.
3. VTU Mathematics formula Handbook is permitted.

			M	L	C
		Module – 1			
Q.1	**a.**	Derive an expression for Angle between radius vector and tangent.	6	L2	CO1
	b.	Find the pedal equation for the curve $r^2 = a^2 \sec 2\theta$.	7	L2	CO1
	c.	Find the radius of curvature of the curve $x^3 + y^3 = 2a^3$ at the point (a, a).	7	L3	CO1
		OR			
Q.2	**a.**	With usual notation prove that $\rho = \frac{(1+y_1^2)^{3/2}}{y_2}$.	7	L2	CO1
	b.	Prove that the pair of polar curves intersect orthogonally $r^n = a^n \cos n\theta$, $r^n = b^n \sin n\theta$.	8	L2	CO1
	c.	Using modern mathematical tool, write a programme code to plot sine and cosine curves.	5	L3	CO5
		Module – 2			
Q.3	**a.**	Expand cos x by Maclaurin's series upto the containing x^4.	6	L2	CO2
	b.	If $u = \tan^{-1}\left(\frac{y}{x}\right)$ where $x = e^t - e^{-t}$ and $y = e^t + e^{-t}$, find $\left(\frac{du}{dt}\right)$.	7	L2	CO2
	c.	Show that $f(x, y) = x^3 + y^3 - 3xy + 1$ is minimum at the point (1, 1).	7	L3	CO2
		OR			
Q.4	**a.**	Evaluate $\underset{x \to 0}{Lt} \left(\frac{\sin x}{x}\right)^{1/x^2}$.	8	L2	CO2
	b.	If $U = x + y + z$, $V = y - z$, $W = z$, find $\frac{\partial(u, v, w)}{\partial(x, y, z)}$.	7	L2	CO2
	c.	Using modern mathematical tool, write a program to prove $u_{xx} + u_{yy} = 0$. If $u = e^x [x \cos y - y \sin y]$.	5	L3	CO5

		Module – 3			
Q.5	**a.**	Solve : $\frac{dy}{dx} + \frac{y}{x} = y^2 x$.	**6**	**L2**	**CO3**
	b.	Solve $(5x^4 + 3x^2y^2 - 2xy^3)\,dx + (2x^3y - 3x^2y^2 - 5y^4)dy = 0$.	**7**	**L2**	**CO3**
	c.	Solve $yp^2 + (x\text{-}y)\,p - x = 0$.	**7**	**L2**	**CO3**
		OR			
Q.6	**a.**	Obtain the General and Singular solution of the equation $p = \log(px - y)$.	**6**	**L2**	**CO3**
	b.	Define Newton's law of cooling. A body in air at 25°C cools from 100°C to 75 °C in 1 minute. Find the temperature of the body at the end of 3 minutes.	**7**	**L3**	**CO3**
	c.	Solve the equation $(px - y)\,(py+x) = 2p$ by reducing into Clairaut's from taking the substitution $X = x^2$, $Y = y^2$.	**7**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Solve : $y''' + 6y'' + 11y' + 6y = 0$.	**6**	**L2**	**CO3**
	b.	Solve : $y'' + 2y' + y = 2x + x^2$.	**7**	**L2**	**CO3**
	c.	Solve : $y'' + 4y = 4\sec^2 2x$ by the method of variation of parameter.	**7**	**L2**	**CO3**
		OR			
Q.8	**a.**	Solve : $(6D^2 + 17D + 12)\,y = e^{-x}$.	**6**	**L2**	**CO3**
	b.	Solve : $x^2 y'' + xy' + 9y = \text{Sin}\,(3\log x)$.	**7**	**L2**	**CO3**
	c.	Solve : $(1 + x)^2 y'' + (1 + x)\,y' + y = 2\cos[\log(1 + x)]$.	**7**	**L2**	**CO3**
		Module – 5			
Q.9	**a.**	Find the rank of the matrix $\begin{bmatrix} 0 & 2 & 3 & 4 \\ 2 & 3 & 5 & 4 \\ 4 & 8 & 13 & 12 \end{bmatrix}$	**6**	**L2**	**CO4**
	b.	Solve the system of equations $x + y + z = 9$; $x - 2y + 3z = 8$; $2x + y - z = 3$ by Gauss Elimination method.	**7**	**L3**	**CO4**
	c.	Solve the following system of equations by Gauss – Seidal method : $10x + y + z = 12$; $x + 10y + z = 12$; $x + y + 10z = 12$ for 4 Iterations.	**7**	**L3**	**CO4**
		OR			

Q.10	a.	Test for consistency and solve : $x - 4y + 7z = 14$, $3x + 8y - 2z = 13$; $7x - 8y + 26z = 5$.	7	L2	CO4
	b.	Find the largest eigen value and corresponding eigen vector of matrix $\begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$ by power method, by taking initial eigen vector $(1, 1, 1)^T$ carryout upto 5 Iteration.	8	L3	CO4
	c.	Using modern mathematical tool write a programme to sovle the system of equations $5x - y - z = -3$; $x - 5y + z = -9$; $2x + y - 4z = 15$ by Gauss Siedal method.	5	L3	CO5

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