U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

February / March 2025 Semester End Main Examinations

Programme: B.E. | **Semester: I**
Branch: Common to all Branches | **Duration: 3 hrs.**
Course Code: 18MA1BSEM1 | **Max Marks: 100**
Course: ENGINEERING MATHEMATICS- 1

Instructions:
1. All units have internal choices, answer one complete question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT – 1	*CO*	*PO*	**Marks**
1	a)	Obtain an expression for the angle between radius vector and the tangent of the polar curve $r = f(\theta)$.	*1*	*1*	**6**
	b)	Find the radius of curvature at any point on the asteroid $x^{2/3} + y^{2/3} = a^{2/3}$ at the point (a, a).	*2*	*1*	**7**
	c)	Expand $\tan x$ in powers of x up to x^4 using Maclaurin's series.	*2*	*1*	**7**
		OR			
2	a)	Find the pedal equation of the curve $r = ae^{\theta \cot \alpha}$ where α is a parameter.	*2*	*1*	**6**
	b)	Prove that the curves $r^n = a^n \cos n\theta$ and $r^n = b^n \sin n\theta$ intersect orthogonally.	*2*	*1*	**7**
	c)	Expand $\sin(x)$ in powers of $\left(x - \frac{\pi}{2}\right)$ upto 3rd degree term.	*2*	*1*	**7**
		UNIT – 2			
3	a)	If $u = f(r, s, t)$ where $r = 2x - 3y$, $s = 3y - 4z$ and $t = 4z - 2x$ then prove that $6\frac{\partial u}{\partial x} + 4\frac{\partial u}{\partial y} + 3\frac{\partial u}{\partial z} = 0$.	*2*	*1*	**6**
	b)	If $z(x + y) = x^2 + y^2$ then show that $\left(\frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)^2 = 4\left(1 - \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)$	*2*	*1*	**7**
	c)	Expand $f(x, y) = x^2y + 3y - 2$ in powers of $(x - 1)$ and $(y + 2)$ upto second degree terms.	*2*	*1*	**7**
		OR			
4	a)	If $u = \log(\tan x + \tan y + \tan z)$ then prove that $(\sin 2x)\frac{\partial u}{\partial x} + (\sin 2y)\frac{\partial u}{\partial y} + (\sin 2z)\frac{\partial u}{\partial z} = 2$.	*2*	*1*	**6**
	b)	If $u = x + 3y^2 - z^3$, $v = 4x^2yz$ and $w = 2z^2 - xy$ then find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at (1, -1, 0).	*2*	*1*	**7**

		c)	If A, B, C are the angles of a triangle show that the maximum value of $\cos A . \cos B . \cos C$ is 1/8.	2	1	**7**
			UNIT – 3			
	5	a)	Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} y^2 \, dydx$ by changing the order of integration.	2	1	**6**
		b)	Evaluate $\int_{-1}^{1} \int_0^{z} \int_{x-z}^{x+z} (x+y+z) dy \, dx \, dz$.	2	1	**7**
		c)	Prove that $\int_0^{\pi/2} \sqrt{\sin\theta} \, d\theta \times \int_0^{\pi/2} \frac{1}{\sqrt{\sin\theta}} \, d\theta = \pi$.	2	1	**7**
			OR			
	6	a)	Evaluate $\int_0^{\infty} \int_0^{\infty} e^{-(x^2+y^2)} dxdy$ by changing into polar coordinates.	2	1	**6**
		b)	Find the volume of the tetrahedron bounded by the planes $x=0$, $y=0$, $z=0$, $x+y+z=1$.	2	1	**7**
		c)	With the usual notations, prove that $\beta(m,n) = \frac{\Gamma(m)\,\Gamma(n)}{\Gamma(m+n)}$.	1	1	**7**
			UNIT – 4			
	7	a)	Solve: $y(2xy + e^x)dx - e^x dy = 0$.	2	1	**6**
		b)	Solve: $(4xy + 3y^2 - x)dx + x(x+2)dy = 0$.	2	1	**7**
		c)	Find the orthogonal trajectories of the family of curves $\frac{x^2}{a^2} + \frac{y^2}{b^2+\lambda} = 1$ where λ is a parameter.	2	1	**7**
			OR			
	8	a)	Solve $\frac{dy}{dx} - y = \frac{2xy^2}{e^x}$.	2	1	**6**
		b)	Solve: $\left[y\left(1+\frac{1}{x}\right) + \cos(y) \right] dx + \left[x + \log x - x\sin(y) \right] dy = 0$.	2	1	**7**
		c)	Find the orthogonal trajectories of the family of curves $r = a(1+\sin\theta)$.	2	1	**7**
			UNIT – 5			
	9	a)	Solve: $y'' + 4y' - 12y = e^{2x} - 3\sin 2x$.	2	1	**6**
		b)	Apply the method of variation of parameters to solve $(D^2+1)y = \sec x$.	2	1	**7**
		c)	Solve: $(2x+1)^2 y'' - 6(2x+1)y' + 16y = 8(2x+1)^2$.	2	1	**7**
			OR			
	10	a)	Solve: $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 6e^{3x} - \log 2$.	2	1	**6**
		b)	Apply the method of variation of parameters to solve $y'' + y = \sec x \tan x$.	2	1	**7**
		c)	Solve: $x^2 \frac{d^2y}{dx^2} - 6x\frac{dy}{dx} + 8y = 6x$.	2	1	**7**

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